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DECENTRALIZED INDEX, IMMUTABLE LEDGER AND THE PERFORMANCE OF DEPOSIT MONEY BANKS IN NIGERIA

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Abstract

The study examined the effect of decentralized index and immutable ledger on the level of performance of deposit money bank in Nigeria. The survey research design was used and the main data collection instrument was the structured questionnaire which was administered to employees in four (4) selected deposit money banks in Delta State (Ecobank, Fidelity Bank, Zenith Bank and United Bank for Africa). A sample of ninety (90) respondents was used and data gathered were analyzed using descriptive statistics (standard deviation, frequency count, and simple percentage) and inferential statistics (regression analysis). Findings indicated that there is a positive effect of decentralized index and immutable ledger had significant effect on the level of performance of deposit money banks. Based on the findings, it recommends that deposit money banks should leverage decentralized index to increase efficiency, reduce costs, and enhance customers' satisfaction. Also, policymakers should create enabling environment for the continuous use of immutable ledger. While acknowledging the vital role decentralized index and immutable ledger can play in enhancing performance, there are challenges such as regulatory uncertainty, security risks, and scalability issues, hence management of deposit money banks should develop strategies to address these challenges associated with the use of decentralized index and immutable ledger.

Keywords: *Decentralized index; Immutable ledger; Performance; Deposit money banks*

JEL Classification: *M12; M15*

1. INTRODUCTION

The rapid evolution of digital technologies has transformed the financial services landscape, offering unparalleled opportunities for innovation, efficiency and security. Akinwunmi and Nwosu (2025) noted that effect of these technologies on performance level in the banking sector remains unclear, particularly in the context of deposit money banks in Nigeria. Despite the potential benefits of digital technologies like enhanced transparency, reduced transaction costs, and improved risk management, its adoption and implementation in the banking sector have been slow and uneven (Igoni & Ekpete, 2025; Deloitte, 2025). Moreover, the link between digital technologies (decentralized index and immutable ledgers in particular) and performance level (customers' satisfaction, and operational efficiency), are not adequately documented in Nigeria

Deposit money banks face increasing pressure to remain profitable, efficient, and customer-oriented amid technological disruptions and rising security threats (Waliullah, Rehman & Khan, 2025). While decentralization may improve local responsiveness, it may also create coordination challenges (Nwafor & Okeke, 2024). On the other hand, immutable ledger can enhance auditing and fraud prevention but may involve substantial implementation costs (Ezuwore-Obodoekwe, et al, 2024). The absence of empirical studies on how these structural and technological factors jointly influence performance level of deposit money banks creates a research gap. This study therefore seeks to examine the effects of decentralized index and immutable ledger on the performance level of deposit money banks in Delta State, Nigeria.

Notably, technological innovations, particularly cryptocurrencies and blockchain technology, have reshaped

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the global financial landscape. Cryptocurrencies (e.g. Bitcoin, Ethereum, and stablecoins, etc.) along with Nigeria's own central bank digital currency present opportunities for banks to reduce transaction costs, facilitate borderless transfers, and increase financial inclusion. Empirical evidence shows that digital technologies improve transaction efficiency through enhanced speed, clarity, and fraud reduction (Oranefo, 2024). Consequent upon the above, this study aims to examine these technologies can affect performance level of deposit money banks with a view to offering insights into the opportunities and challenges associated with the adoption of these technologies in the Nigerian banking sector.

2. REVIEW OF RELATED LITERATURE

2.1 Decentralized Index

The banking industry has undergone significant changes in recent years, driven by advances in technology and changing customer needs. One of the key trends in the industry is the use of decentralized technologies such as blockchain and decentralized finance. Decentralization refers to the removal of a central authority in data management, where all nodes (participants) on a blockchain have equal access and control. A decentralized index is a type of index that is created and maintained by a decentralized network of nodes, rather than a central authority (Williams, 2019). The use of decentralized technologies, including decentralized indexes, has the potential to significantly impact organizational performance in DMBs

Decentralized indexes can provide a range of benefits, including transparent and tamper-proof, which can help to improve trust and confidence in the banking system. This is because decentralized indexes are maintained by a decentralized network of nodes, rather than a central authority, which can help to reduce the risk of manipulation and errors. Decentralized indexes can automate many of the manual processes involved in banking, which can help to improve operational efficiency and reduce costs (Tapscott & Tapscott, 2016). This is because decentralized indexes can use smart contracts to automate tasks, such as data verification and transaction settlement.

