Innovations

Achieving Sustainable Performance of Deposit Money Banks in Nigeria through Artificial Intelligence Strategies

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Abstract: The rise in the number of deposit money banks in Nigeria prompted by the entry of foreign and private banks; the consolidation of existing banks and the establishment of new local banks has increased competition in the banking sector in Nigeria. Unfortunately, the conventional means of capturingthe attention of bank customersand enhancing sustainable performance have failed to address the challenges posed by competition in the banking industry in Nigeria. Consequently,artificial intelligence is a new age survival and technological advancement strategy used in this contemporary time to address the challenges posed by competition in the banking sector.Therefore, this study critically examined how artificial intelligence strategies lead to sustainable performance of deposit money banks in Nigeria. The study adopted an ex-post facto research design for a period of ten years spanning from 2014 to 2023. Sustainable performance was measured using net operating profit while artificial intelligence strategies were measured usingvirtual assistants, expert systems, machine learning algorithms and chat bots. The population of the study comprised the 14 deposit money banks in Nigeria but only 12 that use artificial intelligence were investigated. Pearson correlation analysis was used to determine the extent of relationship between sustainable performance of deposit money banks and artificial intelligence strategies. Panel regression analysis statistical technique was used to determine the nature, direction, effect and the significance of artificial intelligence strategies on sustainable performance of deposit money banks. The study found that artificial intelligence strategies positively relate and have significant effect on sustainable performance of deposit money banks in Nigeria. The conclusion drawn from findings is that artificial intelligence strategies enhance sustainable performance of deposit money banks in Nigeria. The researcherstherefore recommend that banks should sustainedthe use of virtual assistants, expert systems, machine learning

algorithm and chat bots since theyare significant artificial intelligence tools that stimulate and enhance sustainable performance of deposit money banks in Nigeria.

Keywords: *Sustainable performance; AI; artificial intelligence strategies; DMBs; Nigeria.*

Introduction

The performance of businesses is very crucial in predicting the level of growth and outcomes in a developing economy like Nigeria. However, the performance of any business whether financial or non-financial must provide a yardstick upon which business stakeholders can measure the degree of their effectiveness, efficiency, productivity, returns and profitability. Undoubtedly, in order toenhance the sustainable performance of deposit money banks in Nigeria;the bank managers and other stakeholders need tokeep abreast ofthe existence of sophisticated technologies, mechanisms, tools and inventionsthrough artificial intelligence.Artificial intelligence is an advanced technology that enables machines and computers to stimulate human learning, creativity, autonomy, comprehension, decision-making and problem solving (Ndungu and Sije, 2023).It is any artificial system that performs tasks under varying circumstances without human oversight. Importantly, the use of artificial intelligence is expected to improve business performance by supplementing and boosting business operations with respect to human deficiencies (Pratama et al.,2023; Li et al., 2023). Incontrovertibly, artificial intelligence also helpsinintroducing a new as well as better ways of handling bank operations and transactions.Indisputably, human physical operations and the use of orthodox proceduresare now being replaced with technology-driven mechanism such as artificial intelligence in the deposit money banks. Therefore, artificial intelligence has become a roller coaster for technological changes in thebanking sector which is now a prerequisite for the survival of any banking business (Prabu, Venkata,Pranjali,andPoornima,2024).

The growth in the number of deposit money banks in Nigeria spurred by the entry of foreign and private banks, the consolidation of existing banks and the establishment of new local banks has increased competition in the banking sector (Julius, GuddaandAgoki, 2021). In order to survive and grow in the market, banks have been encouraged to adopt new technologies and innovative products (Fang, 2020). Thus, artificial intelligence serves as an offshoot of these technologies and inventions. Technologies and inventions seem to be the main engine of the improved standard of living in this contemporary world today.Thus, judging from this assumption; businesses are very much included. Hence, the changes in the banking business world have been transformed by intelligent machines and advanced technologies. These machines are programmed such that they can perform tasks and functions which prior to this time, could only be performed by

humans with specialized knowledge, special abilities and extensive as well as in-depth training. The world is gradually getting accustomed to seeing specialized cameras serving as security, robots functioning in the workplace, cars driving themselves (self-driving cars), machines transacting business and many more.Therefore, deposit money banks survive stiff competition due tothe advent of artificial intelligence (Wisskirchen, Biacabe, Bormann, Muntz, Niehaus, SolerandBrauchitsch, 2017).

