

Testing The Impact of Blockchain Technology on The Internal Control Quality in Non-Financial Companies Listed on The Egyptian Stock Exchange

Dr. Walaa Nasr-El-dein Gad⁽¹⁾, Dr. Taghred Moukhtar Sayed Moawad⁽²⁾

(1) Lecturer of accounting Higher Institute for Computer Science and Information Systems (CIS), New Cairo Academy.

(2) Ph.D. in Accounting Faculty of Commerce Ain Shams University.

Abstract

Purpose – The purpose of this study is to investigate how blockchain technology would affect Egyptian enterprises' internal control between 2018 and 2022.

Design/methodology/approach – To achieve this main objective, we adopted a quantitative methodological approach by analyzing the content of non-financial companies listed on the Egyptian Stock Exchange's annual reports from 2018 to 2022.

This period frame includes the COVID-19 period. Furthermore, excluding outliers, the final sample consisted of 20 companies with 96 observations and tested has used as a unit root test and regression test.

Findings: Generally, the analysis reveals that the internal control quality is significantly influenced by blockchain technology because the t test probability was 0.000 and it was lower than 0.05 and R^2 adjusted reach to 96.6%. Therefore, the current research suggests promoting awareness of blockchain technology in Egypt to boost internal control quality through financial reports.

Research limitations/implications: The research has limitations because of its lack of an application blockchain in Egypt, focusing on annual reports of non-financial Egyptian companies.

Practical implications: The findings of this research are probably going to be helpful in clarifying the importance of using blockchain in non-financial companies in the Egyptian industry for a wide range of interested parties, including managers, investors, and scholars.

Originality/value: This research strives to establish a novel field of study, as there are few studies in developing countries that introduce applied evidence on the impact of blockchain technology on the internal control quality of non-financial firms in Egypt.

Keywords: Blockchain Technology, Internal Control Quality, Egyptian non-financial companies.

المستخلص

الغرض من هذه الدراسة هو التحقيق في كيفية تأثير تقنية سلاسل الكتل على جودة الرقابة الداخلية للشركات المصرية في الفترة من 2022 إلى 2022.

التصميم / المنهجية / النهج - لتحقيق هذا الهدف الرئيسي، اعتمدنا نهجا منهجيا كميًا من خلال تحليل محتوى الشركات غير المالية المدرجة في التقارير السنوية للبورصة المصرية في الفترة من 2018 إلى 2022.

يشمل إطار الفترة هذه فترة COVID-19 وعلاوة على ذلك، باستثناء القيم المتطرفة، تتكون العينة النهائية من 20 شركة مع 96 ملاحظة وتم اختبارها باستخدام اختبار الجذر الودودي واختبار الانحدار. النتائج: بشكل عام، يكشف التحليل أن جودة الرقابة الداخلية تتأثر بشكل كبير بتقنية سلاسل الكتل لأن احتمالية اختبار t كانت 0.000 وكانت أقل من 0.05 ووصل معدل R2 إلى 96.6% لذلك، يقترح البحث الحالي تعزيز الوعي بتقنية سلاسل الكتل في مصر لتعزيز جودة الرقابة الداخلية من خلال التقارير المالية.

حدود البحث/التداعيات: يواجه البحث بعض القيود بسبب افتقاره إلى تطبيق تقنية سلاسل الكتل بشكل متكامل في مصر، مع التركيز على التقارير السنوية للشركات المصرية غير المالية. التداعيات العملية: من المحتمل أن تكون نتائج هذا البحث مفيدة في توضيح أهمية استخدام تقنية سلاسل الكتل في الشركات غير المالية في الصناعة المصرية لمجموعة واسعة من الأطراف المهتمة، بما في ذلك المديرين والمستثمرين والعلماء.

الأصالة/القيمة: يسعى هذا البحث إلى إنشاء مجال دراسي جديد، حيث توجد دراسات قليلة في البلدان النامية تقدم أدلة تطبيقية حول تأثير تقنية البلوك تشين على جودة الرقابة الداخلية للشركات غير المالية في مصر.

الكلمات المفتاحية: تقنية سلاسل الكتل، جودة الرقابة الداخلية، الشركات غير المالية المسجلة بالبورصة المصرية .

1. Introduction

With the rapid technological advancements and the growing intricacy of transactions, cross-border dealings require collaborative efforts from all parties involved to foster Integrity, truthfulness, openness, and efficient information exchange (Dajani & Yaseen, 2016). Blockchain technology is well-positioned to effectively address these challenges. Its primary application in accounting centers around the ledger (Dai & Vasarhelyi, 2017)

Economic transactions are recorded in a single ledger and disseminated instantly with all necessary parties. Furthermore, even at the owner of the accounting system's request, accounting data on the blockchain is intrinsically non-editable and unchangeable. Blockchain ledgers are therefore anticipated to reduce fraud and accounting errors while enhancing stakeholder confidence. (Abu Afifa et al., 2023)

As blockchain gains wider acceptance, it's pertinent to examine its intersection with an organization's internal control framework. Through meticulous implementation and integration of blockchain, its unique features can be harnessed to establish stronger controls within organizations. Moreover, blockchain-enabled tools hold the promise of enhancing operational efficiency, enhancing compliance with legal and regulatory obligations, as well as the speed and dependability of financial and other reporting. However, it's crucial to acknowledge that blockchain introduces new risks, necessitating the development of corresponding control measures (Burns et al., 2020)

Consequently, the study poses the following query's:

Q1: What the impact of blockchain technology on the internal control quality on non-financial company in Egypt?

2. Related literature review

Selimoglu & Saldi, (2023) examined the internal audit functions within banks' cybersecurity governance procedures by evaluating the strengths, weaknesses, opportunities, and threats (SWOT) associated with integrating blockchain technology. Their research indicates that blockchain technology can serve as replacement to traditional risk management techniques, functioning as a continuous auditing technique to reduce human errors and address unique factors."

Anis, (2023) The study delved into Blockchain's application in auditing and accounting. It investigated auditors' perspectives on blockchain's impact and explored the alleged advantages and difficulties of implementing accounting systems based on blockchain in Egypt. The findings underscore the importance

of understanding blockchain's transformative possibilities in the accounting and audit market. Additionally, the research examined the necessary capabilities for successful deployment of such systems. Notably, disparities emerged between auditors employed at big audit companies and those at small-to-medium-sized audit firms regarding the perceived pros and cons of implementing Blockchain-driven accounting software.

