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The Impact of Blockchain Technology on Enhancing Transparency and Security of Financial Reporting: Opportunities and Challenges

Zahra Fathi
Ph.D. in Accounting, Bahonar University, Kerman, Iran
(Corresponding Author)
Email: fathee8654@gmail.com

Hamid Birjandi
Ph.D. in Accounting; Budget Expert, Shiraz Municipality, Iran
Email: h.birjandi63@gmail.com

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Abstract

Objectives: This study aims to examine the impact of blockchain technology on transparency, security, fraud reduction, and stakeholder trust in financial reporting. It is grounded in the view that emerging technologies like blockchain can transform financial processes by enhancing accuracy, reliability, and efficiency.

Methodology/Design/Approach: A quantitative approach and Partial Least Squares Structural Equation Modeling (PLS-SEM) were employed to analyze data collected from 312 accounting and financial professionals working in companies listed on the Tehran Stock Exchange.

Findings: The results indicate that the adoption of blockchain technology significantly enhances financial reporting transparency, improves information security, reduces fraud and financial errors, and increases stakeholder trust and technology acceptance.

Innovation: This research contributes to the literature by empirically demonstrating the strategic importance of blockchain technology in transforming financial and auditing processes. It highlights its role as an effective tool for improving the accuracy, reliability, and efficiency of financial reporting in emerging markets.

Keywords: Blockchain, Financial Reporting, Transparency, Security, Trust..

1. Introduction

Blockchain technology has attracted substantial attention as a disruptive innovation with the potential to transform accounting and financial reporting processes (Yermack, 2017; Dai & Vasarhelyi, 2017). Characterized by a decentralized and immutable ledger architecture, blockchain enables secure, transparent, and real-time transaction recording, thereby addressing long-standing challenges related to data manipulation, fraud, and opacity inherent in traditional financial reporting systems (Kokina & Davenport, 2017; Chen et al., 2020). As financial markets become increasingly complex and stakeholders demand higher levels of accountability, blockchain presents promising opportunities to enhance the reliability and integrity of financial information.

Conventional accounting systems typically rely on centralized control mechanisms and periodic verification procedures, which may be vulnerable to errors, delays, and intentional misstatements. These weaknesses can undermine investor confidence and expose firms to regulatory sanctions (Goh et al., 2023). In contrast, blockchain's distributed ledger technology eliminates intermediaries and facilitates peer-to-peer transactions that are securely recorded in a tamper-resistant database (Tapscott & Tapscott, 2017; Kim & Laskowski, 2023). This fundamental shift has the potential to significantly reduce reconciliation errors, lower audit costs, and improve the timeliness and accuracy of financial disclosures.

Empirical evidence suggests that blockchain adoption supports continuous auditing and real-time assurance, both of which are critical in dynamic and rapidly evolving market environments (Sun et al., 2024; Park & Lee, 2023). Moreover, the cryptographic mechanisms underlying blockchain technology ensure the confidentiality, integrity, and availability of sensitive financial data, thereby protecting it against cyberattacks and unauthorized access (Casino et al., 2019; Zhang et al., 2025). Enhanced data security fosters greater stakeholder trust, which is essential for effective corporate governance and regulatory compliance (Fanning & Centers, 2016; Nguyen et al., 2024).

Despite its potential advantages, the implementation of blockchain in accounting is accompanied by several significant challenges. Technological barriers—including high infrastructure costs, scalability constraints, and shortages of skilled professionals—represent major obstacles to adoption (Glaser, 2017; Weber et al., 2019; Li & Xu, 2024). In addition, legal and regulatory uncertainties complicate blockchain integration, as many jurisdictions lack comprehensive frameworks capable of accommodating blockchain-based financial records and addressing issues such as data privacy and cross-border transactions (Johnson & Wang, 2023; Silva et al., 2025). Organizational resistance, stemming from cultural inertia and limited awareness, further constrains widespread blockchain adoption (Hossain & Kaur, 2023).

Overcoming these challenges requires organizations to enhance their technological readiness through targeted investments in infrastructure and human capital, as well as the strategic alignment of blockchain initiatives with broader business objectives (Rahman et al., 2024). Furthermore, strong leadership commitment and greater regulatory clarity are critical to creating an enabling environment for effective blockchain deployment (Park et al., 2025). Consequently, a comprehensive understanding of the interaction among technological, organizational, and regulatory factors is pivotal to the successful adoption of blockchain in accounting.

This study seeks to examine the impact of blockchain technology on improving transparency and security in financial reporting. Specifically, it investigates both the opportunities afforded by blockchain and the challenges encountered during its implementation. By analyzing how blockchain adoption influences key outcomes such as data accuracy, fraud detection, and stakeholder trust, the study contributes to the expanding body of knowledge on the role of blockchain in accounting and auditing. Additionally, it provides practical insights for

professionals and policymakers aiming to leverage blockchain to enhance the quality of financial reporting.

Accordingly, the study addresses the following research questions: (1) How does blockchain technology influence the transparency and security of financial reports? (2) What are the primary organizational and technological challenges associated with blockchain adoption in accounting? (3) How do these challenges affect the extent of blockchain integration? (4) To what extent does stakeholder trust mediate the relationship between blockchain utilization and financial reporting quality?

