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Tax Evasion Risks in Kenya: The paradoxical effects of Blockchain Technology

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ABSTRACT

Tax evasion remains a critical challenge in Kenya, undermining government revenue and fiscal sustainability. Traditional tax systems often lack transparency and are prone to inefficiencies and fraud, creating avenues for non-compliance. Blockchain technology characterized by transparency, data security, decentralization, and smart contracts offers a promising solution to enhance tax administration. However, limited studies focus on blockchain's application in Kenya's tax system, particularly at the national level, creating a significant research gap. This study investigated the effect of blockchain technology on tax evasion risks in Kenya, focusing on four dimensions: transparency, data security, smart contracts, and decentralization. The study was anchored on the Technology Acceptance Model and the Diffusion of Innovation Theory, while Agency Theory complemented these by addressing accountability dynamics in tax administration. The study adopted a descriptive and explanatory research designs and targeted 318 employees drawn from the Intelligence Strategic Operations Department and the Strategy, Innovation & Risk Management Department of the Kenya Revenue Authority (KRA). A sample of 253 respondents were selected using stratified random sampling based on Yamane's formula. Primary data was collected through structured questionnaires and analyzed using descriptive statistics and inferential techniques, including correlation and multiple regression analysis. Out of the 253 questionnaires distributed, 211 were returned, yielding a high response rate of 83.4 percent, which enhanced the reliability of the findings. The regression model produced an R Square of 0.776 and an adjusted R Square of 0.772, indicating that blockchain transparency, data security, smart contracts, and decentralization jointly explained 77.6 percent of the variation in tax evasion risks. ANOVA results showed that the overall model was statistically significant ($F = 178.713$, $p < 0.001$). Coefficient analysis revealed that all four blockchain dimensions had positive and significant effects on reducing tax evasion risks: data security ($\beta = 0.361$, $p < 0.001$), blockchain decentralization ($\beta = 0.133$, $p = 0.001$), blockchain technology transparency ($\beta = 0.317$, $p < 0.001$), and smart contracts ($\beta = 0.200$, $p < 0.001$). The study concludes that blockchain technology can substantially reduce tax evasion risks by enhancing transparency, strengthening data security, automating tax-related processes through smart contracts, and distributing control to prevent manipulation. Based on these insights, the study recommends that policymakers and tax authorities integrate blockchain technology into national tax systems to enhance transparency and build tamper-proof audit trails, strengthen data security standards and invest in cybersecurity infrastructure,

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enact legislation supporting the implementation and auditing of smart contracts, and encourage decentralized blockchain networks to reduce single points of failure and corruption.

Keywords: *Blockchain technology, tax evasion risks,* transparency*, data security, smart contracts, and decentralization*

1.0 Introduction

Tax evasion remains a global concern, depriving governments of vital revenue for public services and development. With traditional tax systems prone to manipulation, inefficiencies, and lack of transparency, emerging technologies such as blockchain have gained attention for their potential to transform tax administration (Li et al., 2022). Blockchain is a decentralized, immutable ledger system that enhances trust, accountability, and security in digital transactions. By recording transactions across multiple nodes, it significantly limits the opportunities for record tampering, thereby mitigating common evasion tactics. Countries like Estonia have successfully deployed blockchain in tax reporting, leading to faster audits and higher compliance levels (Janssen et al., 2021).

Globally, blockchain's application in tax systems has been enabled by features such as transparency, data security, smart contracts, and decentralization. These components are consistent with the Diffusion of Innovation Theory, which explains how new technologies are adopted and their attributes such as relative advantage, observability, and complexity affect their rate of adoption (Rogers, 2003). Additionally, the TAM offers further insight by linking perceived usefulness and ease of use to user acceptance, which is crucial in explaining tax authority and taxpayer attitudes toward blockchain tools. The Agency Theory also applies, as blockchain minimizes information asymmetry between taxpayers and tax authorities, thereby aligning the interests of both parties through verifiable, tamper-proof data.

Despite its promise, blockchain adoption is context-specific and heavily influenced by a country's institutional and technological environment. In Brazil, for instance, technical integration challenges hampered adoption, while India raised privacy concerns in implementing blockchain-based taxpayer systems (Kumar et al., 2022). In Australia, the use of blockchain smart contracts to automate tax processes has reduced human error and lowered administrative costs, yet experts caution that without strong governance structures, such technologies alone cannot overcome systemic non-compliance (Smith et al., 2023; Taylor & Brown, 2021).