Nonetheless, the adoption of Blockchain Technology (BT) in auditing also entails specific risks, particularly concerning privacy and security. These risks stem from the public nature of transactions recorded in a distributed ledger (Schmitz & Leoni, 2019; Wang & Kogan, 2018). It is imperative for Academics and professionals should address these BT side effects as they need more research. Furthermore, there are a number of non-technical and technical obstacles that must be overcome for BT to be seamlessly integrated into the accounting environment, such as scalability, security, and the creation of an appropriate architecture. (Shi et al., 2022)

According to (Spanò et al., 2022) several studies highlight the relevance of blockchain technology in auditing practices. Audit processes based on blockchain hold the potential to mitigate or even eliminate corruption risks, especially in supply chain operations, due to the immutability of stored transaction data. Consequently, blockchain can act as a deterrent against unethical behaviour, while its transparency enhances social oversight. Dyball & Seethamraju, (2021) further emphasize that blockchain has the capacity to reduce existing risks and streamline auditing tasks. Additionally, it can serve as a valuable tool for improving global business operations by minimizing human error and opportunities for fraud. Overall, blockchain offers numerous benefits to auditing procedures, including enhanced risk management and more efficient change management protocols.

Abu Afifa et al., (2023) examined accountants' intentions on the adoption of blockchain technology in Vietnam using an expanded Unified Theory of Acceptance and Use of Technology (UTAUT) paradigm. The suggest model aims to Give accountants the motivation they need to use blockchain. To achieve this goal, the study introduces external constructs derived from discussions on blockchain properties relevant to accounting, including aspects like reliability, job relevance, and quality of accounting information. Additionally, the research considers factors such as computer self-efficacy and compatibility as determinants of practitioners' acceptance of blockchain. Notably, the findings indicate that performance and effort expectancy significantly influence positive intentions toward using blockchain, while social

influence plays a comparatively lesser role. Furthermore, the ambition to adopt blockchain, as well as effort and performance expectations, are positively impacted by trust. It's interesting to note that performance anticipation is positively impacted by the quality of accounting information, but negatively by job relevance. Moreover, effort anticipation is positively impacted by computer compatibility and self-efficacy. Surprisingly, the purpose to apply blockchain remains unaffected by compatibility. Moreover, the study reveals that performance and effort expectancy serve as mediators in the indirect consequences on intention to use blockchain of computer self-efficacy, compatibility, and trust.

Wang & Kogan, (2018) ensure that blockchain technology advances the effectiveness of bookkeeping and inspecting frameworks whereas moderating monetary extortion. Execution of this coordinates framework moreover guarantees the security of bookkeeping data and commerce protection, whereas encouraging the fast selection of modern bookkeeping forms (Wu et al., 2019). In today's globalized economy, financial exchanges happen not as it were inside a single nation but too over universal borders. This requires advanced data innovation framework worked over the web. In addition, compatibility between bookkeeping data frameworks and blockchain is a key desire among bookkeepers (Karajovic et al., 2019; Zhang et al., 2020).

Bonsón & Bednárová, (2019) by embracing efficient approach to conduct a writing audit to minimize predisposition and loan logical esteem to it comes about, they distinguished the pending challenges for blockchain, such as adaptability, adaptability, appropriate design, and cybersecurity. Moreover, In order to fully integrate blockchain innovation into a real bookkeeping setting, controllers, reviewers, and other stakeholders must come to an understanding.

(Alfian et al., 2021) give an outline of the vital inner controls over settled resources and how substances can utilize blockchain to make strides those controls. They survey a few of the primary characteristics of blockchain innovation and talks about its potential to make strides inner control over settled resources. At long last, the creators encourage talk about the challenges and confinements of blockchain.(Cangemi, 2021) report focuses out numerous of the Blockchain (BC)-related control concerns, counting possibly invaluable characteristics like unchanging nature and shared records. It too addresses the unused dangers and necessity for extra controls for which the look for arrangements continues.

Smith & Castonguay, (2020) devoted to the angles of the utilize of inventive blockchain innovation in the modernization of the bookkeeping of agrarian undertakings, the preferences of the versatile application of innovation in the inner control framework of ventures of the advanced agrarian complex. The issues of commonsense application of the modern mechanical approach by agrarian organizations are considered, the vulnerabilities of the unused innovation, its «weaknesses» are highlighted and proposition for their disposal are made. The show of the inner control framework for the agro-industrial complex organizations created by the creators, with coordinates components of blockchain innovation and the strategy of test evaluation of the adequacy of the executed advancements, taking into account the most recent patterns in the Russian financial showcase and patterns in the agrarian industry segment.

Rückeshäuser, (2017) Ask about the possibility of implementing blockchain technology in bookkeeping and approve the use of decentralized agreement components that rely on the labor of rare assets (Proof-of-Work, or PoW), enabling exchange approval without the need for third-party permission. PoW is expected to result in permanent and, in this way, fraud-resistant, real-time money related registries in conjunction with the blockchain, a shared database. This judgment needs to be reevaluated in light of the top management's repeated participation in bookkeeping scandals, which are often brought to light by careful examinations of both internal and external control mechanisms.

According to (Wang et al., 2020) At show, the improvement of manufactured insights in different areas is getting way better and superior, and the fake insights data innovation is gradually starting to meet towards the reviewing field. The blockchain capacity application framework requires each hub to store total information, causing squander of the capacity assets; at the same time, it does not make full utilize of the organize steering activity assets.

3- Theoretical Framework

3.1 Definition of blockchain

Blockchain innovation (BT) is one of the most critical troublesome advances these days, it is a decentralized engineering depending on a arrange of computers called nodes (Anis, 2023; Brender et al., 2024; Orcutt, 2019) to approve exchanges for a bound together record, it has earned noteworthy consideration for its potential to revolutionize conventional frameworks of record-keeping and value-based forms. The twofold section framework of bookkeeping has been instrumental in producing exact budgetary reports and moderating data asymmetry between firms and partners. In any case, determined concerns have emerged due to inalienable believe issues and doubts

with respect to the potential distortion of realities by supervisors to outside parties (Inder, 2023).