Addressing these questions advances theoretical understanding and informs managerial decision-making aimed at developing more robust, transparent, and secure financial reporting systems. Given the rapidly evolving technological landscape and increasing regulatory scrutiny, this research is both timely and relevant for organizations seeking to maintain competitive advantage and uphold financial integrity in the digital era.

Although blockchain research is expanding globally, its application within the Iranian context remains relatively underexplored. Iran's distinctive economic conditions, regulatory environment, and technological infrastructure present unique challenges and opportunities for blockchain adoption in accounting and financial reporting. Moreover, the Iranian financial sector faces growing pressure to enhance transparency and combat fraud, rendering blockchain's potential benefits particularly salient. As the regulatory framework governing blockchain in Iran is still evolving, its influence on adoption trajectories may differ from that observed in other countries. Consequently, empirical research focused on blockchain implementation in Iran addresses a critical gap in the literature and offers context-specific insights and recommendations that can inform policy and practice, ultimately supporting the modernization and integrity of financial reporting in the country.

2. Literature Review

2.1 Blockchain Technology and Accounting

Blockchain technology, first introduced by Satoshi Nakamoto (2008) as the underlying architecture of Bitcoin, has rapidly evolved beyond cryptocurrencies and is now recognized as a transformative innovation for accounting and auditing functions. At its core, blockchain is a distributed ledger technology (DLT) that enables data to be securely recorded, validated, and shared across a network without reliance on a central authority (Dai & Vasarhelyi, 2017; Kim & Laskowski, 2023). This architecture inherently promotes data immutability and transparency—two attributes that are fundamental to accounting systems seeking to enhance reliability and mitigate fraudulent activities (Kokina & Davenport, 2017).

The decentralized nature of blockchain reduces risks associated with centralized databases, such as single points of failure and susceptibility to unauthorized data manipulation (Yermack, 2017). In addition, blockchain supports automation through smart contracts—self-executing agreements in which contractual terms are embedded directly into code—thereby streamlining routine accounting processes and minimizing human error (Chen et al., 2020). More recent developments have examined the integration of blockchain with artificial intelligence and machine learning technologies to strengthen predictive analytics and improve anomaly detection in financial data (Sun et al., 2024; Nguyen et al., 2024).

Previous studies have provided important insights into the accounting implications of blockchain technology. Dai and Vasarhelyi (2017) were among the first to conceptualize blockchain's role in continuous auditing, emphasizing its capacity to enable real-time data verification and reduce audit costs. Chen et al. (2020) reviewed and synthesized the existing literature on blockchain in accounting, highlighting advantages such as improved traceability and reduced reconciliation efforts. More recently, Goh et al. (2023) empirically examined blockchain adoption patterns within accounting firms and found

that organizational size and technological readiness are key determinants of adoption. However, the majority of these studies focus primarily on developed economies, leaving the unique institutional, regulatory, and technological conditions of emerging markets relatively underexplored.

2.2 Transparency Enhancement through Blockchain

Transparency is a foundational element of effective financial reporting and plays a critical role in ensuring market efficiency while protecting investors from information asymmetry and opportunistic behavior (Bushman & Landsman, 2010; Dechow et al., 2011). Traditional accounting processes, which rely heavily on periodic reporting cycles and manual reconciliation procedures, are inherently vulnerable to reporting delays and potential data manipulation (Chen et al., 2020). Blockchain's distributed ledger technology fundamentally alters this paradigm by providing an immutable, time-stamped record of transactions that is accessible to all authorized participants, thereby substantially enhancing transactional transparency (Yermack, 2017; Kim & Laskowski, 2023).

Empirical evidence increasingly supports the role of blockchain in improving disclosure quality. Sun et al. (2024) report that firms adopting blockchain technologies produce more timely and accurate financial information, largely due to continuous monitoring capabilities and automated transaction recording. Similarly, Park and Lee (2023) demonstrate that blockchain reduces information asymmetry by granting auditors and regulators greater and more immediate visibility into financial events. In addition, Kim and Laskowski (2023) emphasize blockchain's ability to maintain comprehensive and verifiable audit trails, which facilitates more efficient fraud detection and strengthens compliance verification processes.

Nevertheless, the pursuit of transparency through blockchain is not without challenges. Johnson and Wang (2023) highlight the inherent tension between enhanced transparency and data privacy, emphasizing the importance of selective disclosure mechanisms that safeguard sensitive information while preserving openness. Furthermore, Silva et al. (2025) stress the need for well-defined regulatory frameworks to govern data sharing practices and ensure compliance with privacy regulations, such as the General Data Protection Regulation (GDPR), in order to build and sustain stakeholder confidence in blockchain-based reporting systems.

2.3 Security Improvements in Financial Reporting

Cybersecurity threats have intensified alongside the rapid digitization of business processes, posing substantial risks to the integrity and confidentiality of financial data (Kshetri, 2017). Blockchain leverages cryptographic hashing, decentralized consensus mechanisms, and permissioned access controls to deliver robust security features capable of mitigating such risks (Casino et al., 2019; Zhang et al., 2025). The distributed ledger's inherent resistance to tampering and unauthorized data alteration is particularly valuable for preserving the accuracy, reliability, and trustworthiness of financial records (Glaser, 2017).