In Africa, blockchain has been explored to improve transparency in revenue collection. South Africa's tax authority has piloted blockchain to enhance VAT compliance, while Nigeria has integrated blockchain into customs and informal sector monitoring to curb evasion (Mhlongo & Sithole, 2021; Oluwaseun et al., 2022). However, implementation across Africa faces institutional challenges including weak infrastructure, resistance to reform, and inadequate digital skills, as observed in Ghana and Uganda (Amponsah & Nyarko, 2020; Namukasa et al., 2023). Nonetheless, successful use cases are emerging, such as Rwanda's blockchain-based property tax system, which has significantly improved the identification of taxable assets (Mukiza et al., 2022).

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In the Kenyan context, tax evasion accounts for significant losses estimated at over Kshs 370 billion annually equivalent to nearly 13% of GDP (Institute of Economic Affairs, 2022). KRA continues to face enforcement and data transparency challenges, especially in high-risk areas such as real estate, cross-border trade, and the informal sector (Omondi & Kibet, 2021). Blockchain technology has been proposed to address these gaps by introducing real-time transaction tracking, secure data storage, and automated compliance enforcement.

KRA has expressed interest in blockchain through its 2018 support for the Blockchain and Artificial Intelligence Taskforce, which recommended its application in taxation (Kariuki & Mwangi, 2022). Although Kenya is yet to fully implement blockchain in tax administration, pilot explorations and policy discussions indicate a growing institutional readiness. Transparency could help uncover undeclared income, data security could prevent tampering of digital tax records, smart contracts could automate tax remittances, and decentralization could eliminate manipulation by intermediaries. These four dimensions derived from the above theories form the independent variables of this study.

Despite the potential, barriers such as high setup costs, lack of specialized expertise, and regulatory uncertainty persist (Muthoni et al., 2022; Wanjiru et al., 2021). Moreover, stakeholder resistance, especially within sectors benefiting from opacity, has slowed adoption. Still, with Kenya's expanding digital infrastructure and interest in tax modernization, blockchain remains a promising tool to address persistent tax evasion risks. This study, therefore, sought to investigate the extent to which blockchain technology through its transparency, data security, smart contracts, and decentralization can reduce tax evasion risks in Kenya.

1.1 Statement of the Problem

Tax evasion in Kenya remains a critical barrier to effective revenue mobilization, costing the country approximately Kshs 370 billion annually nearly 13% of GDP (Institute of Economic Affairs, 2022). This challenge is most pronounced in sectors such as real estate, import/export trade, and the informal and digital economies, where enforcement is hampered by data opacity, weak oversight, and limited technological integration (Omondi & Kibet, 2021). E-commerce, in particular, presents growing risks due to its decentralized nature and the lack of tailored tax monitoring frameworks.

Although blockchain technology offers potential solutions through transparency, data immutability, smart contracts, and decentralization Kenya lacks a specific blockchain regulatory policy, and the Data Protection Act (2019) does not yet accommodate decentralized digital systems. While KRA has shown interest in blockchain adoption, practical implementation remains nascent, and context-specific evidence on its effectiveness in curbing tax evasion is scarce. This study therefore sought to examine how blockchain's core features can reduce tax evasion risks in Kenya, especially in high-risk sectors like e-commerce, and to provide empirical insights that inform national tax modernization efforts.

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1.2 Research Objectives

1.2.1 General objective

The general objective of the study was to establish the effect of blockchain technology on tax evasion risks in Kenya.

1.2.2 Specific objectives

i. To establish the effect of blockchain technology transparency on tax evasion risks in Kenya
ii. To determine the effect of blockchain technology data security on tax evasion risks in Kenya
iii. To establish the effect of blockchain technology smart contracts on tax evasion risks in Kenya
iv. To examine the effect of blockchain technology decentralization on tax evasion risks in Kenya.

2.0 Literature Review

2.1 Theoretical Literature Review

The study was primarily anchored in the Diffusion of Innovation Theory, with the Technology Acceptance Model and Agency Theory offering additional insights to complement the analysis.

2.1.1 Diffusion of Innovation Theory

The Diffusion of Innovation (DoI) Theory by Rogers (1962) explains how innovations are adopted over time based on perceived attributes like relative advantage, compatibility, complexity, trialability, and observability. In the context of blockchain adoption in tax administration, these attributes align with blockchain features such as transparency, data security, smart contracts, and decentralization (Rogers, 2003; Ndung'u & Karanja, 2022). These features offer observable benefits like secure records, automated tax processes, and tamper-proof data trails, which facilitate the innovation's acceptance in the Kenya Revenue Authority (KRA). However, critics argue that DoI underrepresents institutional barriers like bureaucracy and digital infrastructure gaps, which can impede technology diffusion (Roberts & Patel, 2022).