Decentralized indexes use advanced cryptography to secure transactions, which can help to improve security and reduce the risk of fraud. This is because decentralized indexes use cryptographic techniques, such as public-key cryptography and hash functions, to secure transactions and protect data. Decentralized indexes can provide real-time data and insights, which can help banks to make better decisions and improve their performance (Schwartz, 2017). This is because decentralized indexes can provide a transparent and tamper-proof record of all transactions, which can help banks to track and analyze data in real-time.

There are challenges of decentralized indexes; for instance, the regulatory framework for decentralized technologies is still evolving and banks must navigate this uncertainty to ensure compliance. This can be a challenge, as regulatory requirements may vary depending on the jurisdiction and the specific use case. Decentralized indexes are still in the early stages of development, and scalability issues can limit their adoption. This is because decentralized indexes may not be able to handle a large volume of transactions, which can limit their use in large-scale applications. Different decentralized indexes may have different architectures and protocols, which can make it challenging to achieve interoperability. This can be a challenge, as banks may need to integrate different decentralized indexes with their existing systems and infrastructure.

2.2 Immutable Ledger

An immutable ledger refers to a secure, tamper-resistant record-keeping system where transactions, once recorded, cannot be altered or deleted. In the context of DMB, immutable ledger technology often built using blockchain or distributed ledger system, ensures that all financial transactions remain transparent, verifiable, and auditable over time. This technology leverages cryptographic hashing, digital signatures, and consensus mechanisms to guarantee that transaction histories are resistant to fraud, manipulation, or unauthorized alterations. As a result, immutable ledgers provide a single source of truth for internal operations, regulatory reporting, and customer dispute resolution (Zubairu & Chiemeke, 2024).

In Nigeria, the Central Bank of Nigeria (CBN) and the Nigeria Interbank Settlement System (NIBSS) has shown increasing interest in distributed ledger technology for payment settlement, fraud detection, and financial inclusion programs. CBN's regulatory sandbox framework encourages the testing of blockchain solutions for secure payments and Know Your Customer (KYC) processes, with strict compliance requirements on data immutability, auditability, and encryption (CBN, 2024). The immutable ledger concept is also reinforced by the Nigeria Data Protection Regulation (NDPR), which emphasizes data integrity in financial systems (BusinessDay, 2023).

Several leading banks including Access Bank, Zenith Bank and United Bank for Africa are exploring immutable ledger applications in their core banking and digital transaction processes. Some DMBs have piloted blockchain-backed internal reconciliation systems, enabling real-time transaction matching across mobile, point of sale (POS) and inter-bank transfer platforms. Immutable ledgers not only reduce reconciliation errors but also speed up dispute resolution between customers and the bank, improving operational efficiency and service quality (Guardian, 2024).

The performance effect of immutable ledger adoption on DMBs can be viewed from several dimensions. First, it enhances fraud prevention and risk management; immutable ledgers make it virtually impossible to manipulate transaction records without detection, thereby deterring insider fraud and external cyberattacks (Onyeama, 2024). Second, it strengthens regulatory compliance. In Delta State, where CBN examiners regularly audit branch records, immutable ledger facilitates transparent reporting and audit readiness. Third, it boosts trust

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and retention of customers as clients have greater confidence in the accuracy/transparency of their transaction histories.

Fourth, it improves operational efficiency as the elimination of manual reconciliation reduces downtime and operational costs. Finally, it drives innovation capacity by enabling secure integration with financial technology (fintech) partners and cross border payment platforms. Empirical studies support these performance benefits. Waliullah et al. (2025) reported that financial institutions using blockchain immutable ledgers achieved significantly faster transaction settlement times and lower fraud incidence rates compared to traditional ledger systems. Similarly, a 2024 Nigerian banking sector pilot showed that blockchain-backed reconciliation reduced operational errors by 38% and improved interbank transaction speed by 52% (CBN Sandbox Report, 2024)..