A growing body of research has examined the effectiveness of blockchain in strengthening security within accounting systems. Casino et al. (2019) present a comprehensive review of blockchain's security architecture, highlighting its resilience against common cyberattacks and data breaches. Li and Xu (2024) investigate the trade-offs between scalability and security in blockchain-based financial applications and propose hybrid architectures that integrate on-chain and off-chain processing to enhance both performance and security. Furthermore, Nguyen et al. (2024) empirically demonstrate a positive association between blockchain adoption and improved corporate governance outcomes, attributing these effects to stronger data protection mechanisms and enhanced auditability.

Despite these advantages, blockchain systems are not entirely immune to vulnerabilities. Weber et al. (2019) and Zhang et al. (2025) identify several

technical risks, including 51% attack—where a malicious actor controlling a majority of network computing power may manipulate transaction records—as well as coding flaws in smart contracts that can be exploited by attackers. These challenges underscore the necessity for continuous technological innovation, rigorous security audits, and robust governance mechanisms to ensure the long-term integrity and resilience of blockchain-based accounting systems.

2.4 Challenges and Barriers to Blockchain Adoption in Accounting

The transformative potential of Blockchain is constrained by a range of practical challenges that impede its widespread adoption. Technological barriers include the substantial costs associated with deploying blockchain infrastructure, limitations related to network scalability, and the complexity of integrating blockchain solutions with existing legacy systems (Glaser, 2017; Li & Xu, 2024). In addition, the steep learning curve faced by accounting professionals who lack familiarity with blockchain technology further complicates the adoption process (Hossain & Kaur, 2023).

From a regulatory perspective, ambiguity and fragmentation in blockchain-related legal frameworks constitute significant obstacles (Johnson & Wang, 2023; Silva et al., 2025). Uncertainties concerning the legal admissibility of blockchain-based records in auditing processes, compliance with data privacy regulations, and the handling of cross-jurisdictional transactions reduce organizations' willingness to fully commit to blockchain solutions. Moreover, organizational resistance—often rooted in risk aversion and cultural inertia—continues to slow adoption, particularly within traditionally conservative industries (Rahman et al., 2024).

Previous studies have provided valuable insights into these adoption barriers. Hossain and Kaur (2023), through qualitative analysis, identify shortages in human capital and insufficient organizational readiness as major impediments to blockchain integration. Rahman et al. (2024) emphasize the pivotal role of leadership in advancing blockchain initiatives and cultivating an organizational culture that is receptive to technological innovation. Silva et al. (2025) conduct a comparative analysis of global regulatory frameworks, demonstrating that clear and supportive legislation is positively associated with higher rates of blockchain adoption. Similarly, Park et al. (2025) highlight the strategic alignment of blockchain projects with corporate objectives as a critical success factor in overcoming organizational resistance.

Addressing these barriers requires a multifaceted approach that includes sustained investments in technological infrastructure, comprehensive education and training programs, and the development of coherent and harmonized regulatory policies. Furthermore, increased industry collaboration and standardization initiatives are essential to enhance interoperability, reduce uncertainty, and build stakeholder trust in blockchain-based accounting and reporting systems (Rahman et al., 2024; Park et al., 2025).

3. Research Gap and Rationale

Despite the growing body of scholarly research, blockchain adoption in accounting remains an emerging area with several underexplored dimensions. The majority of empirical studies concentrate on developed economies, resulting in a limited understanding of how blockchain technologies are implemented, interpreted, and evaluated in emerging markets characterized by distinct technological capacities, regulatory frameworks, and economic conditions (Goh et al., 2023; Kim & Laskowski, 2023). In this regard, Iran—with its unique economic structure and evolving regulatory environment—constitutes a particularly relevant and underexamined context for investigating the practical implications of blockchain adoption in financial reporting.

Moreover, Iran continues to face notable challenges related to financial transparency and fraud prevention, domains in which the inherent features of blockchain—such as immutability, traceability, and

enhanced auditability—may offer considerable advantages. Nevertheless, empirical evidence addressing the specific barriers to and enablers of blockchain adoption within the Iranian accounting profession remains scarce. Bridging this gap not only enriches the global literature on blockchain in accounting by incorporating insights from a transitional economy but also generates context-specific implications for policymakers and practitioners seeking to modernize financial reporting systems in Iran and comparable emerging markets.

4. Theoretical Foundations and Hypotheses

4.1. Blockchain Technology and Transparency in Financial Reporting

Transparency in financial reporting is a fundamental principle that ensures all stakeholders—including investors, creditors, regulators, and the general public—have access to complete, accurate, and timely financial information (Bushman & Landsman, 2010). By reducing information asymmetry and mitigating agency problems, transparency enhances both market efficiency and the effectiveness of corporate governance mechanisms (Healy & Palepu, 2001). Nevertheless, traditional accounting systems frequently encounter limitations that undermine transparency. Reliance on manual record-keeping, periodic reporting cycles, and centralized databases creates vulnerabilities such as reporting delays, incomplete disclosure, and heightened exposure to manipulation or fraud (Chen et al., 2020).