Blockchain is a multifaceted concept with different refinements, outstandingly between private (moreover called permissioned) and open (too known as permissionless) blockchains. Agreeing to Tyma et al. (2022), private blockchains are characterized by their proprietorship structure. They do not show delicate information and are claimed by a single material that manages and supervises the distribution of content on the blockchain. Private blockchains are thought to be less safe than other types since they are closed and have fewer hubs that support trading. (George & Patatoukas, 2020).

Dyball & Seethamraju, (2022) emphasize that private blockchains need straightforwardness and the motivation structure vital to completely use the conveyed highlights of open blockchains. This point of view adjusts with an Ernst and Youthful consider, which outlines how open blockchains lead in blockchain advancement due to their extended plan conceivable outcomes (Brody, 2020). More later open blockchain frameworks confine clients to passing status upgrades or record fingerprints, whereas keeping the basic information behind the firewall of the company (Andersen, 2016)). Thus, private and open blockchains offer distinctive levels of security and protection, each showing unmistakable preferences and drawbacks (Spanò et al., 2022)

Blockchain technology fulfills the need for a trusted third party-maintained shared ledger, providing decentralized, immutable, and secure transaction recording capabilities. Each transaction is cryptographically sealed, making it nearly impossible to destroy, copy, or alter them. (Sachan & Liu (Lisa), 2024)

3.2 Blockchain and Accounting

Numerous research products have already helped to draw attention to the crucial components and features of blockchain in the accounting context. (Bonsón & Bednárová, 2019).

Centobelli et al. (2022) state that "academic researchers and accounting professionals are unaware about blockchain concepts and infrastructures.". professionals in auditing and accounting have expended significant efforts to guarantee the integrity and accuracy of financial information. As per the Institute of Chartered Accountants in England and Wales (ICAEW), Blockchain holds the promise of augmenting the accounting profession through the reduction of expenses associated with ledger maintenance and reconciliation, while also offering unequivocal assurance regarding asset ownership and historical records.

Sachan & Liu , (2024) seeks, via recurring audits, to strike a balance between human legal experts' control over content generated by generative AI and responsible usage. It looks into how Generative AI might be used to draft letters for pre-litigation decisions made by an explainable AI (XAI) system.

Because BT lessens the workload of auditors, it is arguable that this benefits the auditing profession. (Anis, 2023)

Blockchain has a number of benefits for accounting, most notably increased efficiency, security, and openness.

Dyball & Seethamraju, (2022) underscore that blockchain has the possibility to mitigate existing risks and streamline auditing tasks. Furthermore, it can serve as a tool for enhancing global business operations by reducing Human mistake and potential for deception. Blockchain offers numerous benefits to auditing processes, includes improved risk control and more effective protocols for managing changes.(Spanò et al., 2022)

The blockchain is a specific instance of Distributed Ledger Technology (DLT), employs a consensus mechanism to establish an interconnected and unalterable ledger of all transactions, shared among all participants. This framework enables almost instantaneous transfer of value such as assets, records, and identity, between participants, eliminating the need for a central intermediary (Babayeva, 2022). Every transaction, including the associated debits and credits, is recorded in the blockchain ledger for transparent visibility among all parties. All ledger transactions are permanent and irrevocable thanks to the cryptographic consensus process. Although blockchain technology holds the potential to enhance efficiency and reduce costs, it comes with inherent risks. It is crucial for organizations to comprehend these risks and implement suitable precautions to fully harness the advantages of this technique.

3.3. Blockchain and auditing

Due to the escalating frequency of cyberattacks on critical national infrastructures amidst tightening global economic conditions, it is imperative to ensure the integrity of activities coordinated within banks' cybersecurity governance mechanisms. This is crucial to maintaining financial transactions within acceptable risk parameters. In this particular situation, the traditional function of internal audit has been adapting to technological advancements aiding in the management of risks and control processes within information systems to ensure robust cybersecurity governance in corporations. This evolution is particularly crucial in banks, where most business processes rely on

electronic and communication systems equipped with various technological tools.(Selimoglu & Saldi, 2023)

Rozario & Thomas, (2019) propose the creation of a moment blockchain possessed by an inspector and associated to the bookkeeping blockchain of the to begin with client in a arrange. In this manner, reviewers seem extricate information from firms' blockchains and perform keen review strategies inside these blockchains. (Fatz et al., 2019) utilize blockchain innovation to make a framework that issues certificates of entry for products, which are significant in the VAT setting for exchanges between two businesses found in diverse EU nations. (Bonsón & Bednárová, 2019)

On a very basic level, review ability is characterized as an inclusive and independent testing of the undertaking exercises like financing, showcasing, creating, transporting, and contracting, terminating and data innovation preparing which are performed in systematic ways with the commitments of authorized specialists who are perceived as inspectors. In common, review exercises can be categorized as either inner or outside. In this setting, inner review is characterized as advising exercises that incorporate orderly and logical approaches for the assessments and improvement of legitimacy and productivity of control forms in chance administration and governance-related operations through the workers of the associations with an objective (Selimoglu & Saldi, 2023)

Nonetheless, the adoption of Blockchain Technology (BT) in auditing also entails specific risks, particularly concerning privacy and security. These risks stem from the public nature of transactions recorded in a distributed ledger (Schmitz & Leoni, 2019; Wang & Kogan, 2018).It is imperative for scholars and practitioners to address these consequences of BT as they require further understanding. Moreover, the seamless integration of BT into the accounting ecosystem faces numerous technical and non-technical challenges, including scalability, security, and the development of suitable architecture.

It is possible to create a variety of financial reports quickly and affordably using the information in the blockchain-based ledger. Additionally, auditors can conduct audits more effectively if they have access to the entire data population.(Anis, 2023; Bonsón & Bednárová, 2019; Shi et al., 2022)

3.4 Blockchain and internal control

Internal control is a comprehensive process overseen by the enterprise board, its executives, and its personnel. Its objectives include achieving corporate strategic goals, enhancing enterprise efficiency, mitigating various risks,

safeguarding enterprise assets, ensuring the integrity of management information, and fostering organizational compliance with legislative and procedural requirements. (Popchev et al., 2021)

The quality of accounting data is pivotal for both speculators and listed companies, essentially affecting the competitiveness of recorded companies in zones such as operations, financing, and benefit. A major issue influencing the quality of bookkeeping data is data asymmetry, which incorporates insufficient revelation or mutilation of accounting information. Other issues incorporate money related extortion or wrong data, awkward revelation, non-standardized revelation, and shifting accounting rules that render the data exceptional.

