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Artificial Intelligence Adoption and Operational Efficiency of Deposit Money Banks

Ayobaye Salemcity[1], Olabode Olutola Aiyesan[2], Adewumi Tobi Orina[3], Henry Adelakun Adinlewa[4]

Abstract: Understanding the need for taking competitive advantage by organizations and staying abreast of innovations has contributed to the adoption of artificial intelligence (AI) by some deposit money banks (DMBs) in Nigeria. **Objectives:** This study examines the effect of AI on cost reduction and profitability of DMBs in Nigeria. **Prior works** show that operating efficiency cannot not be fully achieved in traditional banking. **Approach:** the study aims to investigate how AI can boost productivity, cut expenses, and improve operational efficiency in deposit money banks in Nigeria. To achieve its objectives, the study employs a quantitative approach by utilizing multivariate models for the analysis of the panel data gathered. The study establishes the need for AI in improving operational efficiency and financial performance in the banking sector. **Results** reveal that AI investments significantly contribute to cost efficiency, which, in turn, enhances profitability in Nigerian DMBs. **Implications:** The study establishes that AI-driven automation and predictive analytics optimize banking operations by reducing operational costs while improving service delivery. **Value:** The study highlights the strategic significance of AI in banking, proposing empirical evidence for academics and researchers, guiding bank administrators and policymakers on AI investment for effectiveness and financial sustainability.

Keywords: artificial intelligence; operational efficiency; cost reduction; profitability; artificial intelligence investments

JEL Classification: The Journal of Economic Literature

1. Introduction

The heavy manual transactions of deposit money banks (DMBs) have been replaced by internet banking due to the adoption of artificial intelligence (AI), because of the growth in financial data and the processing capacity needed to enable real-time responsiveness to the constantly growing demands

[1] Department of Accounting, Adekunle Ajasin University, Akungba-Akoko, Nigeria, Corresponding author: ayobaye.salemcity@aaua.edu.ng.
[2] Department of Accounting, Adekunle Ajasin University, Akungba-Akoko, Nigeria, E-mail: olabode.aiyesan@aaua.edu.ng.
[3] Department of Finance, Adekunle Ajasin University, Akungba-Akoko, Nigeria, E-mail: toridam@yahoo.com.
[4] Afe Babalola University, Ado-Ekiti, Nigeria, E-mail: adinlewahenry@pg.abuad.edu.ng.

of financial data consumers. Firms are now using contemporary technology instead of this antiquated approach, which has a significant effect on the services sector (Zeithaml & Bitner, 2003). By enabling both clients and staff to provide and receive effective service, this continues to grow considerably (Rane et al., 2023).

Deposit Money Banks (DMBs) in Nigeria are progressively accepting AI-driven technologies such as chatbots, predictive analytics, fraud detection systems, and automated credit scoring to improve their service delivery, optimize costs, and ease risks. AI may therefore help financial institutions provide targeted recommendations, automate routine tasks, detect fraudulent behavior, and improve cyber security measures (Jones et al., 2022).

Notwithstanding the advantages of AI adoption, Nigerian DMBs strive with operational inadequacies. The study seeks to determine whether AI adoption efficiently reduces costs, improves profitability, and advances total banking performance. Quite a lot of challenges impede the effective execution of AI in Nigerian banks, these include inadequate infrastructure, high implementation costs, regulatory reservations, and limited technical expertise (Nnaomah et al., 2024). Additionally, Oyeniyi et al. (2024) posit that there is doubt about AI's capability to replace traditional banking operations while ensuring accuracy, security, and customer satisfaction (Rane et al., 2024). Furthermore, the resistance to change among bank employees and customers poses a significant barrier to AI integration (Diener & Špaček, 2021). However, the goal of this study is to investigate how the use of AI may boost productivity, cut expenses, and improve operational efficiency in deposit money banks in Nigeria.