2.1.2 Technology Acceptance Model

The Technology Acceptance Model (TAM), developed by Davis (1986), focuses on how perceived usefulness and ease of use shape user adoption of new technologies. In the case of KRA, blockchain's transparency and automation through smart contracts enhance its perceived usefulness, while its secure and user-friendly interface supports ease of use (Wang & Lin, 2022; Venkatesh et al., 2021). These attributes encourage employee engagement with the system, especially in risk and compliance units. Nonetheless, TAM has been critiqued for its limited attention to organizational dynamics and institutional limitations like ICT capacity, leadership support, and regulatory ambiguity, which also influence adoption in public institutions (Garcia & Torres, 2022; Johnson & Lee, 2023).

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2.1.3 Agency Theory

Agency Theory by Jensen and Meckling (1976) examines the principal-agent relationship, highlighting conflicts of interest and information asymmetry that can lead to tax evasion. Blockchain features such as transparency and data immutability reduce these agency problems by enabling real-time oversight and limiting discretionary manipulation (Mutua & Kariuki, 2022; Mohammed, 2024). Smart contracts automate compliance and reduce opportunities for fraud,

while decentralization enhances accountability by minimizing reliance on intermediaries. Though Agency Theory has been criticized for its narrow focus on monitoring, it remains relevant in addressing trust and compliance issues in tax administration. Collectively, DoI, TAM, and Agency Theory provide a multidimensional framework to explain how blockchain can be adopted and accepted to improve transparency, user engagement, and compliance within Kenya's tax system.

2.2 Empirical Literature Review

2.2.1 Blockchain Technology Transparency and Tax Evasion Risks

Multiple studies have explored the effect of blockchain transparency on tax evasion. Owa et al. (2024) and Smith and Lee (2024) found that blockchain integration enhances financial transaction transparency, which significantly reduces tax evasion risks by creating verifiable and immutable audit trails. In Uganda, Mukasa et al. (2024) emphasized similar benefits within the informal sector, though awareness and digital literacy challenges persist. Additional studies in Malaysia, Spain, China, and Kenya reinforced that blockchain transparency deters evasion by increasing accountability, though technological and regulatory adoption challenges remain a key limitation across contexts.

2.2.2 Blockchain Technology Data Security and Tax Evasion Risks

Research further highlights blockchain's robust data security as a deterrent to tax evasion. Studies in Kenya (Mwangi & Otieno, 2024), India (Kumar & Patel, 2023), and Brazil (Fernandez & Silva, 2023) confirm that blockchain encryption and decentralized storage prevent unauthorized access and manipulation of financial data, thus enhancing compliance. Despite consistent findings across different economies and sectors—including e-commerce and informal business settings—barriers such as high implementation costs, limited expertise, and regulatory gaps continue to impede widespread use of blockchain for tax enforcement.

2.2.3 Blockchain Smart Contract and Tax Evasion Risks

Empirical studies show that blockchain smart contracts enhance tax compliance by automating transactions and minimizing human error. Lim and Tan (2024) found that real-time automation reduced evasion in Malaysia's e-commerce sector, while Mensah and Asare (2024) reported improved transparency among Ghanaian SMEs. Similar findings by Rodriguez and Martinez (2024) in Mexico and Hassan and Yusuf (2023) in the UAE confirmed that smart contracts ensure timely tax remittance and reduce manipulation. However, studies such as Kim and Park (2023) and Sharma and Gupta (2023) noted challenges related to high implementation costs, technical complexity, and regulatory uncertainty. Overall, blockchain smart contracts significantly reduce tax evasion risks by promoting transparency, automation, and data integrity across diverse tax systems.

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2.2.4 Blockchain Decentralization and Tax Evasion Risks

Empirical evidence indicates that blockchain decentralization reduces tax evasion by enhancing transparency, minimizing corruption, and promoting trust in tax systems. Torres and Almeida (2024) found that decentralized networks in Portugal improved real-time access to financial data and strengthened trust between taxpayers and authorities. Similarly, Wang and Li (2023) in China and El-Sayed and Hassan (2023) in Egypt observed that decentralization curtailed manipulation and improved record accuracy, though limited infrastructure and regulatory gaps remained obstacles. Li and Zhang (2023) further confirmed that decentralized systems reduced evasion risks among Chinese firms, while Omondi and Njoroge (2023) in Kenya showed that peer-to-peer validation minimized corruption and revenue leakages. Yilmaz and Kaya (2023) also reported reduced evasion in Turkey's financial sector, albeit hindered by weak enforcement.