Interestingly, a number of deposit money banks have adopted the use of technologies in their day to day operations. The banking sector in Nigeria has undergone tremendous changes in the last two decades. Increased competition has led to the introduction of new products and services in the market. Therefore, in order to survive the menace of competition, banks have been forced to adopt new technology and innovative products. Empirically, extant literature has shown that studies have been conducted on artificial intelligence and business performance (Wisskirchen, Biacabe, Bormann, Muntz, Niehaus, SolerandBrauchitsch, 2017; Soni, Sharma, Singh and Kapoor, 2018; Batallerand Harris, 2016; Matthew Scherer, 2016). The researchers reported varying findings due to different ways of conceptualization and operationalization of AI. In addition, a lot of studies done onartificial intelligencewere done in developed countries (Chang et al., 2018; Huebner et al., 2019; Fang, 2020)which created a geographicalgap.Also,only a few studies were done in Africa (Ondiek, 2021; Julius, GuddaandAgoki, 2021; Wanalo, Mande andNg'ong'a, 2020; Nduta, 2020) thereby creating a gap which need to be filled.In Nigeria, there is paucity of empirical studies on artificial intelligence.A few studied reviewed in Nigeria focused on robotics, job factors, intelligent algorithm, data safety issuesand financial objectives without empirical studies on expert systems, chatbots and virtual assistants.Therefore, this study aimed to address the identified gaps by investigating how artificial intelligence strategies lead to sustainable performance of deposit money banks in Nigeria.

Literature Review
Artificial Intelligence

Artificial intelligence is an advanced technology that enables machines and computers to stimulate human learning, creativity, autonomy, comprehension, decision-making and problem solving (Ndungu and Sije, 2023).It is any artificial system that performs tasks under varying circumstances without human oversight. Artificial intelligence is a new age technological advancement which helps in transforming bank's corporate operations, increasing productivity, and improving sustainable performance in the banking sector. Hence, application and devices equipped with artificial intelligence can identify, see objects, understand and respond to human language. The artificial intelligence strategy helps deposit money bank that use it become a leader in the industry.Therefore,

artificial intelligence is used to promote national security. Significantly, one of the most significant transformation in the banking sector in this present dispensation is the use of artificial intelligence. Specifically, artificial intelligence using financial expert systems has helped to provide a new and emerging industry in the banking sector (Kemboi, 2018).The use of technology has overtime affected the way businesses are being transacted, such that, banks are attesting to how useful and important, artificial intelligence had become, in the performance of their operations and execution of tasks. Furthermore, individuals need to acquire new skills in order to collaborate productively with these sophisticated systems, the adoption of AI technologies often required large investments in training and upskilling the workforce (Prabu, Venkata, PranjaliandPoornima, 2024). The report stressed that in order to fully utilize AI, human expertise and automated procedures must be balanced. In spite of these obstacles, the introduction of AI into financial banks processes is revolutionary. Banks that effectively use AI ominously boost sustainable performance and competitiveness. Therefore, artificial intelligence has had a significant impact on banks' corporate operations. It has enhanced efficiency, effectiveness,growth and innovation that ultimately have benefitedboth the organizations and customers.

Artificial Intelligence Strategies

Strategy is a practical plan or approachused to achieve a targeted goal or objective(Qian Xu andChenghao Xu, 2023).Banking services such as e-banking, mobile banking and open banking use AI technology to provide services in the areas of payments, lending, investments, automation and money transfer. Accordingly, in order toascertain the effect of artificial intelligence on sustainable performance of banks; various artificial intelligence strategies are identified in this work. This is because they have direct effect on the operation, survival and sustainable performance of deposit money banks in Nigeria. Thus, for artificial intelligence to be effective, it must be able to learn from past experience, infer power, respond quickly and possess the ability for decision making (Ifekandu et al., 2023). Hence, the artificial intelligence strategies which this work concentratedon are as follows; expert systems, virtual assistants, machine learning algorithms and automated chat bots.

Expert Systems

Expert systems are artificial intelligence programs adopted in the 1980's. They are capable of replacing human specialty in a particular field of decision making. Expert systems are easily implemented and most widely used artificial intelligence technology. They include computer programs that simulates thinking manner of expert in a particular field. They are often developed with expert system shells. An expert system shell is a software programming environment which enables the construction of expert or knowledge based systems. According to Taghizadeh, Mohammad, Dariush and Jafar (2013), expert

systemsoftware can be developed for any problem thatinvolves a selection from among a definablegroup of choices where the decision is based onlogical steps. Hence any area where aperson/group has special expertise needed byothers is a possible area for an expert system (Babatunde et al., 2024).

Virtual Assistants and Chat Bots

Artificial intelligence technologies such as virtual assistants and chat bots give reliable, accurate and instant responses and feedback to bank customers' inquiries; manage multiple customers' interactions simultaneously and reduce customers' waiting times in the banking hall (Rane et al., 2024). Artificial intelligence-driven chatbots and virtual assistants enhance client happiness and retention by offering prompt, customized assistance in the field of customer care. In addition, businesses can make well-informed, strategic decisions by utilizing AI-driven data analytics; which provide insightful information about consumer behavior and market trends. Furthermore, by optimizing inventory levels and reducing disruptions, AI improves supply chain management through predictive analytics. Furthermore, by providing immediate, individualized support, artificial intelligence (AI) applications in customer service such as "chatbots" and "virtual assistants" have greatly increased customer satisfaction and retention rates (Ifekandu et al., 2023). Also, Virtual Assistants and Chatbotsare programmed to undertake tasks that are usually undertaken by human beings (Skandali et al.,2023).