AI is the machines (programs) that operate in the simulation of human intelligence (Łapińska et al., 2021) in technologies, such as machine learning, data mining, natural language processing, image recognition (Iqbal et al., 2021). According to Kaplan and Haenlein (1987) in Di-Vaio et al. (2020), AI is capable of accurately interpreting outside input, learning from it, and applying that knowledge to accomplish certain tasks and goals through adaptable change. AI is used when a computer simulates cognitive processes like learning (Hussain & Pangilinan, 2023) and problem-solving that is associated with human minds (Joksimovic et al., 2023) in order to increase the likelihood that a project will be completed successfully. AI helps organizations to automate routine and repetitive tasks (Challoumis, 2024), freeing up employees to focus on more complex and creative work (Morandini et al., 2023) and provide insights and recommendations based on vast amounts of data, enabling organizations to make more sound and informed decisions (Aldoseri et al., 2023).

AI-powered analysis of customer data can enable deposit money bank's (DMBs) to provide highly personalized services and products (Okoliko et al., 2023), which can lead to higher customer satisfaction and loyalty (Singh & Singh, 2024), as well as increased revenue (Yaiprasert & Hidayanto, 2024). AI can automate manual processes, reducing the need for human intervention and minimizing operational costs (Prabhod, 2024). This, in turn, can increase profitability for DMBs. Al can influence market growth rate by increasing efficiency and automation (Acemoglu & Restrepo, 2018). By using Al algorithms, businesses can automate many of their processes, such as data analysis, customer service, and logistics (Bortolotti & Romano, 2012). This can result to costs reduction and increase efficiency (Mahi, 2024), while workers are freed up to be more focused on strategic tasks (Ola-Oluwa, 2024).

Banking institutions may leverage on the revolutionary power of this technology and preserve their competitive advantage in the ever changing financial market by first acknowledging the potential benefits of AI adoption and then successfully navigating the hurdles connected with its

implementation. The study supposes that the adoption of AI should improve operating efficiency in DMBs in Nigeria. Considering this, the study aimed to establish effects of AI on cost reduction and profitability in DMBs in Nigeria.

2. Literature Review

2.1. Artificial Intelligence

Onyezere et al. (2024) define AI as a set of theories and techniques used to create machines that are capable of stimulating intelligence. AI, according to Selfridge and Simon in Wamba-Taguimdje et al. (2020), is the use of computers to simulate intelligent behavior with little or no human intervention. AI, as defined by Wamba-Taguimdje et al. (2020), is the use of technology instruments to replicate human cognitive capacities to attain goals autonomously while accounting for potential limits.

The business processes are being substantially reshaped by AI and its components, including deep learning, machine learning, Chabot, neural networks, virtual assistants, and others (Kuzey et al. in Wamba-Taguimdje et al., 2020). Because AI enables businesses to increase customer happiness, cut expenses, and perform better, it has grown in popularity in the corporate world (Elegunde & Osagie, 2020). AI has advanced significantly since the introduction of machine learning (automated learning from datasets), including Deep Learning (which uses neural networks) (Buchanan, in Wamba-Taguimdje et al., 2020). Instead of modeling massive amounts of data, machine learning techniques are employed to train neural networks that learn by consuming millions of test data (Zemouri et al. in Wamba-Taguimdje et al., 2020). Machine learning and neural network processing can perform faster and more relevantly than human labor when combined with vast amounts of data (Wamba-Taguimdje et al, 2020). Al uses a wide variety of technologies, such as machine learning, deep learning, and natural language processing. Self-learning systems, perception, speech recognition, decision-making and language translation are all made possible by these technologies.

2.1.1. Machine Learning

Machine learning (ML) is a subset of AI (Zhang et al., 2023) that involves training algorithms to recognize patterns (Taye, 2023) and make decisions based on data (Luz & Ray, 2024). It is a branch of the artificial intelligence application domains. ML is used for a variety of computer jobs where explicit algorithms can be devised or programmed. In fraud detection domain, machine learning earns credit as there are innumerable ways to breach security. Thus, the learning systems help to fight fraud by detecting unique activity or behaviors and flag them for security teams (Erdelyi & Goldsmith, 2018). AI applications in banking, such as predictive analytics and automated customer service, ultimately rely on machine language for execution. Understanding machine language can provide insights into the performance and optimization of these AI systems (Adediran & Olaniyi, 2024). Machine language is the bedrock upon which all software, including AI applications used in banking, is built. It provides the direct interface with hardware, ensuring that instructions are executed efficiently. While machine language itself is complex and challenging to work with directly, its role in enabling high-level applications and optimizations is critical. Understanding machine language helps in appreciating the underlying mechanisms of AI systems and their impact on modern banking technologies.