However, there are implementation challenges of immutable ledger; the initial cost of blockchain integration, including staff training and system upgrades, can be prohibitive for smaller banks. Legacy banking systems may lack the interoperability needed to integrate distributed ledgers without significant redevelopment. There are also regulatory uncertainties around the use of public versus private blockchain systems in Nigeria's banking sector (BusinessDay, 2024). Additionally, rural branches face infrastructure limitations such as unreliable internet connectivity, which can affect the real-time synchronization of ledger data.

To maximize the performance benefits of immutable ledgers, DMBs should adopt a phased integration approach, starting with internal reconciliation and compliance reporting before expanding to customer facing applications. They should invest in staff training on blockchain security and data integrity, collaborate with fintech partners for interoperable solutions, and align with CBN's evolving regulatory guidelines. Thus, immutable ledger offers DMBs, a powerful tool to improve transparency, enhance operational efficiency, reduce fraud, and strengthen customer trust.

2.3 Performance of Deposit Money Banks (DMBs)

Organizational performance refers to the ability of an organization to achieve its goals and objectives (Richard et al., 2009). It entails the effective use of resources like human capital, technology, and finance to create value for stakeholders. In the context of DMBs, performance is critical to ensuring stability and security of the financial system (Berger & Humphrey, 1997). The adoption of blockchain technology in DMBs has the potential to significantly impact organizational performance (Tapscott & Tapscott, 2016).

Blockchain is a decentralized, digital ledger that records transactions across a network of computers (Nakamoto, 2008). It uses cryptography to secure and validate transactions, making it a secure and transparent way to conduct business (Swan, 2015). The adoption of blockchain technology in DMBs can improve performance in several ways. First, it can automate many of the manual processes involved in banking, such as transaction processing and settlement (Williams, 2019). This can lead to increased efficiency and reduced costs.

Second, it technology uses advanced cryptography to secure transactions, making it virtually impossible for hackers to manipulate the blockchain (Yli-Huumo et al., 2016). This can lead to improved security and reduced risk of fraud. Furthermore, these technologies provide a transparent and tamper-proof record of all transactions, making it easier to track and verify transactions (Schwartz, 2017). This can lead to improved accountability and reduced risk of errors. Additionally, these technologies can enable faster and secure transactions, leading to increased customer satisfaction and loyalty (Tapscott & Tapscott, 2016). The adoption of these technologies can also offer a competitive advantage to DMBs, enabling them to differentiate themselves from their competitors.

The regulatory framework for these technologies is still evolving, and DMBs must navigate this uncertainty to ensure compliance (Schwartz, 2017). Additionally, these technologies are still in their early stages and scalability issues can limit its adoption (Yli-Huumo et al., 2016). Different technology platforms may have different architectures and protocols, making it challenging to achieve interoperability (Swan, 2015). Moreover, while most of these technologies are secured, they are not immune to security risks and DMBs must ensure that they have adequate security measures in place(Williams, 2019). The use of these technologies requires specialized skills and expertise, and DMBs must ensure that they have the necessary talent to support the adoption of these technologies.

2.4 Theoretical Framework

Blockchain technology has emerged as a revolutionary innovation with the potential to transform various industries, including finance, healthcare, and supply chain management (Tapscott & Tapscott, 2016). At its core, blockchain technology is a decentralized, distributed ledger that records transactions across a network of computers (Nakamoto, 2008). This technology has been touted as a game-changer for organizational performance, enabling greater transparency, security, and efficiency (Catalini & Gans, 2016).

The rise of blockchain technology can be attributed to its ability to provide a secure, transparent, and tamper-proof record of transactions (Swan, 2015). This is achieved through the use of advanced cryptography and a decentralized network of computers that verify and validate transactions (Antonopoulos, 2014). The implications of blockchain technology are far-reaching, with potential applications in various industries, including finance, healthcare, and supply chain management (Drescher, 2017).

Several theoretical theories can be applied to understand the effect of blockchain technologies on organizational performance; however, this study was hinged on the transaction cost theory (TCT) and resource-based view (RBV). First, TCT posits that organizations strive to minimize transaction costs, which include costs associated with searching, negotiating, and monitoring transactions. Blockchain technology can reduce transaction costs by enabling secure, transparent, and efficient transactions.