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2.3 Conceptual Framework

Figure 1 shows the study's conceptual framework which shows the interrelation between the independent variable and the dependent variable.

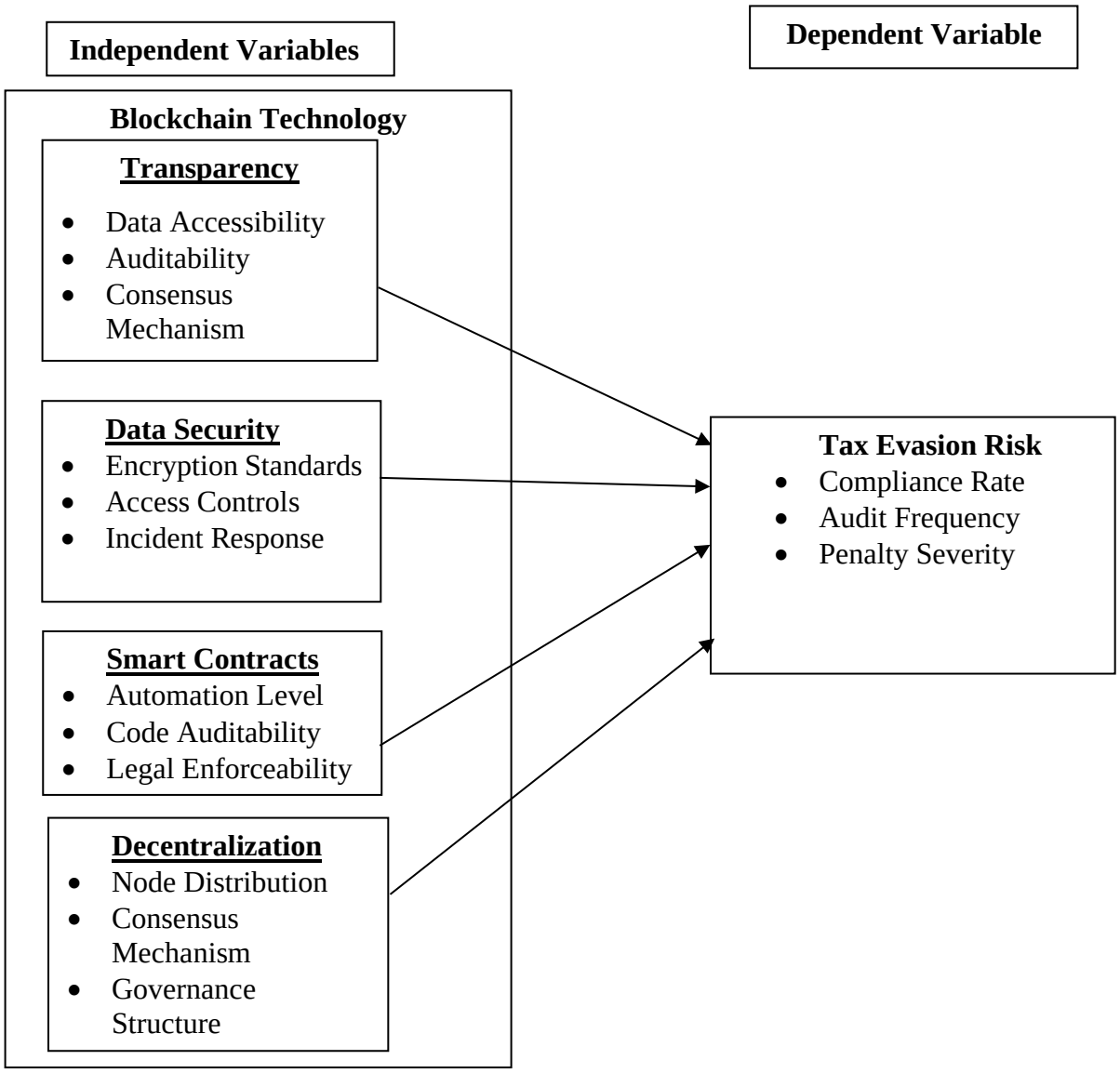

Figure 1: Conceptual Framework

3.0 Research Methodology

This section outlines the methodological framework adopted to investigate the effect of blockchain technology on tax evasion risks in Kenya. The study employed a descriptive and explanatory research design to describe blockchain adoption and examine causal relationships between its attributes—transparency, data security, smart contracts, and decentralization—and tax evasion risks. The target population comprised 318 employees from two Kenya Revenue Authority (KRA) departments: Intelligence & Strategic Operations, and Strategy, Innovation & Risk Management,

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chosen for their involvement in compliance and innovation. Using stratified random sampling, a sample of 253 respondents was determined through Yamane's formula to ensure adequate representation. Primary data were collected using structured questionnaires based on a 5-point Likert scale, while a pilot test involving 25 non-target KRA staff ensured clarity, validity, and reliability of the research instruments.