2.1.2. Chatbot

Chatbot are software applications designed to simulate conversation with human users, particularly over the Internet (Lin et al., 2023). They use natural language processing (NLP) (Kasthuri & Balaji,

2023), machine learning (ML), and sometimes it is used to interpret and respond to users' quests. Chatbots can operate through various platforms, including websites, mobile apps, and messaging services (Merelo et al., 2024), providing users with automated interactions that mimic human conversation (Rapp et al., 2024). Chatbots use NLP to recognize and generate human-like text. This includes interpreting user inputs, which are characteristically written in everyday language, and generating responses that align with the context and content of the inquiry. The sophistication of a chatbot largely depends on its underlying technology and design.

Chatbots are examples of artificial intelligence in banking that are replacing the front-desk scenes at the banks. These AI machines provide another level of digitized and customized interactive experiences to the customers (Gao & Liu, 2023). Chatbots play a crucial role to improve customer service and operational efficiency in the banking sector. One of invaluable advantages of chatbot is their ability to provide 24/7 support for both customers and banks. This round-the-clock accessibility ensures that customers get assistance whenever they need it, even outside of traditional banking hours (Anifowose & Ekperiware, 2022). This can lead to improvement in the service of banks to their customer without the need for continual human direction. Shittu (2020) in his study examines the influence of chatbots in the Nigerian banking sector. He discovered that, for industries to stay relevant there is the need for partnership between employees and artificial intelligence. AI-powered chatbots, however, offer additional benefits while delivering a more personalized banking experience to their customers. For instance, if a customer frequently inquires about loan options, the chatbot might proactively provide information on current loan products or special offers without the customer requesting for it. This level of personalization helps banks engage more effectively with their customers and improve overall satisfaction.

2.1.3. Artificial Intelligence and Cost Reduction

Cost reduction refers to schemes and practices aimed at reducing expenses while ensuring that the quality of the product or service is retained (Alzoubi et al., 2022). The process involves critical thinking to improve profitability and competitiveness in any firm (Soori et al., 2023). Cost reduction in corporate tasks is achievable through a variety of approaches which include process optimization (Mithas et al., 2022), workforce efficiency (Charles & Ochieng, 2023), and technological developments. Obiki-Osafiele et al. (2024) in their study also maintained that the automation and integration of modern technologies such as AI into the operation of companies can lead to significant reductions in labor cost and enhance their operational efficiencies.

Effects of AI on cost reduction covers diverse businesses and sectors (Enholm et al., 2022), indicating its transformative ability to optimize processes, increase operating efficiency, and minimize operating expenses. AI enables automation of repetitive and time-consuming tasks previously performed by humans. The application of AI allows the automation of tasks that are repetitive in nature and time-consuming which have previously been herculean task to humans. This automation shrinks labor expenses while increasing efficiency (Prabhod, 2024). For example, AI-powered robotic process automation (RPA) may handle data entry, customer questions, and basic decision-making, freeing up human resources for more complicated and strategic duties (Bughin et al., 2018). AI algorithms can quickly and accurately evaluate large amounts of data, generating insights that assist enterprises in streamlining processes. This capacity leads in better resource allocation, optimized supply chain management, and waste reduction, all of which contribute to decreased operational costs (Brynjolfsson & McAfee, 2017). In industry such as manufacturing and logistics, AI-powered predictive maintenance systems can identify equipment faults before they happen. This proactive strategy

decreases downtime, lowers maintenance costs, and increases the lifespan of machinery and infrastructure (Adaramola et al., 2024). However, Li et al. (2021) maintained that AI is not always beneficial to the performance of organizations. Shiyyab et al. (2023) in their research also emphasized that AI has negative impact on total expenses of companies. On these premises, the following hypothesis was proposed:

Hypothesis 1: Artificial intelligence adoption has no significant effect on cost reduction in deposit money bank in Nigeria.