Machine Learning Algorithms

Machine learning artificial intelligence algorithms are used in marketing to precisely target particular audience segments, hence improving company performance. Integrating artificial intelligence increases competitiveness, inventiveness, and agility, which in turn increases profitability, market share and sustainable performance. The use of artificial intelligence in corporate operations such as deposit money banks has had a major impact on organizational performance in different parts of the world in recent years. Furthermore, in line with current trends, Saroha et al. (2023) examined how businesses used artificial intelligence to attain maximum productivity, efficiency and effectiveness. For instance, AI-driven data analytics gprovide companies with more comprehensive understanding of consumer behavior and industry trends. It also facilitates better strategic planning and decision-making. In addition, the integration of machine learning and natural language processing algorithmhelp deposit money banks to evaluate enormous volumes of data fast and precise.

Sustainable Bank Performance

Sustainable simply means ability to continue for a long time or capable of being sustained over a period of time. It also means ability of something to be maintained at a certain level (Anetohet al., 2022). Sustainable is akin to

sustainability which means the ability to maintain or improve the state and availability of desires resources, conditions or operations over a long period of time (Anetoh et al., 2022). Performance connotes many things such as output, result, productivity, effectiveness, efficiency and so on. It can be the execution or accomplishment of work, act or fulfilment of a task. Although many scholars have conducted research on performance such as (Anetoh et al., 2020; Dike et al., 2021; Okeke et al., 2020; Anetoh&Anetoh, 2016). Bank performance entails the effectiveness and efficiency with which a bank operates. Sustainable performance connotes the harmonization of financial objectives in delivery of core business activities in order to maximize value and demonstrate accountability. Also, it is the ability of the organization to achieve its business objectives, maintain financial stability and enhance values for shareholders over a long period of time (Kamble et al., 2020). Furthermore, sustainable bank performance entails bank having good return on assets, equity, good earning management and so on. Therefore, artificial intelligence strategies have positive significant effects on sustainable performance of commercial banks (Ndungu and Sije, 2023).

Theoretical Foundation: Bank-Focused Theory by Kapoor (2010)
This study drewinspiration and anchored on Bank-Focused theorypropounded by Kapoor (2010). This theory states that banks adopt non-traditional low-cost delivery channels to provide banking services to itsexisting customers. The theory assumes that using artificial intelligence increases the level of convenience, accuracy, speed and quality so as to meet up with ever growing and dynamic customers' request on timely basis. According to this theory, automated teller machines, internet banking or mobile phone banking, POS and others are used to personalize customers' transaction without having to waste time and energy, queuing in the banking hall for long time due to the usage of artificial intelligence. Banks address these issues by providing branchless banking services with an easy to use interface. The only thing required is to input the needed information into the system and the transaction is concluded.Based on Bank-Focused theory, the customers' primary concerns are the quality of experience, security of identity and transactions, reliability and accessibility of service and extent of personalization allowed. This engenders bank customers' patronage of the bank's products for enhanced and sustainable performance. Therefore, this study originated from this theory and anchors on it.

Empirical Review
Qian Xu andChenghao Xu (2023)conducted an investigation the relation between AI and performance inautomobile manufacturing firms. The study revealed that there is a significant and positive correlation between artificial intelligence and return to assets. In addition, the study found that there is a significant and positive correlation between artificial intelligence and return to equity.Ho, LinhTu, Christopher, Gan, Shan Jin, and Bryan Le. (2022) investigated on the impact of the

coronavirus pandemic on the performance of (AI). The findings showed that the negative impact of COVID-19 on the AI stock market was less severe than on the conventional stock market in the first month of the pandemic. Agarwall, Das and Swain (2021) assessed the influence of AI on operatingperformance of the companiesindifferent sectors in India. The study found that artificial Intelligence has a significant influence on companiesoperating cost and profit.Ibekwe and Helen, (2020) examined the effect of artificial intelligence on organizational performance of selected manufacturing companies in Port Harcourt. The study found that artificial intelligence has a positive and significant effect on organizational performance of manufacturing companies in Port Harcourt.