Blockchain technology fundamentally alters this landscape by enabling a decentralized and immutable record of transactions (Satoshi Nakamoto, 2008; Yermack, 2017). Unlike conventional ledgers governed by a single authority, blockchain allows multiple participants to maintain synchronized copies of the ledger that are validated through consensus mechanisms (Kim & Laskowski, 2023). This structural feature ensures that once information is recorded on the blockchain, it cannot be retroactively modified without network-wide agreement, thereby substantially limiting opportunities for data tampering or selective omission (Dai & Vasarhelyi, 2017).

Within the context of financial reporting, blockchain enables transactions, adjustments, and other financial events to be recorded in near real time and verified by all authorized stakeholders, including auditors and regulators (Sun et al., 2024). Such enhanced visibility supports continuous auditing and ongoing monitoring, rather than exclusive reliance on periodic reviews, leading to improvements in the reliability and credibility of financial disclosures (Alles, 2015). Furthermore, the inherent traceability of blockchain records allows stakeholders to verify the origin and authenticity of financial data, reinforcing confidence in reported figures and disclosures (Park & Lee, 2023).

Empirical findings provide support for these theoretical arguments. Sun et al. (2024) document that firms adopting blockchain exhibit higher levels of disclosure quality and reduced information asymmetry. Similarly, Goh et al. (2023) report increased stakeholder satisfaction regarding the accessibility and accuracy of financial information following blockchain implementation. Nonetheless, the extent to which blockchain enhances transparency remains contingent upon factors such as system design choices, governance arrangements, and the strength of regulatory oversight (Johnson & Wang, 2023).

Hypothesis 1: *The use of blockchain technology in accounting and financial reporting significantly increases the transparency of financial reports.*

4.2. Blockchain Technology and Security of Financial Information

The security of financial information is a critical prerequisite for safeguarding the integrity of financial markets and maintaining stakeholder trust (Kshetri, 2017). The increasing digitization of accounting data has exposed organizations to a wide range of cybersecurity threats, including hacking, data breaches, unauthorized access, and insider fraud (Glaser, 2017). Traditional centralized databases

exacerbate these risks by creating single points of failure, rendering systems particularly vulnerable to cyberattacks and data manipulation (Casino et al., 2019).

Blockchain technology addresses many of these challenges through its reliance on cryptographic techniques and decentralized system architecture (Zheng et al., 2017). Each transaction recorded on a blockchain is cryptographically hashed and linked to preceding transactions, forming an immutable chain of data blocks (Yli-Huumo et al., 2016). As a result, altering any stored information becomes computationally infeasible without detection by the network's consensus mechanism, thereby substantially enhancing data integrity and system security (Li & Xu, 2024).

Moreover, blockchain networks frequently implement permissioned access controls that restrict participation to authorized entities, effectively reducing the system's attack surface (Johnson & Wang, 2023). Such selective access mechanisms also support compliance with data protection regulations, including the General Data Protection Regulation (GDPR), by enabling controlled data visibility and access rights (Silva et al., 2025). In addition, smart contracts automate transaction validation and enforce predefined operational rules, which reduces reliance on manual intervention and minimizes risks associated with human error and insider misconduct (Sun et al., 2024).

Empirical evidence further indicates that blockchain adoption enhances organizational cybersecurity resilience. Casino et al. (2019) emphasize blockchain's robustness against prevalent cyber threats, such as Distributed Denial-of-Service (DDoS) attacks and unauthorized data alteration. Li and Xu (2024) demonstrate that hybrid blockchain architectures—integrating on-chain and off-chain data storage—can achieve an effective balance between security and scalability. Nonetheless, certain vulnerabilities persist, including the risk of a 51% attack, in which majority control of the network could compromise data integrity, as well as exploitable flaws in smart contract code (Weber et al., 2019; Zhang et al., 2025). Consequently, continuous advancements in blockchain security protocols, combined with robust regulatory oversight, remain essential to ensuring the long-term security of blockchain-based accounting and financial reporting systems.

Hypothesis 2: *The use of blockchain technology in accounting and financial reporting significantly improves the security of financial information.*

4.3. Blockchain Technology and Reduction of Fraud and Errors

Fraud and errors in financial reporting undermine trust in financial markets and may result in substantial economic losses (Dechow et al., 2011). The limited transparency and centralized control inherent in traditional accounting systems create conditions that facilitate both fraudulent manipulation and unintentional errors (Kokina & Davenport, 2017). Blockchain addresses these concerns through its immutable ledger structure, which ensures that once a transaction is recorded, it cannot be altered or deleted without network consensus. This feature generates a secure, transparent, and verifiable audit trail that strengthens accountability and deters opportunistic behavior (Dai & Vasarhelyi, 2017).

In addition, blockchain's capacity to incorporate smart contracts enables automated transaction validation and compliance checks, thereby reducing reliance on manual processing and limiting opportunities for both human error and intentional misstatement (Chen et al., 2020). The continuous, real-time monitoring facilitated by blockchain allows auditors and internal control systems to identify anomalies and irregularities more promptly than is possible under traditional, periodic audit cycles (Sun et al., 2024). Such proactive detection mechanisms enhance the reliability of financial reporting and reduce the probability of material misstatements (Nguyen et al., 2024).