2.1.4. Artificial Intelligence and Profitability

Profitability is an important factor that measures the financial success and performance of a company (Diana & Maria, 2020). This is a show of the ability of a company to generate profits through its operations after the consideration of all the expenses it incurred during the financial year. This assertion was also shown in the research of Olayinka, (2022) that crucial to the growth and sustainability of a company is its ability to ensure sound financial health and performance of the business (Olayinka, 2022). Lin (2008) therefore defined profitability as the measure of sustainability in business and the ability of companies to income through its available income (Bessler et al., 2005).

Profitability in deposit money banks revolves around their ability to generate income while managing costs and risks effectively (Choudhry, 2022); central to this is the concept of net interest margin, which represents the difference between the interest earned on loans and the interest paid on deposits (Campmas, 2020). A higher margin indicates efficient use of financial resources.

Profitability in deposit money banks is increasingly influenced by the adoption of AI technologies (Adedoja et al., 2024), which enhance operational efficiency (Prabhod, 2024), customer engagement (Hollebeek et al., 2021), and risk management and enabling data-driven decision-making (Javaid, 2024). Integrating AI technologies can enable banks to restructure several procedures in their operations such as loan approvals, risk assessment, and fraud detection. For instance, AI algorithms can analyze vast amounts of data quickly, allowing banks to make faster lending decisions while minimizing risk which eventually can culminate to higher profit for the company. Additionally, AI can optimize pricing strategies for loans and deposits by analyzing market trends and customer behavior, helping banks to maximize interest income (Ashta & Herrmann, 2021). Overall, AI adoption not only reduces costs but also creates opportunities for new revenue streams, ultimately enhancing the bank's profitability in a competitive landscape.

However, there are other studies that revealed that some factors influence the profitability of a company aside AI such as customer behavior (Joel & Oguanobi, 2024), pricing strategy (Kalusivalingam et al., 2020), quality and innovation of products/services (Lulaj, 2023). Based on these studies, the following hypothesis was proposed:

Hypothesis 2: Artificial intelligence adoption has no significant effect on profitability of deposit money banks in Nigeria.

2.2. Theoretical Review

Two theories have been closely linked to this study- Resource-Based View Theory articulated by Barney (1991) which posits that a firm's unique resources and capabilities contribute significantly to its competitive advantage and market performance. For DMBs in Nigeria, leveraging AI technologies

can be observed through the RBV lens to determine how these technologies boost their resource base and contribute to market growth. RBV submits that banks with advanced AI capabilities, such as sophisticated data analytics and machine learning algorithms, can leverage these resources to improve decision-making, operational efficiency, and customer service, thereby enhancing their market position and growth rate. Meanwhile, Roger (1962) developed the Innovation Diffusion Theory to traverse how, why, and at what rate innovations and new technologies spread among individuals and organizations. The theory investigates how new technology or ideas gain acceptability and propagate among various sectors of a population. This theory highlights that the goal for implementing technology is to improve corporate operations and gain a competitive advantage over larger competitors.

3. Methodology

3.1. Data

Expost facto research design was adopted for the study since there existed all the needed data in the financial statements of the samples that were purposively selected from the population of the study. The study selected deposit money banks that are vast in the use of AI as the sample size which includes; Access bank, Zenith bank, First bank of Nigeria, Guaranty trust bank, Eco bank, Fidelity bank, Sterling bank and Union Bank. All these banks have deployed AI to their operations. The study employed secondary source of data collection in order to achieve the specific objectives and hence address the research problem of the study. The use of secondary data was adjudged to be a better source in that, the data collected through such source is free from bias as seen in most primary data. The collected data were analyzed using both descriptive and inferential statistics.