Wisskirchen et al., (2017) examined the impact of artificial intelligence and robotics on the workplace. The study found that that manylost their jobs because they lack sufficient training to perform in a new AI environment. Cockburn, Henderson, and Stern (2017) investigated the effect of artificial intelligence on innovation in Toronto, USA. The study found that artificial intelligence aids in automation of many tasks for enhanced innovation development and market sustainability. Morikawa (2016) examined the impact of artificial intelligence on future business in Japan. The findings showed that Japanese firms are positively impacted by artificial intelligence. Salfano and Robert (2014) investigated the relationship between artificial intelligence and market share in selected companies in Sri Lanka. The findings showed that artificial intelligence has a significant relationship with the market share of companies studied.

Methodology
The study adopted an ex-post facto research design. The study covered a period of ten years spanning 2014 to 2023. The population of the study comprised 14 deposit money banks while 12 deposit money banks that use artificial intelligence formed the sample size as well as unit of analysis. The datasourced based on artificial intelligence strategies and banks sustainable performance were scrutinized. Furthermore, datasourced for the study were collated, coded and computed. Importantly, artificial intelligence variables such as virtual assistants, expert systems, machine learning algorithms and chat botswereoperationalizedand accordingly measured. Sustainable bank performance which is the dependent variable was also measured using net operating profit. Pearson correlation analysis was used to determine the extent of relationship between sustainable performance of deposit money banks and artificial intelligence strategies. Regression analysis statistical technique was used to determine the nature, direction, significance and the effects of artificial intelligence strategies on sustainable performance of deposit money banks. However, the model adopted in this study assumed a linear relationship between artificial intelligence strategies and sustainable bank performance which was tested at 5% level of significance.In addition, the panel least square regression analysis was used which was guided by the following linear model:

$SBPERF_{it} = \beta_{0it} + \beta_1 EXPEST_{it} + \beta_2 VAST_{it} + \beta_3 MACLA_{it} + \beta_4 CBOTS_{it} + \varepsilon_{it..}$

Where;

SBPERF stands for sustainable bankperformance measured using net operating profit. EXPEST stands for expert system, VAST connotes virtual assistant, MACLA means machine learning algorithms while CBOTS stands for chatbots.

Results and Discussion of Findings

The study investigated the empirical effect of artificial intelligenceonsustainable performance of quoted deposit money banks in Nigeria for a period of 10 years spanning 2014 to 2023. The study conducted some preliminary data tests such as descriptive statistics, correlations and variance inflation factor (VIF) analysis in order to make this study stand out and also to provide a genuine result. However, table 1 shows the descriptive statistics of the study.The descriptive statistics result on table 1 shows the mean values for each of the variables, their maximum values, minimum values, standard deviation and Jarque-Bera values which show the normality and nature of the data.The aim of the descriptive statistics is to describe the general distributional properties of the data, to identify any unusual observationsorany unusual patterns of observations that may cause problems for main analyses to be carried out on the data.Sustainable bank performance which is the dependent variable was measured using net operating profit.

Table 1:Descriptive Statistics

	SBPERF	EXPEST	VAST	MACLA	CBOT
Mean	2.056500	0.191667	0.675000	0.883333	0.333333
Median	1.650000	0.000000	1.000000	1.000000	0.000000
Maximum	5.590000	1.000000	1.000000	1.000000	1.000000
Minimum	-2.160000	0.000000	0.000000	0.000000	0.000000
Std. Dev.	1.367998	0.395263	0.470339	0.322369	0.473381
Skewness	0.626215	1.566686	-0.747265	-2.388201	0.707107
Kurtosis	3.298878	3.454505	1.558405	6.703504	1.500000
Jarque-Bera	8.289543	50.12297	21.55908	182.6498	21.25000
Probability	0.015847	0.000000	0.000021	0.000000	0.000024
Sum	246.7800	23.00000	81.00000	106.0000	40.00000
Sum Sq. Dev.	222.6987	18.59167	26.32500	12.36667	26.66667
Observations	120	120	120	120	120

Source: Researchers' summary of descriptive result (2025) using E-view 12

The mean average of operating profit was 2.056. It was observed that over the period under review, the sampled banks have average positive operating profit of 2.056. Within the period under review, the banks have maximum net operating profit value of 5.590 and minimum value of -2.160. The large difference between the maximum and minimum net operating profit, indicates that the performance of the banks differs greatly among the banks selected and over the period under review, this shows that the banks are not homogenous. By implication, it means that banks whose net operating profit falls below 2.056 are poorly performed banks with low average while those banks whose net operating profit were above 2.056 are highly performed banks. The standard deviation for banks performance was 1.367. The skewness for banks performance was 0.626 implying that the data on net operating profit were skewed to the right hence most values were bunched to the left of the distribution. The kurtosis for banks performance was 3.298 that are slightly greater than 3 hence the distribution is said to be leptokurtic hence it may have few outliers.