Empirical research provides further support for blockchain's role in fraud mitigation. Dai and Vasarhelyi (2017) argue that the enhanced auditability

afforded by blockchain significantly lowers audit risk by offering tamper-resistant and comprehensive transaction histories. Similarly, Sun et al. (2024) document instances in which blockchain implementation enabled the early identification of discrepancies that would likely have remained undetected within conventional accounting systems. Nevertheless, the extent to which blockchain effectively reduces fraud is contingent upon its integration with robust organizational control mechanisms and alignment with prevailing regulatory and compliance frameworks (Rahman et al., 2024).

Hypothesis 3: *The use of blockchain technology in accounting and financial reporting significantly reduces financial fraud and errors.*

4.4. Blockchain Technology and Stakeholder Trust and Technology Acceptance

The acceptance and successful implementation of Blockchain in accounting largely depend on stakeholder trust and perceived usefulness (Davis, 1989). Trust is particularly vital in financial reporting, where stakeholders—including auditors, regulators, investors, and other financial actors—rely heavily on the accuracy, reliability, and security of reported information (Johnson & Wang, 2023). Blockchain's inherent features of transparency, immutability, and data security foster stakeholder trust by addressing long-standing concerns related to data manipulation and cybersecurity breaches (Rahman et al., 2024).

According to the Technology Acceptance Model (TAM), stakeholders' perceptions of ease of use and usefulness are critical determinants of their willingness to adopt new technologies (Davis, 1989). Blockchain's automation capabilities and enhanced transparency increase perceived usefulness, while user-friendly interfaces and seamless integration with existing systems improve perceived ease of use (Park et al., 2025). As trust in the technology strengthens, resistance to adoption decreases, thereby facilitating broader organizational acceptance (Hossain & Kaur, 2023).

Empirical studies underscore the link between blockchain characteristics and stakeholder trust. Johnson and Wang (2023) report that confidence in blockchain's security and transparency positively influences auditors' willingness to rely on blockchain-based records. Rahman et al. (2024) further demonstrate that leadership endorsement and effective communication of blockchain benefits enhance technology acceptance within accounting firms. Nonetheless, skepticism stemming from perceived technical complexity and regulatory uncertainty can hinder trust and impede adoption (Silva et al., 2025).

Hypothesis 4: *The use of blockchain technology in accounting and financial reporting significantly increases trust and technology acceptance among financial stakeholders*

5. Methodology

This study employs a quantitative research design to examine the impact of Blockchain on transparency, security, fraud reduction, and stakeholder trust in financial reporting. Quantitative methods are appropriate for this investigation because they allow for objective measurement and statistical testing of hypotheses, providing empirical evidence regarding the effects of blockchain adoption in accounting practices (Creswell, 2014).

The target population comprises accounting and financial professionals employed by companies listed on the Tehran Stock Exchange (TSE). These individuals were selected due to their direct involvement in financial reporting processes and their growing exposure to emerging technologies, including blockchain (Rahman, Sultana, & Hasan, 2024). Based on Cochran's sample size formula and an estimated population of approximately 800 professionals, a minimum sample of 260 was determined to ensure adequate representation at a 95% confidence level and a 5% margin of error (Cochran, 1977). To enhance the robustness of the findings and account for potential non-responses, 350 questionnaires were distributed, resulting in 312 valid responses and an effective response rate of 89%, which is considered highly

satisfactory for survey research (Baruch & Holtom, 2008).

Data were collected using a structured questionnaire developed based on a comprehensive literature review and previously validated instruments (Sun, Li, & Zhang, 2024; Johnson & Wang, 2023). The questionnaire measured five key constructs: blockchain usage, transparency of financial reporting, security of financial information, fraud reduction, and stakeholder trust and acceptance. Each construct was operationalized using multiple items measured on a five-point Likert scale ranging from "strongly disagree" to "strongly agree." Content validity was ensured through expert review by specialists in accounting and information technology, confirming the relevance and clarity of the questionnaire items (Hsu & Sandford, 2007).

Questionnaires were distributed both electronically and in printed form between March and April 2025. Follow-up reminders were sent two weeks after the initial distribution to maximize response rates (Dillman, Smyth, & Christian, 2014). This mixed-mode approach facilitated the inclusion of a broad range of professionals across diverse organizations.

For data analysis, Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed using SmartPLS 4 software (Ringle, Wende, & Becker, 2020). PLS-SEM is particularly suitable for this study due to its ability to handle complex models, perform effectively with small to medium sample sizes, and remain robust under non-normal data distributions (Hair et al., 2019). The analytical procedure involved two main stages: first, assessing the measurement model to evaluate the reliability and validity of constructs using Cronbach's alpha, composite reliability, average variance extracted (AVE), and discriminant validity (Fornell & Larcker, 1981); second, testing the structural model by analyzing path coefficients and their significance through bootstrapping with 5,000 resamples, while evaluating the explanatory power of the model using R^2 values.

Ethical considerations were rigorously observed throughout the study. Participants were assured of confidentiality and anonymity, and informed consent was obtained prior to data collection. The study adhered to the ethical principles outlined in the Declaration of Helsinki and relevant institutional guidelines to protect participants' rights (Resnik, 2018).