Validity was confirmed through factor loadings above 0.7, and reliability through Cronbach's alpha values exceeding 0.7, indicating internal consistency. Data were analyzed using SPSS Version 27, employing both descriptive and inferential statistics—specifically correlation and regression analyses—to establish relationships between variables. Diagnostic tests such as normality, multicollinearity, heteroscedasticity, and linearity ensured the robustness of the model. Ethical standards were strictly upheld, with necessary approvals from Moi University and NACOSTI, and informed consent obtained from participants. Confidentiality and voluntary participation were guaranteed throughout the research process, ensuring integrity and credibility of the study's findings

4.0 Results and Discussion

The model summary (Table 1) shows a strong relationship between the predictors—blockchain transparency, data security, smart contracts, and decentralization—and tax evasion risks, with an R of 0.881. The R Square value of 0.776 indicates that these four variables jointly explain about 77.6 percent of the variation in tax evasion risks, while the adjusted R Square of 0.772 confirms that the model remains highly explanatory even after accounting for the number of predictors.

Table 1: Model Fitness

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.881[a]	.776	.772	.205218744963564

a. Predictors: (Constant), Blockchain decentralization, Smart contract, Blockchain technology transparency, Data security

The ANOVA results (Table 2) further validate the model's strength, with an F statistic of 178.713 and a significance level of $p < 0.001$, indicating that the combined effect of the blockchain variables on tax evasion risks is statistically significant.

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Table 2: Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	30.106	4	7.526	178.713	.000[b]
	Residual	8.676	206	.042		
	Total	38.781	210			

a. Dependent Variable: Tax evasion risks
b. Predictors: (Constant), Blockchain decentralization, Smart contract, Blockchain technology transparency, Data security

The coefficients table (Table 3) reveals that all four blockchain dimensions have positive and significant effects on reducing tax evasion risks. Data security emerged as the strongest predictor ($\beta = 0.361$, $p < 0.001$), highlighting that robust encryption, access control, and secure data management are critical in preventing tax fraud. Blockchain decentralization also showed a significant positive influence ($\beta = 0.133$, $p = 0.001$), suggesting that distributing control across multiple participants enhances transparency and minimizes opportunities for manipulation. Transparency ($\beta = 0.317$, $p < 0.001$) and smart contracts ($\beta = 0.200$, $p < 0.001$) likewise contribute significantly, emphasizing that immutable transaction records and automated contract execution deter underreporting and promote compliance.

These findings align with global evidence on blockchain's role in combating tax evasion. Mwangi and Otieno (2024) similarly reported that data security through encryption and real-time validation in Kenyan financial institutions reduced opportunities for fraudulent tax reporting, supporting the strong effect of data security found here. The significant role of transparency resonates with Owa et al. (2024) and Smith and Lee (2024), who observed that transparent, immutable records improved compliance and reduced evasion in Nigeria and the United States. Smart contract results are consistent with Lim and Tan (2024) and Mensah and Asare (2024), who found that automated, self-executing contracts closed loopholes and minimized human error in tax reporting. Finally, the positive impact of decentralization supports the findings of Torres and Almeida (2024) and Wang and Li (2023), who showed that distributed blockchain networks reduced opportunities for corruption and underreporting by eliminating single points of control. Collectively, these results confirm that blockchain technology, through its multidimensional capabilities, offers a powerful framework for reducing tax evasion risks.

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Table 3: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-1.143	.438		-2.608	.010
	Blockchain technology transparency	.227	.051	.317	4.467	.000
	Data security	.361	.072	.361	5.026	.000
	Smart contract	.355	.082	.200	4.352	.000
	Blockchain decentralization	.372	.111	.133	3.344	.001

a. Dependent Variable: Tax evasion risks

5.0 Conclusion

The study concludes that blockchain technology significantly reduces tax evasion risks when applied across its core dimensions of transparency, data security, smart contracts, and decentralization. This demonstrates that blockchain provides a robust framework for strengthening tax compliance. The findings confirm that integrating blockchain into tax administration enhances the accuracy and reliability of financial records, limits opportunities for manipulation, and fosters trust between taxpayers and authorities. This overall effect underscores blockchain's potential as a transformative tool for modern tax systems seeking to minimize evasion.