These issues can seriously harm the social picture and showcase esteem of listed companies. Improving the quality of disclosed data can progress financing, boost the listed companies' liquidity, and decrease funding expenses. Also, higher quality uncovered data can lower speculation chance, reinforce financial specialist certainty, and eventually have a significant positive affect on the trade picture and esteem of listed companies.(Ang, 2021)

Presently, there are at least five areas within the realm of accounting and assurance encompasses financial accounting, managerial accounting, accounting information systems, internal control, and financial audit or review services. Blockchain technology has a great deal of potential to be used in these fields.

In 2016, major accounting companies and the American Organized of Certified Open Accountants (AICPA) assembled to investigate the conceivable outcomes of blockchain in the bookkeeping and affirmation divisions. In no time from that point, they started inquiring about the innovation. Deloitte set up Deloitte Rubix to assess blockchain's potential applications. EY shaped an inquiry about group centering on different perspectives counting commerce demonstrate estimating, computerized contract usage, integration of stock information, receipt era, and installment administrations. PwC presented the DeNovo stage, concentrating on blockchain's potential in the FinTech industry. Furthermore, KPMG collaborated with Microsoft Corp to build up blockchain nodes in two European and Asian nations. (Alfian et al., 2021; Kokina et al., 2017)

ISACA provides guidance on best practices for addressing IT internal controls in ICFR audits through their publication titled Using COBIT 5 in the Design and Implementation of Internal Control Over Financial Reporting, Third Edition: IT Control Objectives for Sarbanes-Oxley (ISACA, 2014). This

comprehensive guide draws insights from well-known internal control structures and authoritative standards, such:

- 1- Public Company Accounting Oversight Board (PCAOB):
 - Reference: Auditing Standard No. 5
 - Purpose: PCAOB's standard specifically addresses the audit of internal control over financial reporting.
- 2- American Institute of Certified Public Accountants (AICPA):
 - Reference: Statement on Standards for Attestation Engagements No. 16
 - Purpose: AICPA's standard provides guidance on attestation engagements related to internal controls.
- 3- Committee of Sponsoring Organizations of the Treadway Commission (COSO):
 - Reference: 2013 Internal Control—Integrated Framework
 - Purpose: COSO's framework offers a comprehensive approach to internal control assessment and design.
- 4- ISACA's COBIT 5 Control Framework:
 - Purpose: ISACA's COBIT 5 framework focuses on governance and management of enterprise IT, including internal controls.

This ISACA guide serves as a valuable resource for practitioners navigating the complexities of internal controls within the context of financial reporting. It aligns with industry standards and provides practical insights for effective implementation (Sheldon, 2019)

A vigorous inside control system, complete with approaches and procedures ensuring accuracy, completeness, reliability and convenient planning of accounting information, is fundamental for avoiding extortion. Reports, regularly comprising a noteworthy parcel of a company's information, are profoundly helpless to false authorization, recording, and burglary. A viable report administration framework ought to consolidate inner controls to improve the unwavering quality of report bookkeeping and protect against false financial activities and burglary.

Blockchain innovation, eminent for its inalienable transparency, approval components, and unchanging nature, rises as a profitable tool for improving internal control systems inside a report setting. This article explains the center standards of blockchain and diagrams its application in defending reports against wrong or fraudulent acquisition, recording, and disposal. In addition, it highlights a few of the challenges and impediments related with implementing a blockchain system.(R. Leavins & Ramaswamy, 2023)

Blockchain holds the potential to revolutionize the internal control framework of companies. However, like any new technology, its implementation can pose challenges and potentially disrupt existing processes within an organization. There may be individuals within the organization who are hesitant to adopt this new technology, as resistance to change often arises when significant alterations to traditional practices occur. It's crucial to recognize that the success of any system relies on the support of its users. Therefore, organizations must be mindful of the emotions and apprehensions of the individuals involved to ensure the smooth acceptance of the new system. Blockchain holds the potential to revolutionize the internal control system of companies. Be that as it may, like any unused innovation, its usage can posture challenges and possibly disturb existing forms inside an organization. There may be people inside the organization who are reluctant to embrace this modern innovation, as resistance to alter frequently emerges when critical changes to conventional hones happen. It's vital to recognize that the victory of any framework depends on the back of its clients. Hence, organizations must be careful of the feelings and worries of the people included to guarantee the smooth acknowledgment of the modern system.

Blockchain innovation, when connected fittingly (e.g., in cryptocurrencies, keen contracts, and security data capacity), can upgrade the effectiveness of inside controls. For occurrence, the utilize of cryptocurrencies can speed up the recordkeeping prepare and diminish the dangers of human mistake and extortion. The selection of savvy contracts can lower the probability of overlooking standard terms or legitimate clauses and dispose of delays caused by holding up for counterparties to make changes and react. Another advantage of blockchain for inner controls is it taking care of protection data.

Blockchain stores security data in numerous areas, making it much harder for programmers to compromise this information. Moreover, blockchain permits clients to keep up control over their security data without requiring endowing it to third parties. (Li & Ma, 2021).

The unique properties of blockchain technology can be leveraged to create more stringent organizational controls. Encouragement, blockchain-enhanced devices have the potential to advance operational productivity and viability, progress unwavering quality and responsiveness of money related and other announcing, and make strides compliance with laws and directions. At the same time, blockchain makes modern dangers and the require for unused controls. (Rspe et al., 2020)

According to (Smith & Castonguay, 2020) Businesses that use blockchain technology need to adjust their arrangements and strategies over inside counterparties and controls hazard appraisal to address expanding control over the dispersion of budgetary information, whereas their review committees have to be arranged to deal with these issues driving up to monetary explanation planning. Outside inspectors require to survey blockchain usage as a money related announcing chance and adjust the possibly more dependable and timelier review prove gotten from blockchain-based announcing frameworks in opposition to the associated increment in inside control testing.