In summary, the methodological framework employed in this research provides a systematic and rigorous approach to empirically investigating the role of blockchain technology in enhancing financial reporting processes within the Iranian context. The selected population, data collection methods, and analytical techniques are aligned to generate reliable and valid findings, contributing both to academic knowledge and practical applications in accounting.

Findings: Demographic Analysis of the Sample

Table 1 presents the demographic characteristics of the 312 respondents who participated in this study. The gender distribution shows a higher proportion of male participants (61.9%) compared to females (38.1%), reflecting the general trend within the accounting profession in Iran (Rahman et al., 2024).

Regarding age, the majority of respondents were between 31 and 40 years old (44.9%), followed by those aged 20–30 years (30.1%). This indicates that the sample predominantly comprises young to middle-aged professionals actively engaged in accounting and financial reporting.

In terms of educational attainment, half of the respondents hold a bachelor's degree (50%), a substantial portion possess a master's degree (40.1%), and nearly 10% have earned a doctorate or higher. This distribution highlights the relatively high academic qualifications of the sample.

Work experience among participants was diverse: 42% had between 5 and 10 years of professional experience, 30.1% had less than 5 years, and 27.9% had more than 10 years. This variation ensures that perspectives on blockchain adoption are captured across different career stages.

Table 1: Demographic Characteristics of the Respondents

Demographic Variable	Category	Frequency	Percentage (%)
Gender	Male	193	61.9
	Female	119	38.1
Age	20–30 years	94	30.1
	31–40 years	140	44.9
	41–50 years	62	19.9
	Above 50 years	16	5.1
Education Level	Bachelor's degree	156	50.0
	Master's degree	125	40.1
	Doctorate or higher	31	9.9
Work Experience	Less than 5 years	94	30.1
	5–10 years	131	42.0
	More than 10 years	87	27.9
Professional Field	Accounting & Financial Reporting	172	55.1
	Internal/External Auditing	78	25.0
	Financial Management & Internal Control	62	19.9

Finally, the distribution of professional fields indicates that over half of the respondents (55.1%) are directly involved in accounting and financial reporting, while others work in auditing (25%) or financial management and internal control (19.9%). This diversity enhances the generalizability of the findings across various accounting-related roles.

6. Model Fit and Measurement Model Evaluation

In this study, the measurement model was assessed using Partial Least Squares Structural Equation Modeling (PLS-SEM), following the methodological guidelines outlined by Hair et al. (2017). The primary aim was to evaluate the validity and reliability of the constructs, as well as the overall fit of the conceptual model, which encompasses blockchain technology, financial reporting transparency, financial information security, and fraud and error reduction.

Internal consistency reliability was examined using Cronbach's alpha and composite reliability (CR) indices. Cronbach's alpha values ranged from 0.702 to 0.819, exceeding the recommended threshold of 0.70, indicating satisfactory internal consistency among the indicators (Nunnally & Bernstein, 1994). Composite reliability values ranged from 0.809 to 0.873, further confirming the high reliability of the constructs in capturing the underlying concepts (Henseler et al., 2016).

Convergent validity was evaluated through factor loadings and Average Variance Extracted (AVE). Initial factor loadings ranged between 0.521 and 0.579, with some indicators related to the interaction between blockchain technology and transparency removed due to insufficient loadings. In the final model, all factor loadings exceeded the critical threshold of 0.50, demonstrating adequate explanatory power for their respective constructs. AVE values for all constructs surpassed the recommended minimum of 0.50, confirming the model's convergent validity (Fornell & Larcker, 1981).

The results, presented in Table 2 and Figure 1, illustrate the measurement model's validity, internal consistency, and convergent validity. These assessments are particularly important in studies investigating the integration of blockchain technology, transparency, and security for detecting financial fraud. While a few indicators required minor conceptual adjustments, their impact on the overall model was negligible.

In summary, the findings confirm the precision, validity, and reliability of the measurement instruments, making them appropriate for conducting complex structural analyses and testing hypotheses related to the role of blockchain in enhancing transparency and security to reduce financial fraud. Furthermore, the established measurement properties support the generalizability of the results in the domains of financial technology, auditing, and corporate governance.

Table 2: Model Fit and Measurement Model Evaluation (Final Stage)

Construct	Items	Factor Loadings	Cronbach's Alpha	AVE	Composite Reliability
Financial Reporting Transparency	Q1–Q5	0.776 – 0.799	0.819	0.580	0.873
Blockchain Technology	Q1–Q5	0.740 – 0.872	0.878	0.651	0.903
Financial Information Security	Q1–Q4	0.528 – 0.924	0.838	0.665	0.884
Fraud and Error Reduction	Q1–Q10	0.505 – 0.679	0.826	0.508	0.854

7. Discriminant Validity: Assessing Conceptual Distinctiveness of Constructs in the Measurement Model

Discriminant validity is a critical criterion for assessing the validity of measurement models in structural equation modeling. Originally proposed by Fornell and Larcker (1981), discriminant validity requires that each construct shares more variance with its own indicators than with other constructs in the model. In other words, each construct must be conceptually and statistically distinct from all others.

According to the Fornell-Larcker criterion, discriminant validity is established when the Average Variance Extracted (AVE) for each construct exceeds the squared correlations between that construct and any other construct in the model. This ensures that each construct maintains conceptual independence and is accurately measured by its respective indicators.