First, the study concludes that blockchain transparency plays a pivotal role in deterring tax evasion. The ability of blockchain to create immutable, verifiable records and provide real-time access to transaction data ensures accountability and discourages fraudulent reporting. By making financial activities visible and traceable, transparency creates a system in which taxpayers are more likely to comply voluntarily, and tax authorities can easily detect discrepancies. This makes transparent blockchain platforms a key investment area for governments aiming to enhance revenue collection and fairness in taxation.

Second, data security emerged as the most influential factor in lowering tax evasion risks. Advanced encryption, strict access controls, and reliable incident response measures safeguard financial data from unauthorized access and tampering. This high level of protection not only reduces the likelihood of fraudulent reporting but also builds confidence among taxpayers and institutions. The conclusion is clear: adopting blockchain systems with strong security protocols is essential for ensuring the integrity of tax records and sustaining long-term compliance in an increasingly digital economy.

Finally, the study concludes that smart contracts and decentralization complement transparency and security in reducing tax evasion. Smart contracts automate tax-related transactions and provide self-executing agreements that minimize human error and eliminate loopholes for fraud. Decentralization distributes control across multiple participants, eliminating single points of manipulation and reinforcing trust in financial reporting. Although decentralization showed a relatively smaller effect than other factors, its contribution remains significant in creating a

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resilient and tamper-proof tax administration framework. Collectively, these conclusions affirm that comprehensive adoption of blockchain technology can transform tax systems by enhancing transparency, securing data, enabling automation, and distributing control to reduce tax evasion risks effectively.

6.0 Recommendations

The first recommendation is for government and tax authorities to adopt blockchain platforms that prioritize transparency and immutable record-keeping. By integrating blockchain into national tax administration systems, authorities can create verifiable audit trails and provide real-time access to transaction data, making it difficult for taxpayers to conceal income or manipulate records. This requires the development of clear regulatory guidelines, investment in appropriate infrastructure, and collaboration with technology providers to ensure that blockchain systems are tailored to the needs of tax compliance and enforcement.

Second, policymakers should strengthen data security standards in all tax-related digital systems. The study showed that robust encryption, access controls, and transparent incident response procedures are essential in minimizing opportunities for tax evasion. Governments and revenue agencies should therefore establish stringent cybersecurity frameworks for blockchain-based tax systems and mandate regular security audits. Continuous training for tax officers and IT personnel is also crucial to maintain these security standards and respond effectively to emerging cyber threats.

Third, the study recommends mainstreaming smart contracts within tax administration processes. Tax authorities should promote the use of automated, self-executing contracts to handle routine tax calculations, filings, and payments. This will reduce human error, close loopholes that facilitate fraud, and streamline reporting. To implement this effectively, governments need to enact supportive legislation that recognizes the legality of smart contracts, provides guidance on dispute resolution, and ensures that these digital agreements are enforceable in tax-related transactions.

Finally, tax authorities and policymakers should encourage decentralized blockchain networks to improve trust and resilience in tax systems. Decentralization minimizes the influence of single points of control, reducing corruption and increasing taxpayer confidence in the fairness of the system. To achieve this, governments should invest in digital infrastructure and taxpayer education to ensure that all stakeholders understand and can participate in decentralized systems. This approach will help create a more transparent and equitable environment where voluntary compliance is the norm and tax evasion opportunities are significantly curtailed.

7.0 Recommendations for Further Research

Future studies could explore the long-term impact of blockchain adoption on tax compliance across different sectors and jurisdictions. While this study demonstrated significant short-term effects of transparency, data security, smart contracts, and decentralization on reducing tax evasion risks, longitudinal research would provide deeper insights into how these relationships evolve over time and under varying economic conditions. Such studies could also examine the sustainability of blockchain's effectiveness as technology and regulatory environments continue to change.

Further research is also recommended to evaluate sector-specific applications of blockchain in tax administration. Different industries such as manufacturing, agriculture, e-commerce, and financial

services face unique tax compliance challenges and may adopt blockchain at different rates. Comparative studies across these sectors could identify best practices, highlight barriers to adoption, and guide policymakers in designing tailored strategies that maximize blockchain's potential in diverse economic contexts.

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