3.2. Research Method

The research employed multivariate models to assess the impact of artificial intelligence (AI) adoption on operational efficiency (cost reduction and profitability) of deposit money banks in Nigeria. The models used for the study are specified as:

$$CR_{it} = \alpha + \beta_1 AI_{it} + \ldots\ldots\ldots + \epsilon_{it} \quad (1)$$

$$PROF_{it} = \alpha + \beta_1 AI_{it} + \ldots\ldots\ldots + \epsilon_{it} \quad (2)$$

where CR is the cost reduction, PROF is the profitability and AI is the artificial intelligence. The i is the i^{th} firm while t is the time period involved in the study (2017-2023), α is the Intercept, β_1 is the coefficient of independent variables and ϵ is the model disturbance term.

3.3. Variable Measurement

Artificial intelligence was measured as the annual total amount spent on AI-related acquisitions, such as software licenses, hardware purchases, cloud computing subscriptions, and other AI technology investments over a defined period.

Cost reduction measures the effectiveness of AI adoption in lowering the bank's operational expenses. This dependent variable was quantified by comparing the bank's total operating costs before and after

the implementation of AI technologies. It was measured as the percentage decrease in operational costs, calculated as:

$$Cost\ reduction = \left(\frac{Operating\ Cost\ Before\ AI\ -\ Operating\ Cost\ After\ AI}{Operating\ Cost\ Before\ AI} \right)\ x\ 100$$

This ratio will indicate the efficiency gains achieved through AI-driven process automation and optimization.

Profitability also assesses the bank's financial performance following AI adoption. It will be measured using the profit margin ratio, which is calculated as the quotient of net profit to total revenue, expressed as a percentage:

$$Profitability = \left(\frac{Net\ Profit}{Total\ Revenue} \right)\ x\ 100$$

This metric helped to determine whether AI investments have led to an improvement in the bank's ability to generate higher returns.

4. Empirical Results

4.1. Descriptive Statistics

The descriptive statistics presented in Table 1 below provided valuable insights into operational efficiency and AI-related investments of Deposit Money Banks (DMBs) in Nigeria. These statistics focus on cost reduction, profitability and AI software and hardware capitalization. The data represents a total of 56 observations, summarizing important central tendencies and distribution characteristics such as the mean, median, maximum, minimum, standard deviation, skewness, kurtosis, and Jarque-Bera test results.

Table 1. Descriptive Statistics

	Cost Reduction (%)	Profitability (%)	AI Software and Hardware Capitalization (₦ billion)
Mean	19.07321	33.73214	17.84643
Median	17.25000	31.95000	13.50000
Maximum	42.10000	61.90000	69.20000
Minimum	6.500000	13.90000	1.900000
Std. Dev.	8.847095	12.38216	14.50100
Skewness	0.591414	0.390910	1.452530
Kurtosis	2.511755	2.185498	4.986440
Jarque-Bera	3.820755	2.974193	28.89906
Probability	0.148025	0.226028	0.000001
Sum	1068.100	1889.000	999.4000
Sum Sq. Dev.	4304.910	8432.482	11565.34
Observations	56	56	56

Source: Researcher computation, 2024

The mean cost reduction among the sampled banks is 19.07%, indicating that, on average, AI adoption has contributed to a 19% decrease in operational costs. The median value of 17.25% suggests that half of the banks achieved cost reductions below this value, highlighting a degree of variability in AI's effectiveness in reducing costs across different banks. The maximum cost reduction recorded is 42.1%, showing that some banks experienced substantial cost savings, while the minimum cost

reduction is 6.5%, indicating that not all banks achieved significant operational cost decreases. The standard deviation of 8.85% further supports this variability, suggesting moderate differences in cost reduction outcomes. The skewness value of 0.59 indicates a slightly positive skew, meaning most banks tend to cluster around the lower end of cost reduction, with fewer banks achieving significantly higher reductions. The kurtosis of 2.51 is close to normal distribution (kurtosis = 3), indicating a relatively normal distribution of cost reduction data. The Jarque-Bera test probability of 0.148 suggests that the data does not deviate significantly from normality.