Despite worries expressed by businesses approximately administrative loads forced by the US Securities and Trade Commission (SEC) and the costs to guarantee ICFR compliance, the Center for Review Quality (CAQ) has given prove that the SOX Act improves corporate extortion expectations, corporation valuation, and the health of the US capital showcase (COSO, 2013). ICFR controls are outlined to decrease inner and outside commerce dangers in a way that permits day-to-day operations to be conducted in a viable and proficient way. Inside control anticipates that the targets established by the business are not accomplished. It constitutes a add up to of measures, rules, and controls in terms of IT and regulation that ought to guarantee that the unwavering quality of the monetary reports is shielded. Fabric blunders in monetary bookkeeping contrarily impact choices and influence the accomplishment of vital and money related objectives.(Doekhi, 2023)

Chen Na (2020) concluded that fraud and distortion of accounting information are still present in listed businesses and that a common problem is a lack of sufficient disclosure of accounting information. The level of concern in society about the quality of accounting information has grown. By guaranteeing the integrity and correctness of accounting information straight from the source, the use of blockchain in internal control, external audit, and accounting information systems has changed the elements that influence the quality of accounting.

Immutable financial records shared via blockchain prevent misappropriation, falsification, or destruction of financial information among trading partners and stakeholders. Unlike opaque financial records, which are harder to maintain, blockchain allows agents, subsidiaries, and chain partners to transparently share their financial information. Additionally, blockchain technology can impact the quality dimensions of the International Financial Reporting Standards (IFRS). (Doekhi, 2023)

While blockchain offers immutable virtual provenance workflows, the challenge lies in independently verifying whether the blockchain accurately represents physical events. This dilemma, known as the Oracle Paradox, poses architectural challenges for blockchain adoption, including smart contracts. Proponents argue that individuals can act as reliable oracles in smart contracts. However, auditing research reveals that people remain the weak link in most internal control applications, encompassing those related to blockchain. Their susceptibility to collusion, bribery, errors, and scam continues, even in the presence of blockchain technologies (Dai & Vasarhelyi, 2017; Rückeshäuser, 2017; Sachan & Liu (Lisa), 2024).

While blockchain adoption does not obviate the necessity for robust IT governance in organizations, governance complexities arise when a blockchain consortium is in play. Auditors face the task of assessing controls both within and around the consortium. Their evaluation includes understanding the existence and authority of a steering committee, as well as the voting power and resource commitments of each consortium member (financial, personnel, or computational (Sheldon, 2019).

4- Research methodology:

The design of the research approach is as follows, drawing from the theoretical background part mentioned above:

4.1 Data collection :

The research study focused on companies listed on the Egyptian Stock Exchange EGX 30 In the time frame of 2018 to 2022. The researchers carefully selected the study sample based on the following criteria:

- Financial statements prepared according to a calendar year (from January to December).
- Availability of financial statements for the specified period.
- Inclusion of non-financial companies listed on the Egyptian Stock Exchange that report in the local currency (excluding financial institutions and companies using currencies other than the Egyptian pound).
- After applying these conditions and excluding outliers, the final sample consisted of 20 companies with 96 observations. Data was sourced from the Mubasher Information website (<https://www.mubasher.info/countries/eg>) and the Egyptian Stock Exchange website (<https://www.egx.com.eg/ar/homepage.aspx>).
-

4.2 Measurement:

Independent variable

Blockchain:

There is no company that applies Blockchain completely in Egypt, but rather on part of its account. The Arab Republic of Egypt seeks, by the year 2030, to fully transform into the digital age and be an integrated digital system. The two researchers have proposed a set of items that, after reviewing the accounting literature conducted by Anis (2023) if the company has them, will have the ability to apply Blockchain. Completely, where if the item is available, it takes the number one, and if it is not available, it takes the number zero. These items are as follows:

- The company uses smart contracts.
- It has a strong infrastructure
- It has a strong accounting information system
- The audit office is one of the Big Four offices
- It has a strong internal control system that applies governance rules.
- Blockchain is based on a set of programmed procedures and basic standards, so accounting standards must be applied.

Dependent Variable:

Internal Control Quality: The internal control quality is represented by a binary variable. If the financial report is clean, it takes the value 1; otherwise, it is 0.

Control Variables:

1. Firm Age:

- Firm age estimates the company's newness or seniority and its ability to maintain continuity and reputation.
It can be expressed in terms of the years that have passed since the business's foundation (Ilaboya & Ohiokha, 2016)

2. Big Four:

- A binary variable (1 for yes, 0 for no) indicates whether a Big Four auditor has reviewed the company's financial statements.

3. Total Assets:

- Measuring total assets using blockchain technology impacts internal control quality.

- Total assets are a critical element in the financial position statement and significantly influence the quality of internal control processes.

Upon reviewing the accounting literature related to blockchain and auditing, the researchers found no articles that combined these two variables. Consequently, they proposed building a model to assess the impact of blockchain on internal control quality, considering control variables such as company age, the presence of Big Four auditors, and total assets. The regression equation is as follows:

$$ICQ = \alpha + \beta_1 BC + \beta_2 BIG4 + \beta_3 FA + \beta_4 TA + \epsilon$$

Where: ICQ: internal control quality,
 BC: blockchain,
 BIG4: big four,
 FA: firm age and TA: total assets

4.3 Data analysis:

Unit Root test

First, the researchers conducted a unit root test. The null hypothesis posits that the time series of study variables exhibit a unit root problem, while the alternative hypothesis suggests that they do not. By analyzing the properties of the time series, the researchers ensured their stability. This step was crucial to using stable time series in the estimation process. (Table 1) presents the results of the unit root test for the study variables

Table 1 unit root test for the study variables and descriptive statistics

Variables	OBS	mean	Std. Dev.	Dickey-Fuller test T test	Prob.*	Stability level
Blockchain	96	1.229167	0.703063	-5.047547	0.000	Null
Big 4	96	0.593750	0.493710	-4.085655	0.0016	Null
Firm age	96	34.27083	20.10890	-3.021755	0.0363	Null
Total assets	96	207618	2738002	-4.010119	0.0021	Null
Internal control quality	96	0.572917	0.497251	-6.316151	0.0000	Null