Similarly, EXPEST, VAST, MACLA and CBOT were observed to have mean values of 0.191, 0.675, 0.883 and 0.333 respectively with standard deviation of0.395, 0.470, 0.322 and 0.473 suggesting considerable clustering of expert system, virtual assistants, machine learning algorithm and automated chatbot for the distribution around the mean value. The maximum and minimum values are 1 and 0 which were captured using a dichotomous variable 1 if the bank is actually making use of these artificial intelligence strategies in their operation or 0 if otherwise. Within the period under review, it was discovered that about 19% of the banks selected are making use of expert system, 67% were using virtual assistants, 88% of the banks are using machine learning algorithm while 33% of the banks were using automated chatbot in dealing with their customers. Generally, the JB Probability values of 0.0000 shows that all the variables are normally distributed at 1% level of significance except SBPERF that was distributed at 5% levelwhich indicate that the variables follow the Gaussian standard distribution. This is an indication that all variables are approximately normally distributed. This further implied that there are no variables with outlier, even if there are, they are not likely to distort the conclusion and are therefore reliable for drawing generalization. This also justifies the use panel regression estimation techniques. Hence, any recommendations made to a very large extent would represent the characteristics of the true population of study.

Correlation Analysis

Pearson's correlation matrix was applied to ascertain the degree of relationship between artificial intelligence and bank sustainable performancemeasures so as to determine the direction, strength and significance of association i.e. positive or negative correlation and the magnitude of the correlation between dependent variable and independent variables as well as whether the correlation is

significant or not. Therefore, in examining the association among the variables, the researchersused Pearson correlation coefficient.The result of the correlation coefficient as presented on table 2 showed positive correlation.

Table 2: Correlation Analysis Result

	SBPERF	EXPEST	VAST	MACLA	CBOT
SBPERF	1.000000				
EXPEST	0.739327	1.000000			
VAST	0.859209	0.337884	1.000000		
MACLA	0.767284	0.176966	0.412901	1.000000	
CBOT	0.809473	0.598818	0.490653	0.256978	1.000000

Source: Researchers' summary of correlation result (2025).

This association identified buttresses the point that our variables have a linear relationship. Furthermore, the strength of the relationship between variables measured by the Pearson product-moment correlation showed that the association between the dependent variable with the independent variables is relatively highabove the threshold of 0.60. The result shows that there exists a positive and a very strong association betweensustainable bank performance and artificial intelligence variables. Therefore, this strongly proves that artificial intelligence strategies will go a long way in improving sustainable performance of banks.

Test of Multicollinearity Using Variance Inflation Factor (VIF)

Multicollinearity was tested by computing the Variance Inflation Factor (VIF) and its reciprocal or the tolerance value. Collinearity diagnostics measure to see if two independent variables measure the same thing or are perfectly related to other. To check for multi-collinearity problem or to know whether the independent variables used are perfectly correlated, we used Variance Inflation Factor (VIF) to check for the multi-collinearity problem. Therefore, the study noticed that no two explanatory variables are perfectly correlated. Thisindicates absence of multicollinearity in the model used for the analysis. This also justifies the use of the panel least regression. In addition, the result of Variance Inflation Factor (VIF) is presented on table 3:

Table 3: Variance Inflation Factor Result

Variance Inflation Factors
Date: 06/01/25   Time: 13:38
Sample: 2014 2023
Included observations: 120

Variable	Coefficient Variance	Uncentered VIF	Centered VIF

C	0.145712	1.348538	NA
EXPEST	0.047586	1.610705	1.594526
VAST	0.036076	1.858554	1.706431
MACLA	0.062098	1.741318	1.292888
CBOT	0.041695	2.084358	2.041482

Source: Researcher's summary of VIF result (2025)

As can be observed from the result of VIF in table 3; the mean value of each of the independent variables coefficient is less than 10. The variance inflation factor (VIF) values of all variables are less than 10; therefore, the effect of multi-collinearity is negligible. This implies that there was no multicollinearity problem with the variables thus all the variables were maintained in the regression model. Consequently, it was concluded that there is no issue or problem of multicollinearity among the independent variables used in this study. It can also be seen from the table that each of the independent variables had a variance inflation factor (VIF) less than 10. Specifically, Expert System (EXPEST) VIF value is 1.594; Virtual Assistance (VAST) is 1.706, Machine Learning Algorithm (MACLA) is 1.293 approximately while Automated Chatbot (CBOT) has a value of 2.041. This implies that there is no multicollinearity issue or problem among the variables.Therefore, all the measuring variables were used in the regression model.

Regression Analysis

The effectsof the independent variables on the outcome or dependent variable (SBPERF)were ascertained. Artificial Intelligence proxies are (EXPEST, VAST, MACLA and CBOT) while sustainable bank performance surrogate is net operating profit. The study usedregression analysis techniquesince the data had both time series (2014-2023) and longitudinal properties (deposit money banks in Nigeria). However, the study takes into cognizance the non-homogeneity nature of the banks.Thus, the need for testing its effect on the data generated. This necessitates the use of Hausman effect test to ascertain which effect to explain. That is whether fixed effect or random effect is to be used in interpreting the regression result.However, table 4 shows the Hausman test result while table 5 shows the Random effect result.