Profitability, as measured by the profit margin, has a mean of 33.73%, reflecting a strong financial performance across the banks following AI adoption. The median profitability of 31.95% is relatively close to the mean, suggesting a balanced distribution of profit levels among the banks. The maximum recorded profitability is 61.9%, while the minimum is 13.9%, indicating a wide range of profitability outcomes and illustrating that while some banks have significantly benefited from AI, others are still struggling to achieve comparable profitability gains. The standard deviation of 12.38% points to considerable variation in profitability outcomes. A skewness of 0.39 implies a slight positive skew, suggesting that more banks achieved lower profitability levels, though a few outliers have performed exceptionally well. The kurtosis value of 2.19 indicates a distribution that is slightly flatter than normal. The Jarque-Bera probability of 0.226 shows no significant deviation from normality, reinforcing that the profitability data is moderately well-behaved statistically.

AI software and hardware capitalization, representing the banks' investment in AI technologies, has a mean value of ₦17.85 billion. The median capitalization is ₦13.5 billion, indicating that half of the banks invested less than this amount in AI-related infrastructure. The maximum investment recorded is ₦69.2 billion, showing that some banks made significant financial commitments to AI, while the minimum is just ₦1.9 billion, indicating that some banks have not heavily invested in AI. The standard deviation of ₦14.50 billion points to considerable disparity in AI investments. The skewness value of 1.45 suggests a strong positive skew, with most banks clustering towards the lower end of AI investment, while a few banks have made disproportionately large investments. The kurtosis of 4.99, together with the Jarque-Bera probability of 0.000001, indicates a leptokurtic distribution with significant deviations from normality, driven by a few banks with extremely high investments.

4.2. Test of Variables

4.2.1. Correlation Coefficient

The correlation coefficients derived from Table 2 using Pearson's method, provide an understanding of how each of these variables interacts with others in Deposit Money Banks (DMBs) in Nigeria. Each variable's relationship with others reveals significant patterns regarding the influence of AI investments on operational efficiency of Deposit Money Banks (DMBs) in Nigeria.

Table 2. Correlation Statistics

	AI Software and Hardware Capitalization	Cost Reduction (%)	Profitability Net Profit (%)
AI Software and Hardware Capitalization	1.000		
Cost Reduction (%)	.810**	1.000	

Profitability	**Net Profit (%)**	.801**	.990**	1.000

Source: Researcher computation, 2024

AI software and hardware capitalization, representing the banks' investment in AI infrastructure, exhibits strong positive correlations with all other variables. Additionally, AI software and hardware capitalization show a strong correlation with cost reduction ($r = 0.810$, $p < 0.01$). This suggests that greater investments in AI infrastructure contribute significantly to reducing operational costs. Given that AI technologies can streamline processes, automate repetitive tasks, and improve efficiency, this positive relationship emphasizes how capitalizing on AI software and hardware can enhance operational cost efficiency.

The correlation between AI capitalization and profitability ($r = 0.801$, $p < 0.01$) reveals that banks that invest heavily in AI tend to report higher profit margins. This indicates that AI infrastructure not only contributes to reducing costs but also enhances profitability. The correlation analysis highlights the significant role that AI investments, both in software/hardware and research, play in driving key financial outcomes in Deposit Money Banks in Nigeria. AI adoption is strongly linked to cost reduction, which in turn leads to improved profitability. The interdependencies between these variables underscore the transformative impact of AI on financial performance; with banks that invest more heavily in AI tend to reap greater benefits in terms of cost efficiency, profitability, and growth.