Source: The Authors

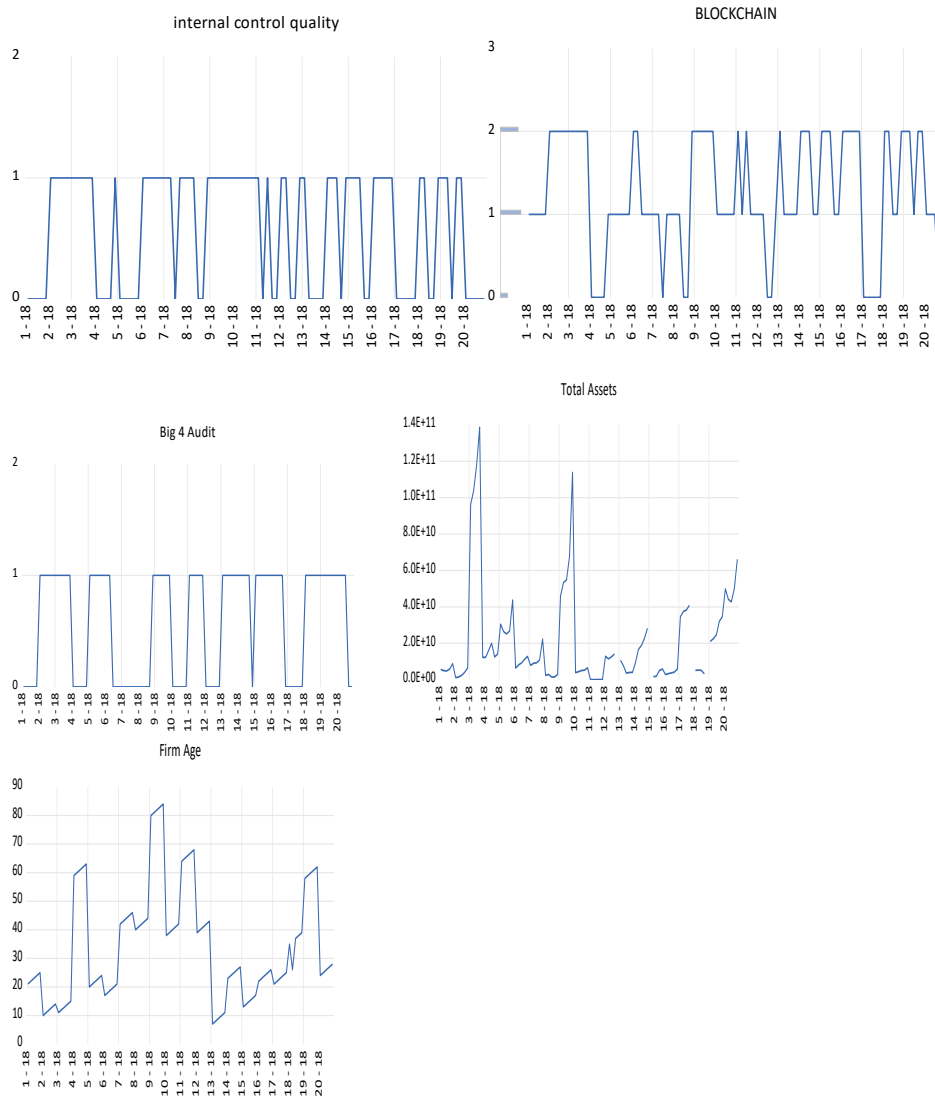


Figure 1 Dickey–Fuller test *Source: The Authors*

The graphical analysis of variable movements and the results of the Dickey–Fuller test indicate that all variables exhibit stationarity at the I (0) level.

Consequently, the data series are suitable for further quantitative analysis

Hausman Test:

The researchers employed a test to determine the appropriate model for assessing the impact of blockchain technology on internal control quality. The null hypothesis posited the use of a random effects model for the study

variables, while the alternative hypothesis suggested a fixed effects model. (Table 2) presents the results of this test.

Table 2 Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	2.747315	4	0.6010

Considering the outcomes from Table 2, it is evident that the test significance at the 95% confidence level is 0.935, exceeding the 5% significance level. Consequently, we accept the null hypothesis, indicating that the random effects model is the most suitable approach for assessing the impact of blockchain technology on internal control quality.

Regression model coefficients

Next, the estimated coefficients from the random effects model were employed to assess the significance of the regression model regarding the impact of blockchain technology on internal control quality. Table 3 presents the model estimates.

Table 3 The impact of blockchain on the internal control quality

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.144285	0.220597	0.654069	0.5152
BLOCKCHAIN	0.920726	0.030004	30.68637	0.0000
BIG_4_AUDIT	-0.774020	0.049158	-15.74553	0.0000
FIRM_AGE	-0.007314	0.006050	-1.209031	0.2306
TOTAL_ASSETS	3.44E-13	7.97E-13	0.431675	0.6673

Source: the authors

Table 4 Explanatory power - goodness of fit

Root MSE	0.079399	R-squared	0.974235
Mean dependent var	0.572917	Adjusted R-squared	0.966005
S.D. dependent var	0.497251	S.E. of regression	0.091682
Akaike info criterion	-1.728661	Sum squared resid	0.605204
Schwarz criterion	-1.087574	Log likelihood	106.9757
Hannan-Quinn criter.	-1.469523	F-statistic	118.3701
Durbin-Watson stat	1.603023	Prob(F-statistic)	0.000000

Source: the authors

The results from Table No. 3 and 4 reveal the following:

Explanatory Power:

Blockchain technology explains approximately 96.6% of the variations in internal control quality. The regression coefficient is 0.966.

The remaining unexplained percentage is attributed to factors not included in the model.

Quality of Fit:

At a 95% confidence level, the regression model is statistically significant.

The F-test value is 118.3701 with a significant level of 0.000 (less than 5%), indicating a good fit.