Table 4. Hausman Effect Test

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	8.044097	4	0.0900

Source: Researchers' summary of Hausman effect tests result (2025).

A careful look on table 4 indicates that both fixed effect and random effect models were tested. Hausman specification test was then used to decide between the two results. The result from the Hausman test as shown on table 4 revealed a Chi-square value of 8.044 with corresponding p-value of 0.0900 which is greater than 0.003 that is statistically not significant at 5%. This implies that the researchers considered and preferred the random effect as the most appropriate estimator and its result is presented on table 5.

Table 5: Random Effect Regression Result

Cross-section random effect test equation:
Dependent Variable: SBPERF
Method: Panel Least Squares
Date: 22/01/25   Time: 02:59
Sample: 2014 –2023
Periods included: 10
Cross-sections included: 12
Total panel (balanced) observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.482446	0.001367	12.32798	0.0000
EXPEST	0.388771	0.015291	6.805789	0.0032
VAST	0.235402	0.187734	2.188574	0.0408
MACLA	0.458005	0.046834	8.855519	0.0004
CBOT	0.231107	0.161782	3.145330	0.0247

Effects Specification

Cross-section fixed (dummy variables)

Root MSE	0.648091	R-squared	0.773674
Mean dependent var	2.056500	Adjusted R-squared	0.741031

S.D. dependent var	1.367998	S.E. of regression	0.696161
Akaike info criterion	2.237094	Sum squared resid	50.40257
Schwarz criterion	2.608760	Log likelihood	-118.2256
Hannan-Quinn criter.	2.388029	F-statistic	83.70091
Durbin-Watson stat	1.822875	Prob(F-statistic)	0.000000

Source: Random Regression result (2025).

Table 5 shows the panel regression analysis of 12 quoted deposit money banks in Nigeria. From the result on table 5, the study observed that the R. squared value was 0.773(77.3%) which implies that about 77.3% of the systematic variations on the dependent variable were explained by the variations from the independent variables used in the model. The remaining 22.7% was as a result of other factorsnot captured in the model but has been taking care of by the stochastic error term. The robustness of the result of R-square confirms the fitness and appropriateness of the model used in the analysis. Based on the result on table 5, the F-statistics value of 83.7009 and its corresponding p-value of 0.0000 showed that the analysis of our variables in the regression model was generally significant at 5% level of significance used as the benchmark in this study.This shows that the model was well specified and that the artificial intelligence variables jointly have a significant effect on sustainable bank performance of deposit money banks. In addition, the Durbin Watson statistics value of 1.82 showed that the model is well spread since the value is approximately 2. This implies absence of auto correlation problem among the independent variables used in this study.

Furthermore, the regression result on table 5revealed that expert system has a positiveand significant effect on sustainable performance of quoted deposit money banks in Nigeriawith a positive coefficient value of 0.389; t-statistics value of 6.806 and a probability value of 0.0032 which is statistically significant at 5% level of significance.Also, virtual assistant has a positive and significant effect on sustainable bank performance of deposit money banks in Nigeria ($\beta = 0.235$, $t = 2.188$, $p = 0.041$). Machine learning algorithm has a positive and significant effect on sustainable bank performance of deposit money banks in Nigeria ($\beta = 0.458$, $t = 8.856$, $p = 0.000$). In addition, chat bot has a positive as well as a significant effect on sustainable bank performance of deposit money banks in Nigeria ($\beta = 0.231$, $t = 3.145$, $p = 0.025$).The results show that all artificial intelligence variables are significant determinants ofsustainable bank performance of DMBs in Nigeria. This means usingartificial intelligence strategies increasesustainable performance of deposit money banks which is in line with Anetoh et al. (2020).

The implication of the result is that the more banks use expert system, virtual assistants, machine learning algorithm and chat bot in their operations; the more return from their assets that increase their net operating profit. Artificial intelligence is getting smarter due to integration of natural language processing and machine learning. By helping customers round the clock, they help bank managers as well as bank staff to focus on other important tasks.CHATBOTs are not only used for answering customer's questions but also for providing a wide range of services which include bill payment, fund transfer, view recent transactions and much more.Chat bots have many advantages for both banks and customers as they improve convenience, provide new data collection and enable new user touch points. These and many more help to improve the sustainability and performance of deposit money banks in Nigeria.