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Second, the RBV suggests that organizations can gain a competitive advantage by acquiring and leveraging valuable, rare, and inimitable resources. Blockchain technology can be considered a valuable resource improving the level of performance.

3. METHODOLOGY

The study examined the effect of decentralized index and immutable ledger on the level of performance of deposit money bank in Nigeria. The survey research design was used and the main data collection instrument was the structured questionnaire which was administered to employees in four (4) selected deposit money banks in Delta State (Ecobank, Fidelity Bank, Zenith Bank and United Bank for Africa). The dependent variable is DMBs performance while the independent variables are decentralized index and immutable ledger.

Furthermore, the study population comprised employees of four (4) DMBs in Delta State with branches Obiaruku, Abraka, Ozoro and Oghara, hence resulting to a population of one hundred and fifteen (115), out of which a sample of ninety (90) respondents was selected. The model of the study is given as follows:

$$DMBsPerf = f(DecInd, ImmLed)$$

$$DMBsPerf_i = \beta_0 + \beta_1 DecInd_i + \beta_2 ImmLed_i + u_i$$

Where: DMBsPerf is deposit money bank performance; DecInd is decentralized index; ImmLed is immutable ledge. Data gathered were analyzed via descriptive statistics (standard deviation, simple percentages, and frequency counts) and inferential statistics (multiple regression models). STATA 13.0 statistical software was used in carrying out statistical tests.

4. RESULTS

Table 1: Decentralized Index and DMBs Performance

Decentralized index	SD 1	D 2	U 3	A 4	SA 5
Decision-making is distributed across different levels rather than concentrated.	10	18	19	20	23
	11.1 %	20%	21.1%	22.2%	25.5%
Decentralization in my bank has improved efficiency and service delivery.	5	6	5	30	44
	5.6%	6.6%	5.6%	33.3%	48.9%
Employees are empowered to make decisions that enhance customer satisfaction and performance	7	4	3	25	51
	7.7%	4.4%	3.3%	28.0%	56.6%
Decentralized structures in my bank encourage innovation and adaptability to new technologies such as blockchain.	10	12	15	20	33
	11.1%	13.3%	16.7%	22.2%	36.6%
Decentralization contributes positively to the organizational performance of my bank.	5	6	10	20	49
	5.6%	6.6%	11.1%	22.2%	54.4%

Source: Computed by the Researchers (2025)

Table 1 indicates that decentralization plays an important role in shaping performance in DMBs. A significant proportion of respondents affirmed that decision-making is distributed across different levels of the bank, though a notable minority still perceived authority to be concentrated at the top. This finding suggests that while decentralization exists, it may not be fully entrenched in all aspects of organizational decision-making. More striking, however, is the strong support for the view that decentralization improves efficiency and service delivery.

Over 80% of respondents agreed or strongly agreed that distributing authority enhances operational outcomes, reflecting the capacity of decentralized structures to reduce bottlenecks and improve responsiveness to customer needs. This is consistent with the idea that empowering employees contributes to organizational agility. Indeed, employee empowerment emerged as one of strongest outcomes, with more than 84% acknowledging that it enhances customer satisfaction and overall performance; this demonstrates that decentralization not only improves internal decision-making but also has a direct positive impact on customer-facing services.

The role of decentralization in fostering innovation and adaptability, particularly in relation to emerging technologies like blockchain, was also highlighted, although responses were more mixed. While 58.8% agreed or strongly agreed, about one-quarter of respondents expressed reservations. This indicates that although decentralization creates opportunities for innovation, its effectiveness may depend on the extent to which employees are trained and supported to adopt new technologies. Decentralization was strongly linked to organizational performance, with 76.6% of respondents agreeing or strongly agreeing that it contributes positively.

Furthermore, this suggests that decentralized structures enhance efficiency, employee participation, and adaptability, ultimately leading to better organizational outcomes. Nevertheless, the presence of some dissenting views implies that challenges remain, particularly in achieving widespread

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acceptance of decentralized practices and ensuring that innovation is fully realized within DMBs.