The Drane-Watson coefficient is 1.6, close to the ideal value of 2

The regression equation is as follows:

$$ICQ = \alpha + \beta_1 BC + \beta_2 BIG4 + \beta_3 FA + \beta_4 TA + \epsilon$$

After regression

$$ICQ = \alpha + \beta_1 BC - \beta_2 BIG4 + \epsilon$$

$$ICQ = 0.144285 + 0.920726 BC - 0.774020 BIG4 + 0.09 \epsilon$$

Heteroscedasticity test for residuals stability:

A number of presumptions underpin the OLS method and regression models, including the constancy of homoscedasticity, which requires that the mean equal zero. If the heteroscedasticity variation is employed, certain techniques are employed to address this issue, such as the White test. If the p-value is higher than 0.05, the null hypothesis states that the model has a random error instability issue.

Table 5 Heteroscedasticity test.

Overall test of Heteroscedasticity	Chi-square	P - value
	147.7395	0.0000



Source: the authors

The table above indicates that the chi-squared test yielded a value of 147.7395 with a p-value of 0.000. This result leads us to accept the null hypothesis, suggesting that the study model does not exhibit random error instability.

Ramsey Reset test:

The Ramsey RESET Test assesses whether the model includes relevant variables and excludes irrelevant ones, ensuring unbiased coefficient estimates. Selecting to accept the null hypothesis that the research model incorporates all appropriate variables when the p-value exceeds 0.05.

Table 6 Ramsey Reset test.

	F-test	Df	P – value
Ramsey RESET overall Test	2.408172	(1, 91)	0.1242
	T -test	Df	P – value
	1.551829	91	0.1242

Source: the authors.

The table above indicates that the p-value for the F test exceeds 0.05. This suggests that the research model does not include any inappropriate variables.

VIF test

Minimum possible value = 1.0 and the values > 10.0 may point to a collinearity problem.

Table 7 VIF test

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
BLOCKCHAIN	0.002028	7.922734	1.937700
BIG_4_AUDIT	0.004216	4.889065	1.986183
FIRM_AGE	1.30E-06	4.001826	1.016961
TOTAL_ASSETS	7.18E-25	1.643907	1.039758
INTERNAL_CONTROL_QUALITY	0.002293	2.413290	1.030676

Since the VIF values in the previous table don't go over 10, it can be said that no variable exhibits multi-collinearity.

5- Conclusion

In the realm of Blockchain and Internal Controls, a convergence of technologies and procedures aims to create effective mechanisms for monitoring and managing decentralized systems. This bridge between blockchain's inherent

decentralization and the critical need for data security and operational control is essential. The research demonstrates that blockchain technology significantly impacts internal control quality. Approximately 96.6% of the variations observed in internal controls can be attributed to blockchain adoption. The strong association between blockchain and improved internal controls underscores its potential for enhancing financial reporting processes. Organizations should consider adopting blockchain technology to strengthen their internal control systems. However, it's vital to acknowledge that blockchain is not a standalone solution; other factors also play a role in effective internal controls.

6- References

- Abu Afifa, M. M., Vo Van, H., & Le Hoang Van, T. (2023). Blockchain adoption in accounting by an extended UTAUT model: empirical evidence from an emerging economy. *Journal of Financial Reporting and Accounting*, 21(1). <https://doi.org/10.1108/JFRA-12-2021-0434>
- Alfian, A., Ritchi, H., Adrianto, Z., Setiono, K., & Sugianto, L. (2021). CONSTRUCT IDENTIFICATION ON BLOCKCHAIN IMPLEMENTATION IN EMERGING ACCOUNTING AND ASSURANCE DOMAIN. *Indonesian Journal of Business and Entrepreneurship*. <https://doi.org/10.17358/ijbe.7.1.82>
- Andersen, N. (2016). Blockchain Technology A game-changer in accounting? *Deloitte, Berlin*.
- Ang, C. (2021). Current Problems in Accounting Information Disclosure Quality and the Causes Analysis. In *Journal of Frontiers of Society, Science and ...*
- Anis, A. (2023). Blockchain in accounting and auditing: unveiling challenges and unleashing opportunities for digital transformation in Egypt. *Journal of Humanities and Applied Social Sciences*, 5(4). <https://doi.org/10.1108/jhass-06-2023-0072>
- Babayeva, A. (2022). *The Effects of Digitalization on Auditing A Study Investigating the Benefits and Challenges of Digitalization on the Audit Profession*. Lund School of Economics and Management, Lund University.

- Bonsón, E., & Bednárová, M. (2019). Blockchain and its implications for accounting and auditing. In *Meditari Accountancy Research* (Vol. 27, Issue 5). <https://doi.org/10.1108/MEDAR-11-2018-0406>
- Brender, N., Gauthier, M., Morin, J. H., & Salihi, A. (2024). Three lines model paradigm shift: a blockchain-based control framework. *Journal of Applied Accounting Research*, 25(1). <https://doi.org/10.1108/JAAR-06-2022-0143>
- Brody, P. (2020). *How public blockchains are making private blockchains obsolete*. EY Global.
- Burns, J., Steele, A., Cohen, E. E., & Ramamoorti, S. (2020). *Blockchain and Internal Control: The COSO Perspective*.
- Cangemi, M. P. (2021). BLOCKCHAIN AND INTERNAL CONTROL: THE COSO PERSPECTIVE: AN INTRODUCTION AND BRIEF REVIEW. *EDPACS*, 64(1), 14–19. <https://doi.org/10.1080/07366981.2021.1892708>
- Centobelli, P., Cerchione, R., Del Vecchio, P., Oropallo, E., & Secundo, G. (2022). Blockchain technology design in accounting: Game changer to tackle fraud or technological fairy tale? *Accounting, Auditing and Accountability Journal*, 35(7). <https://doi.org/10.1108/AAAJ-10-2020-4994>
- Dai, J., & Vasarhelyi, M. A. (2017). Toward blockchain-based accounting and assurance. *Journal of Information Systems*, 31(3). <https://doi.org/10.2308/isys-51804>
- Dajani, D., & Yaseen, S. G. (2016). The applicability of technology acceptance models in the Arab business setting. *Journal of Business and Retail Management Research*, 10(3).
- Doekhi, R. J. M. (2023). *The Intercompany Settlement Blockchain: Benefits, Risks, and Internal IT-Controls*. https://doi.org/10.1007/978-3-031-11089-4_4
- Dyball, M. C., & Seethamraju, R. (2021). The impact of client use of blockchain technology on audit risk and audit approach—An exploratory study. *International Journal of Auditing*, 25(2), 602–615. <https://doi.org/10.1111/ijau.12238>