4.2.2. Regression Analysis

Objective 1: The effect of artificial intelligence adoption on cost reduction of deposit money banks in Nigeria

The regression analysis presented below is designed to assess the relationship between AI Software and Hardware Capitalization and Cost Reduction (%) in the context of Deposit Money Banks (DMBs) in Nigeria. The output provides valuable insights into how investments in AI infrastructure and research affect cost reduction, an essential metric for bank profitability and efficiency.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.834[a]	.696	.684	4.9709	1.043
a. Predictors: (Constant), AI Software and Hardware Capitalization					
b. Dependent Variable: Cost Reduction (%)					

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2995.267	2	1497.633	60.608	.000[a]
	Residual	1309.643	53	24.710		
	Total	4304.910	55			

a. Predictors: (Constant), AI Software and Hardware Capitalization

b. Dependent Variable: Cost Reduction (%)

Coefficients[a]

Model		Unstandardized Coefficients	Standardized Coefficients			
	B	Std. Error	Beta	T	Sig.	
1	(Constant)	9.744	1.077		9.049	.000
	AI Software and Hardware Capitalization	1.089	.229	1.786	4.752	.000

a. Dependent Variable: Cost Reduction (%)

The correlation coefficient (R) of 0.834 indicates a strong positive relationship between the independent variable (AI Software and Hardware Capitalization) and the dependent variable (Cost Reduction). This suggests that the independent variable explain a substantial portion of the variance in cost reduction. The R-Square value of 0.696 reveals that approximately 69.6% of the variation in cost reduction is explained by the influence of AI Software and Hardware Capitalization. This indicates a good fit of the model, as a significant proportion of the variance in cost reduction is captured by the independent variable. The adjusted R-Square of 0.684 accounts for the number of predictors in the model, providing a slightly more conservative estimate of the variance explained by the independent variable. This value confirms that about 68.4% of the variability in cost reduction is attributed to AI-related investments expenditure, even after adjusting for the number of predictors in the model.

The F-statistic of 60.608 is quite large, indicating that the regression model provides a significantly better fit to the data compared to a model with no predictors. This large value indicates that the independent variable has a statistically significant impact on cost reduction. The p-value is less than 0.05, meaning the model is statistically significant at the 1% level. This suggests that AI Software and Hardware Capitalization have a significant effect on cost reduction in the DMBs under study. The significance of the F-test implies that, as a whole, the model fits the data well.

The coefficient for AI Software and Hardware Capitalization is 1.089, indicating that for every ₦1 billion increase in AI Software and Hardware Capitalization, cost reduction increases by approximately 1.09 percentage points, holding other factors constant. The p-value of 0.000 suggests that this effect is highly statistically significant. The positive relationship confirms that increased AI investments significantly contribute to cost reduction in DMBs. This could be because AI technologies help automate processes, optimize resource use, and improve operational efficiency, thereby reducing costs.

Objective 2: The effect of artificial intelligence adoption on profitability of deposit money banks

This regression analysis aims to examine the impact of AI Software and Hardware Capitalization on Profitability (Net Profit %) of Deposit Money Banks (DMBs) in Nigeria. By analyzing these relationships, the model provides insight into how technological and research investments influence the financial performance of these banks, particularly focusing on profitability.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.809[a]	.655	.642	7.4072	1.010

a. Predictors: (Constant), AI Software and Hardware Capitalization

b. Dependent Variable: Profitability Net Profit (%)

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5524.569	2	2762.285	50.346	.000[a]
	Residual	2907.913	53	54.866		
	Total	8432.482	55			

a. Predictors: (Constant), AI Software and Hardware Capitalization

b. Dependent Variable: Profitability Net Profit (%)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	21.112	1.604		13.159	.000
	AI Software and Hardware Capitalization	1.156	.342	1.354	3.385	.001

a. Dependent Variable: Profitability Net Profit (%)

The correlation coefficient (R) of 0.809 indicates a strong positive relationship between the independent variable (AI Software and Hardware Capitalization) and the dependent variable (Profitability). This suggests that investments in AI infrastructure play a significant role in influencing profitability in DMBs. The R-Square value of 0.655 means that approximately 65.5% of the variation in profitability is explained by AI Software and Hardware Capitalization highlighting the importance of technological investments in driving profitability.

The adjusted R-Square of 0.642 provides a more refined estimate, accounting for the number of predictors in the model. This indicates that, after adjusting for the number of variables, approximately 64.2% of the variance in profitability can still be explained by AI investments. The relatively small difference between R-Square and Adjusted R-Square indicates that the model is not overfitted and remains robust even when accounting for multiple predictors.