Table 2: Immutable Ledger and DMBs Performance

immutable ledger	SD 1	D 2	U 3	A 4	SA 5
The use of an immutable ledger has improved the accuracy and reliability of financial records in my bank.	4 (4.4%)	8 (8.9%)	13 (14.4%)	30 (33.3%)	35 (38.9%)
Immutable ledger technology has reduced the risk of data manipulation and fraud in my bank.	5 (5.6%)	9 (10.0%)	12 (13.3%)	29 (32.2%)	35 (38.9%)
Adoption of immutable ledger systems has enhanced trust and transparency in my bank's operations.	6 (6.7%)	10 (11.1%)	14 (15.6%)	27 (30.0%)	33 (36.7%)
Immutable ledger technology has improved regulatory compliance and auditing processes in my bank.	5 (5.6%)	11 (12.2%)	13 (14.4%)	28 (31.1%)	33 (36.7%)
The use of an immutable ledger has positively contributed to the overall performance of my bank.	4 (4.4%)	8 (8.9%)	13 (14.4%)	30 (33.3%)	35 (38.9%)

Source: Computed by the Researchers (2025)

The findings from Table 2 indicate that the adoption of immutable ledger technology is perceived positively in relation to organizational performance in deposit money banks. On the accuracy and reliability of financial records, 72.2% of respondents agreed or strongly agreed that the immutable ledger has improved record-keeping, while only 13.3% disagreed, highlighting strong confidence in its reliability. Similarly, 71.1% of respondents agreed or strongly agreed that the technology reduces the risk of data manipulation and fraud, with only 15.6% expressing disagreement. In terms of transparency, 66.7% of respondents agreed or strongly agreed that immutable ledgers enhance trust and transparency in bank operations, while 17.8% disagreed, suggesting that the majority view it as a trust-building mechanism.

On regulatory compliance and auditing, 67.8% agreed or strongly agreed that the technology improves compliance processes, with 17.8% disagreeing, reinforcing its perceived importance for oversight and accountability. Finally, overall performance received strong endorsement, with 72.2% of respondents agreeing or strongly agreeing that immutable ledger systems contribute positively to organizational performance, while only 13.3% disagreed. The results demonstrate that immutable ledger technology is widely regarded as a valuable tool for enhancing **accuracy, fraud prevention, transparency, compliance, and overall organizational performance** in DMBs, though a small minority of respondents remain cautious about its effectiveness.

Table 3: Multiple Regression Model

Variables	Beta (β)	t-value	Sig. (p)
Decentralized Index	0.18	2.45	0.016
Immutable Ledger	0.25	3.60	0.001
Model Summary R = 0.91	Adjusted R^2 = 0.81	F= 68.2, p < 0.001	

Source: Computed by the Researchers (2025)

The regression analysis revealed that the model explained 81% of the variance in performance, indicating strong explanatory power of the independent variables; the predictors had significant positive effects showing their importance in enhancing trust, efficiency, and risk management. The overall F-statistic confirmed that the model was statistically significant ($p < 0.001$). Overall, findings indicated that there is positive effect of decentralized index and immutable ledger had significant effect on the level of performance of DMBs

5. CONCLUSION AND RECOMMENDATIONS

In this study, we investigated the effects of decentralized index and immutable ledger on the performance level of DMBs in Nigeria. Survey design was employed and data collection instrument was a structured questionnaire, which was administered to employees in four (4) selected DMBs in Delta State such as Ecobank, Fidelity Bank, Zenith Bank and

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United Bank for Africa). The study sample comprised ninety (90) respondents and data obtained were analyzed via descriptive statistical tools (standard deviation, frequency counts, and simple percentages) and inferential statistical tools (multiple regression models).

Given the findings, the study recommends that DMBs should leverage decentralized index to increase efficiency, reduce costs, and enhance customers' satisfaction. In addition, there is there is the need for policymakers to create enabling environment for the continuous use of immutable ledger. While acknowledging the vital role decentralized index and immutable ledger can play in enhancing performance, there are challenges like regulatory uncertainty, security risks, and scalability issues, hence management of deposit money banks should develop strategies to address these challenges associated with the use of decentralized index and immutable ledger.

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