- Dyball, M. C., & Seethamraju, R. (2022). Client use of blockchain technology: exploring its (potential) impact on financial statement audits of Australian accounting firms. *Accounting, Auditing and Accountability Journal*, 35(7). <https://doi.org/10.1108/AAAJ-07-2020-4681>
- Fatz, F., Hake, P., & Fettke, P. (2019). Towards tax compliance by design: A decentralized validation of tax processes using blockchain technology. *Proceedings - 21st IEEE Conference on Business Informatics, CBI 2019, 1*. <https://doi.org/10.1109/CBI.2019.00071>
- George, K., & Patatoukas, P. N. (2020). The Blockchain Evolution and Revolution of Accounting. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3681654>
- Ilaboya, Ofuan. J., & Ohiokha, Izien. F. (2016). Firm Age, Size and Profitability Dynamics: A Test of Learning by Doing and Structural Inertia Hypotheses. *Business and Management Research*, 5(1). <https://doi.org/10.5430/bmr.v5n1p29>
- Inder, S. (2023). *Triple Entry Accounting with Blockchain Technology*. <https://doi.org/10.1108/s1569-37592023000111b008>
- Karajovic, M., Kim, H. M., & Laskowski, M. (2019). Thinking Outside the Block: Projected Phases of Blockchain Integration in the Accounting Industry. *Australian Accounting Review*, 29(2). <https://doi.org/10.1111/auar.12280>
- Kokina, J., Mancha, R., & Pachamanova, D. (2017). Blockchain: Emergent industry adoption and implications for accounting. *Journal of Emerging Technologies in Accounting*, 14(2). <https://doi.org/10.2308/jeta-51911>
- Li, W., & Ma, W. (2021). Blockchain adoption and accounting information system: An investigation of challenges and expected value. In *The 15th China Summer Workshop on*
- Orcutt, M. (2019). *Once hailed as unhackable, blockchains are now getting hacked*. MIT Technology Review.
- Popchev, I., Radeva, I., & Velichkova, V. (2021). The impact of blockchain on internal audit. *Big Data, Knowledge and Control Systems Engineering - Proceedings of the 7th International Conference, BdKCSE 2021*. <https://doi.org/10.1109/BDKCSE53180.2021.9627276>

- R. Leavins, J., & Ramaswamy, V. (2023). Improving Internal Control Over Fixed Assets with BLOCKCHAIN. *International Journal of Business & Management Studies*, 04(06). <https://doi.org/10.56734/ijbms.v4n6a1>
- Rozario, A. M., & Thomas, C. (2019). Reengineering the audit with blockchain and smart contracts. *Journal of Emerging Technologies in Accounting*, 16(1). <https://doi.org/10.2308/jeta-52432>
- Rspe, P. E., Ive, C. T., Burns, J., Steele, A., Cohen, E. E., Ramamoorti, S., Burns, J., & Cohen, E. E. (2020). BLOCKCHAIN AND INTERNAL CONTROL Sponsored By Contributing Authors. *Coso*, 1(1).
- Rückeshäuser, N. (2017). Do we really want Blockchain-based accounting? Decentralized consensus as enabler of management override of internal controls. *Internationalen Tagung Wirtschaftsinformatik (WI 2017)*,.
- Sachan, S., & Liu (Lisa), X. (2024). Blockchain-based auditing of legal decisions supported by explainable AI and generative AI tools. *Engineering Applications of Artificial Intelligence*, 129. <https://doi.org/10.1016/j.engappai.2023.107666>
- Schmitz, J., & Leoni, G. (2019). Accounting and Auditing at the Time of Blockchain Technology: A Research Agenda. *Australian Accounting Review*, 29(2). <https://doi.org/10.1111/auar.12286>
- Selimoglu, S. K., & Saldi, M. H. (2023). Blockchain technology for internal audit in cyber security governance of banking sector in Turkey: A SWOT analysis. In *Contemporary Studies of Risks in Emerging Technology: Part B*. <https://doi.org/10.1108/978-1-80455-566-820231002>
- Sheldon, M. D. (2019). A primer for information technology general control considerations on a private and permissioned blockchain audit. *Current Issues in Auditing*, 13(1). <https://doi.org/10.2308/ciia-52356>
- Shi, Z., Bergers, J., Korsmit, K., & Zhao, Z. (2022). *AUDITEM: Toward an Automated and Efficient Data Integrity Verification Model Using Blockchain*. <https://arxiv.org/abs/2207.00370v1>
- Smith, S. S., & Castonguay, J. J. (2020). Blockchain and accounting governance: emerging issues and considerations for accounting and assurance professionals. *Journal of Emerging Technologies in Accounting*, 17(1). <https://doi.org/10.2308/jeta-52686>

- Spanò, R., Massaro, M., Ferri, L., Dumay, J., & Schmitz, J. (2022). Blockchain in accounting, accountability and assurance: an overview. *Accounting, Auditing and Accountability Journal*, 35(7). <https://doi.org/10.1108/AAAJ-06-2022-5850>
- Wang, Y., Gou, Y., Guo, Y., & Wang, H. H. (2020). Construction of Audit Internal Control Intelligent System Based on Blockchain and Cloud Storage. *Proceedings of the 4th International Conference on Trends in Electronics and Informatics, ICOEI 2020*. <https://doi.org/10.1109/ICOEI48184.2020.9143061>
- Wang, Y., & Kogan, A. (2018). Designing confidentiality-preserving Blockchain-based transaction processing systems. *International Journal of Accounting Information Systems*, 30. <https://doi.org/10.1016/j.accinf.2018.06.001>
- Wu, J., Xiong, F., & Li, C. (2019). Application of internet of things and blockchain technologies to improve accounting information quality. *IEEE Access*, 7. <https://doi.org/10.1109/ACCESS.2019.2930637>
- Zhang, Y., Xiong, F., Xie, Y., Fan, X., & Gu, H. (2020). The Impact of Artificial Intelligence and Blockchain on the Accounting Profession. *IEEE Access*, 8. <https://doi.org/10.1109/ACCESS.2020.3000505>