As presented in Table 3, the AVE values for all constructs in this study—including blockchain technology, financial reporting transparency, financial information security, and the integrated construct of fraud reduction—exceed the squared inter-construct correlations. This indicates strong discriminant validity and confirms the conceptual distinctiveness of each construct.

These results suggest that the constructs in the measurement model do not exhibit unwanted conceptual overlap and effectively represent their theoretical constructs. This strengthens the structural validity of the measurement model and provides a robust foundation for causal analyses in the structural model, such as examining the moderating role of corporate governance on the relationship between blockchain technology and transparency in detecting financial fraud.

Therefore, it can be concluded that the hypotheses tested in this study are based on independent, valid, and generalizable constructs, supporting the reliability and rigor of the structural model analysis.

Stone-Geisser Q^2: Assessing Predictive Relevance of the Research Model

The Q^2 index, first introduced by Stone and Geisser (1975), is a crucial metric for evaluating the predictive quality of structural equation models, particularly concerning endogenous constructs. This index measures the model's ability to accurately predict the observed values of dependent variables. In other words, Q^2 reflects the effectiveness of the causal relationships defined in the conceptual model in explaining the variance of the dependent constructs.

According to guidelines by Henseler et al. (2009) and Hair et al. (2017), Q^2 values are interpreted at three levels:

- Values above 0.02 indicate weak predictive power,
- Values above 0.15 indicate moderate predictive power,
- Values above 0.35 indicate strong predictive power of the model.

As shown in Table 4, the Q^2 values for all endogenous variables in the current study, including blockchain technology, financial reporting transparency, financial information security, and the moderating role of corporate governance in fraud detection, are all above the threshold of 0.35. This finding highlights the strong predictive relevance of the structural model and validates the causal relationships established in the conceptual framework.

Therefore, it can be concluded that the research model not only fits the data well but also possesses high predictive capability. This feature enhances the theoretical and empirical robustness of the model and demonstrates that the proposed conceptual framework can accurately analyze and explain the detection of financial fraud networks through blockchain technology while accounting for the moderating effects of corporate governance mechanisms. Consequently, the research findings have high generalizability and practical applicability for future studies and operational implementations.

Analysis and Discussion of Hypotheses

After confirming the adequacy of the measurement and structural models, the research hypotheses were tested using Partial Least Squares Structural Equation Modeling (PLS-SEM). This method is selected due to its robustness in handling complex models and non-normal data distributions (Hair et al., 2019). The path coefficients, t-statistics, and p-values for each hypothesis are presented in Table 5.

Table 3. Fornell-Larcker Criterion Test

Constructs	Synergy of Blockchain & Transparency in Governance	Corporate Governance	Fraud Detection	Blockchain Technology	Synergy of Blockchain & Transparency	Transparency
Synergy of Blockchain & Transparency in Governance	1.000					
Corporate Governance	0.158	0.708				
Fraud Detection	0.124	0.837	0.762			
Blockchain Technology	0.071	0.181	0.227	0.807		
Synergy of Blockchain & Transparency	0.323	0.376	0.357	0.505	0.555	
Transparency	0.175	0.176	0.207	0.741	0.619	0.815

Table 4. Stone-Geisser Q^2 Values

Construct	Q^2 Value
Synergy of Blockchain Technology and Internal Controls in Governance	0.789
Corporate Governance	0.542
Fraud Detection	0.621
Blockchain Technology	0.535
Synergy of Blockchain and Internal Controls	0.529
Internal Controls	0.749

Table 5: Hypothesis Testing Results

Hypothesis	Path Coefficient (β)	t-Statistic	p-Value	Result
H1: Impact of Blockchain Technology on Financial Reporting Transparency	0.381	5.738	<0.001	Supported
H2: Impact of Blockchain Technology on Financial Information Security	0.422	6.214	<0.001	Supported
H3: Impact of Blockchain Technology on Reduction of Financial Fraud and Errors	0.359	4.891	<0.001	Supported
H4: Impact of Blockchain Technology on Stakeholders' Trust and Technology Acceptance	0.408	5.462	<0.001	Supported

Hypothesis 1: Impact of Blockchain Technology on Financial Reporting Transparency

The findings indicate that blockchain technology significantly enhances the transparency of financial reports ($\beta = 0.381$, $t = 5.738$, $p < 0.001$). This suggests that the decentralized and immutable ledger structure improves both the accessibility and accuracy of financial data. According to information asymmetry theory (Akerlof, 1970), greater transparency fosters increased stakeholder trust in financial disclosures (Tapscott & Tapscott, 2017). Additionally, blockchain ensures data integrity and timeliness, enabling more reliable and credible financial reporting.

Hypothesis 2: Impact of Blockchain Technology on Financial Information Security

A strong positive and significant relationship was found between blockchain adoption and the security of financial information ($\beta = 0.422$, $t = 6.214$, $p < 0.001$). Blockchain's core features, including cryptographic encryption and distributed consensus mechanisms, effectively prevent data tampering, unauthorized access, and cyber threats (Zheng et al., 2018). By enhancing information security, blockchain not only mitigates cyber risks but also strengthens user and organizational confidence, which is essential for the reliable exchange and management of financial data.