The F-statistic of 50.346 is quite large, which indicates that the model significantly improves the prediction of profitability compared to a model with no predictors. This suggests that the independent variable (AI Software and Hardware Capitalization) has a statistically significant effect on profitability. The p-value of less than 0.05 (p = .000) suggests that the model is statistically significant at the 1% level. This confirms that the independent variable has a significant influence on profitability demonstrating the importance of AI as a factor that affects profitability.

The coefficient for AI Software and Hardware Capitalization is 1.156, meaning that for every ₦1 billion increase in AI-related investments, profitability increases by approximately 1.16 percentage points, holding all other factors constant. The p-value of 0.001 indicates that this relationship is statistically significant at the 1% level. This suggests that AI investments are positively associated with profitability, and banks that invest in AI technologies experience significant improvements in their profit margins. The positive coefficient highlights the importance of AI in enhancing operational efficiency, optimizing resources, and potentially increasing revenue through innovations.

The results demonstrate that AI Software and Hardware Capitalization has a significant positive effect on profitability. This finding highlights the value of technological advancements in the banking sector,

where AI applications such as automation, data analytics, and customer service optimization can directly contribute to higher profits. Banks that prioritize AI investments are likely to see better financial outcomes, reinforcing the importance of adopting cutting-edge technology in a competitive market.

The high R-Square value (0.655) and significant F-statistic (50.346) indicate that the model explains a large portion of the variance in profitability, making it a reliable tool for predicting the influence of AI investment on financial outcomes. However, the moderate standard error (7.4072) and Durbin-Watson statistic suggest that there may be room for further refinement, particularly in terms of controlling for autocorrelation and potentially including additional variables that capture other determinants of profitability.

5. Summary and Conclusion

This study observed the effect of adopting artificial intelligence (AI) on the operating efficiency of deposit money banks (DMBs) in Nigeria, focusing on its impact on cost reduction and profitability. The research adopted an ex-post facto design and utilized secondary data from annual financial statements of selected DMBs. The study revealed that the adoption of AI technologies in deposit money banks significantly contributed to cost reduction. Automation of processes, improved decision-making, and enhanced operational efficiency were major contributors to this effect. Banks that invested in AI experienced a decrease in operational costs, leading to improved financial performance.

The study also found that AI adoption had a positive and significant impact on the profitability of DMBs. By automating routine banking tasks, improving fraud detection, and personalizing customer services, AI helped banks enhance their profit margins. AI technologies such as machine learning algorithms and predictive analytics were instrumental in improving profitability outcomes.

The findings highlight that AI adoption is crucial for the financial growth and market competitiveness of Nigerian DMBs. By leveraging AI to enhance operational efficiency, improve customer experiences, and tap into new revenue streams, banks can position themselves for sustained growth in an increasingly competitive digital economy. The study underscores the importance of strategic AI investments and suggests that the benefits will likely outweigh the costs in the long term, driving future advancements in Nigeria's banking sector.

6. Implication and Future Research

This study underscores the importance of AI adoption in fostering operational efficiency in DMBs in Nigeria. The study reveals the direct contribution of AI investment to the profitability and operational efficiency of DMBs which disclose that investment in AI significantly contributes to cost reduction and enhanced profitability. This might primarily be achieved through automating its major activities, improved decision-making, and operational optimization. Integrating AI into the core strategic plans on an organization should be paramount so they can have edge over other institutions. Future studies could also unravel the lagged effect that Research and Development may have on financial performance by researching on other qualitative variables that can be considered along with AI such as customer satisfaction, operational risk and employee productivity. This will help to gain more insight into the impact of AI on financial performance of the banking sector. Exploring the impact of AI on

risk management of DMBs, carrying comparative analysis of AI adoption across other African countries, identifying the specific technology such as blockchain, natural language processing or machine learning that actually contribute to profitability and drive cost reduction will also contribute substantially to future studies of how AI affects the profitability of DMBs in Nigeria.

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