Conclusion and Recommendations

The study examined the effect ofartificial intelligence (AI) as one of the most recent digital technological advancementon sustainable performance of deposit money banks in Nigeria. To achieve this objective, we employed an ex-post facto research design and ascertained the effect ofartificial intelligence strategies on the sustainable performance of deposit money banks in Nigeria for a period of 10 years. Based on the findings, the study concludes that artificial intelligence strategies have significant effects on sustainable performance of deposit money banks in Nigeria. The implication of the findings is that the application of artificial intelligence strategies should be sustained by deposit money banks in Nigeria. Conclusively, artificial intelligence strategies have indubitably paved way for using more sophisticated and technological-driven methods in carrying out operations in banks as well as other financial sectors. The study concludes that using artificial intelligence strategies will help banks to gain competitive advantages for enhanced and sustainable performance and productivity. Based on the findings, the researchers therefore recommend that;

1. Bank managers should invest moreonexpert systems services in their operationsin order to assist in communication with bank customers, bank staff and other bank users.
2. Bank managers should sustain the usage of virtual assistants in their banking operationssince it is a significant technological tool that replaces human efforts and also enhances sustainable bank performance.
3. Bank managers should sustain using machine learning algorithms since it is a very powerful AI tool that can discover threats and automatically crush them.
4. Banks in Nigeria should sustain the usage of chat botssince it is aa crucial AI tool used to gain competitive advantage for sustainable performance of deposit money banks.

Conflict of Interest

The researchers have no conflicting interest to declare.

References

1. Åberg, E., andKhati, Y. (2018). Artificial intelligence in customer service: a study on customers' perceptions regarding ivr services in the banking industry. Linnaeus University Masters thesis.
2. Agarwall, H., Das, C. P. and Swain, R.K. (2021). Does Artificial Intelligence Influence the Operational Performance of Companies? A Study.Proceedings of the 2nd International Conference on Sustainability and Equity (ICSE-2021). Atlantis Highlights in Social Sciences, Education and Humanities, volume 2.
3. Alsheibani, Sulaiman, Yen Cheung, and Chris Messom. (2018). Artificial intelligence adoption: AI-readiness at firm-level. Paper presented at 22nd Pacific Asia Conference on Information Systems (PACIS 2018), Yokohama, Japan, June 26–30.
4. Alsedrah, M.K. (2017). Artificial intelligence. A publication of the American University of the Middle East. Retrieved from www.researchgate.net.
5. Anetoh, J.C., Okafor, C.A., Obiezekwem, C.J., andOkeke, L.N. (2022). Influence of entrepreneurial marketing dimensions on sustainability of plastic manufacturing firms in Anambra State. African Journal of Business and Economic Development, 2(1), 115-132.
6. Anetoh, J.C., Anetoh, V.C., OkekeGoodfaithNnenna, Okeke-Ezeanyanwu J.A., andObiezekwem, C.J. (2020). Entrepreneurial marketing and performance of chemical manufacturing firms in Nigeria. British Journal of Management and Marketing Studies, 3(3), 67-84.
7. Anetoh, V.C., Anetoh, J.C., Okeke, G.N., Obiora, F.C., andUzoamaka, E.C. (2020). Financial leverage and performance of beverage manufacturing companies in Nigeria. International Journal for Innovative Research in Multidisciplinary Field, 6(5), 360-366.
8. Anetoh, J.C., andAnetoh, V.C. (2016). Effect of financial leverage on company performance: a study of selected quoted companies in Nigeria. International Journal of Social Sciences and Conflict Management, 1(2), September, 1-40.
9. Babatunde, S. O., Odejide, O. A., Edunjobi, T. E., andOgundipe, D. O. (2024). The role of AI in marketing personalization: A theoretical exploration of consumer engagement strategies. International Journal of Management & Entrepreneurship Research, 6(3), 936-949.
10. Brauchitsch, B.V. (2017). Artificial intelligence and robotics and their impact on the workplace. A publication of IBA Global Employment Institute.
11. Cockburn, I.M., Henderson, R., and Stern, S. (2017). The Impact of Artificial Intelligence onInnovation. Paper prepared for the NBER Conference on Research Issues in Artificial Intelligence. Toronto
12. Davis, S J., Hansen, S., and Seminario-Amez, C. (2020). Firm-Level risk exposures   and   stock returns in the wake of COVID

19. NBER Working Paper 27867.Cambridge: National Bureau of Economic Res earch, Available online: www.nber.org.

13. Dike, G.N., Anetoh, J.C., Obiezekwem, C.J., andEboh, S.O. (2021). Organizational justice and employee performance of government owned polytechnics in Anambra State of Nigeria. Journal of Business and African Economy, 7(1), 28-41. www.iiardpub.org.

14. Dike, G.N., Anetoh, J.C., Eboh, S.O. andObiorah, K.C. (2021). Performance appraisal methods and employee performance of selected firms in Anambra State of Nigeria. Journal of Business and African Economy, 7(1), 42-57. www.iiardpub.org.