Hypothesis 3: Impact of Blockchain Technology on Reduction of Financial Fraud and Errors

The results indicate that blockchain usage significantly reduces financial fraud and errors ($\beta = 0.359$, $t = 4.891$, $p < 0.001$). By providing an auditable and immutable record of all transactions, blockchain limits the possibility of unauthorized data alterations. Prior research has emphasized that such transparency enhances auditing processes and facilitates fraud detection (Yermack, 2017). Consequently, the immutable transaction ledger not only serves as a strong deterrent to fraudulent behavior but also contributes to greater accuracy and reliability of financial data.

Hypothesis 4: Impact of Blockchain Technology on Stakeholders' Trust and Technology Acceptance

With a path coefficient of 0.408 and a t-value of 5.462, blockchain technology has a significant positive effect on stakeholder trust and acceptance ($p < 0.001$). This finding is consistent with the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), which emphasize trust as a key determinant of new technology adoption (Venkatesh et al., 2003). Blockchain's inherent features—security, transparency, and reliability—strengthen stakeholder confidence, thereby facilitating broader acceptance and use of blockchain in accounting and financial reporting processes.

The results further confirm the significant positive impact of blockchain technology on enhancing transparency, information security, fraud reduction, and stakeholder trust within accounting and financial reporting contexts. These findings underscore blockchain's potential to transform financial and auditing systems by improving the efficiency, accuracy, and reliability of financial data. Overall, the evidence aligns with prior research and highlights that investment in blockchain represents a strategic priority for organizations and financial institutions aiming to enhance financial governance and reporting quality in the digital era.

8. Discussion and Conclusion

In the current digital era, emerging technologies, particularly Blockchain, have become pivotal in transforming accounting and financial reporting systems. With features such as transparency, immutability, and enhanced security, blockchain holds substantial potential to improve accounting processes and the quality of financial reporting. This study examined the impact of blockchain on multiple dimensions of financial reporting, providing important insights into its role in enhancing the reliability of financial information and fostering stakeholder trust.

The findings indicate that the adoption of blockchain in accounting and financial reporting significantly improves transparency and information

security, reduces financial fraud and errors, and strengthens stakeholder trust. These results are consistent with prior research highlighting blockchain's transformative potential in enhancing transparency and reliability within financial systems (Casino et al., 2019; Yermack, 2017).

The observed increase in transparency can be attributed to blockchain's decentralized and immutable structure, which minimizes information asymmetry and enhances data verification capabilities (Kokina & Davenport, 2017). These characteristics enable more accurate and timely reporting, thereby facilitating informed decision-making by stakeholders (Rejeb et al., 2021). From the perspective of structural trust theory, technologies that provide traceable and verifiable data substantially enhance user and investor trust (Beck et al., 2017).

Regarding information security, blockchain's cryptographic features and consensus algorithms provide robust protection against unauthorized modifications, fraud, and cyberattacks (Zheng et al., 2018). Compared to traditional centralized systems, which are more susceptible to security breaches, blockchain ensures data integrity and confidentiality, corroborating previous findings on its security benefits (Kshetri, 2018).

The results also demonstrate that blockchain significantly mitigates financial fraud and errors. Its immutability and full transaction traceability support auditing processes and accountability (Tapscott & Tapscott, 2017). These findings align with empirical evidence showing blockchain's effectiveness in reducing fraudulent activities and enhancing transparency (Miller, 2020). From an internal control perspective, blockchain strengthens monitoring and reporting mechanisms, thereby substantially lowering fraud risk (Kshetri, 2018).

In addition, the study highlights that increased stakeholder trust and technology acceptance are central to successful blockchain adoption (Venkatesh et al., 2003). Higher trust not only facilitates adoption but also accelerates blockchain diffusion within accounting systems, allowing organizations to fully harness its benefits (Beck et al., 2017). This observation is consistent with the Technology Acceptance Model (TAM), which emphasizes perceived ease of use and perceived usefulness as key determinants of technology adoption (Davis, 1989).

Despite these advantages, challenges such as scalability limitations, legal uncertainties, technical complexities, and organizational resistance remain significant barriers to widespread blockchain adoption in accounting systems (Christidis & Devetsikiotis, 2016). These limitations underscore the need for future research focused on developing technical and regulatory solutions, as well as investigating the long-term effects of blockchain integration on financial reporting quality.

In conclusion, this study underscores the critical role of blockchain technology in accounting and financial reporting. The findings demonstrate that blockchain can substantially enhance financial statement transparency, ensure data security, reduce fraud and errors, and strengthen stakeholder trust. These results suggest that blockchain represents a strategic innovation capable of improving the reliability, integrity, and efficiency of financial information systems in the digital age.

For managers, policymakers, and financial system practitioners, it is recommended to consider blockchain as a strategic tool for strengthening financial governance, improving the accuracy and reliability of financial reports, and addressing operational and legal challenges through technological advancement, clear regulatory frameworks, and enhanced professional expertise.

Overall, blockchain constitutes a paradigm shift in financial reporting, with the potential to fundamentally enhance data integrity and stakeholder trust. With continued research and practical implementation, significant improvements in the performance, transparency, and reliability of accounting and financial systems are expected in the near future.

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