15. Dwivedi, Y.K., Hughes, L.,Ismagilova, I. (2021). Artificial Intelligence: Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. International Journal of Information Management 57: 101994.

16. Elegunde, A. F. andShotunde, O. I. (2020). Effects of Artificial Intelligence on business performance in the Banking Industry (A Study of Access Bank Plc and United Bank for Africa-UBA),.IOSR Journal of Business and Management (IOSR-JBM), 22(5), 2020, 41-49.

17. Ho, L.T, Christopher, G., Shan, J. and Bryan, L. (2022). Artificial Intelligence and firm performance: does machine intelligence shield firms from Risks? Journal of Risk and Financial Management 15: 302.18,

18. Ibekwe, W. and Helen, O. (2020).Effect of artificial intelligence on organizational performanceof manufacturing companies in Port-Harcourt FUO Quarterly Journal of Contemporary Research, 8(1), 1- 11.

19. Ifekandu, C.C., Anene, J.N., Iloka, C.B. and Ewuzie, C.O. (2023). Influence of artificialintelligence on customer experience and loyalty: mediating role of personalization. Journal of Data Acquisition and Processing, 38(3), 1936-1959.

20. Kamble, S.S., Gunasekaran, A. and Gawankar, S.A. (2020). Achieving sustainable performance in a data-driven agriculture supply chain: a review for research and application.International Journal of Production Economics, 219 (C), 179-194.

21. Li, L., Lin, J., Luo, W., and Luo, X. R. (2023). Investigating the effect of artificial intelligence on customer relationship management performance in e-commerce enterprises. Journal of Electronic Commerce Research, 24(1), 68-83.

22. Maria, C., and Elena-Iuliana, I. (2016). Organizational performance – a concept that self-seeks to find itself. Annals of the Constantin Brâncuşi" University of Târgu Jiu, Economy Series, (4), 179-183.

23. Morikawa, M. (2016). Intelligence and robotics on business and employment: Evidence froma survey on Japanese firms. RIETI Discussion Paper Series.

24. Ndungu, J.K. and Sije, A. (2023). Effect of AI strategies on performance of commercial banks in Kenya. International Journal of Social Sciences and Humanities Research, 11(4), 114-120. www.researchpublish.com.

25. Prabu, S. Venkata, H.R.D., Pranjali, M., andPoornima, U. K. (2024). Application of Artificial Intelligence in business operations and its impact on organizational performance: An Empirical Study.African Journal of Biological Sciences, 6(6) (2024) 6812-6820.

26. Pratama, M. P., Sampelolo, R., andLura, H. (2023). Revolutionizing education: harnessing the power of artificial intelligence for personalized learning. Klasikal: Journal of Education, Language Teaching and Science, 5(2), 350-357.

27. Okeke, G.N., Anetoh, J.C., Obiezekwem, C.J., Anetoh, V.C., Okafor, C.A., Ebomah, E.M., andIkpo, K.P. (2020). Effect of economic indicators on the performance of small and medium scale enterprises in Nigeria. International Journal of Advances in Engineering and Management, 2(4), 412-420.

28. Qian, X.andChenghao, X. (2023). The impact of Artificial Intelligence Strategy on corporate financial performance: an empirical analysis based on listed companies panel Data.Radojevi´c et al. (Eds.): ICAID 2022, AHIS 7, 365–371.

29. Rane, N.L., Paramesha, M., Choudhary, S.P. and Rane. J. (2024). Artificial intelligence in sales and marketing: enhancing customer satisfaction, experience and loyalty. Journal of Advances in Artificial Intelligence, 2(2), 245-264.

30. Salfano, P. and Robert, M. (2014). Investigate the relationship between artificial intelligence and market share in selected companies in Sri Lanka. International Journal of Advanced Research in Data Processing, 4 (1), 112-121

31. Scherer, M.U. (2016). Regulating artificial intelligence systems: Risks, challenges, competencies, and strategies. Harvard Journal of Law & Technology, 29(2), 354-400.

32. Skandali, D., Magoutas, A., andTsourvakas, G. (2023). Artificial intelligent applications in enabled banking services: The next frontier of customer engagement in the era of ChatGPT. Theoretical Economics Letters, 13(5), 1203-1223.

33. Soni, N., Sharma, E,K., Singh, N., and Kapoor, A. (2018). Impact of artificial intelligence on business. Paper presented at the University of Delhi, Delhi, India. Retrieved from www.researchgate.net.

34. Taghizadeh, A, Mohammad, R, Dariush, S., and Jafar, M. (2013). Artificial intelligence, its abilities and challenges. International Journal of Business and Behavioral Sciences, 3(12).

35. Wisskirchen,G, Biacabe, B.T., Bormann, U., and Brauchitsch, B.V. (2017). Artificial intelligence and robotics and their impacts on the workplace. IBA Global Employment Institute.