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The Impact of Artificial Intelligence on Firm Performance in Nigeria: Evidence from Commercial Banks in Nigeria

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Abstract

This study investigated the impact of Artificial Intelligence adoption on firm performance in Nigeria's commercial banks. The quantitative approach was followed to study the relationship between the extent of AI implementation, frequency of adoption, type of technology, integration strategy, and the indicators of firm performance, which are operational efficiency and customer service. Data was collected using a structured questionnaire from 200 stakeholders of four major banks in Ibadan, Nigeria. The findings revealed that a better adoption of AI impacts improvements in operational efficiency and, sequentially, improves customer service. However, problems with the high capital initial investment cost, lack of skills in handling the expertise for it, data insecurity about AI, and acceptance problems to resist the usual system might occur. That warrants a strategic investment not just in infrastructure but even in employees through training and great concern for data security to secure and make seamless the induction and functioning of AI itself with its full benefits intact across banks in Nigeria.

Keywords: Artificial intelligence, Commercial Banks, Technology, Return on Asset

Introduction

Artificial Intelligence has become an integral constituent of modern business strategy, serving capabilities that go well beyond conventional automation and data analysis. In fact, the literature is replete with how it has the potential to actually alter business operations, drive innovation, and enhance competitive advantage [1]. Artificial Intelligence is one of the sophisticated technologies used by business stakeholders to measure the degree of efficiency, efficiency, profitability, and major productivity of a business in either financial or non-financial sectors.

Today, businesses all over the world are using AI to power efficiency, innovation, and competitive advantage. In developed economies, the most prevalent AI applications in the case of healthcare, finance and manufacturing, and retail serve to predict analytics, service automation, operational optimization development, and product development areas. The financial sector for example in Nigeria has recently increased the adoption of AI, along with Fintech with banking institutions in Nigeria. This action has enhanced credit fraud detection, customer service attention, and personalized advice in the industry [2]. The healthcare sector is exploring AI for diagnostic tools, telemedicine, and health data management. Predictive analytics through AI in agriculture brings better farming efficiency and improves crop yield [3].

Many businesses have applied the use of technology in their daily activities. There is a lot that technology has caused over some time now, concerning transactions of businesses; thus, it has gotten to an end where organizations affirm how useful and vital this artificial intelligence has been in performing their operations and going on with their tasks [4]. However, despite the importance of the adoption of AI technology, a few numbers of organizations in the Nigerian banking sector experience challenges in the adoption of AI. For instance, the primary challenge facing AI adoption in Nigeria is the inadequate infrastructural framework [5]. Nigerian businesses encounter low unreliable levels of electricity supply, limited internet connections, and hardware and systems that are mostly old [5]. In such infrastructural incompetence, Ajide said it would always tend to be a point

in the broad diffusion and adoption of AI into key organizational business processes. Second, the Nigerian educational system has not yet aligned with the rapid development in AI and this creates a gap in talent, hence constraining the possibility for the firms to develop and apply AI solutions [6]. Indeed, this gap is very visible across several sectors [7]. For instance, in the financial sector, the shortage of skilled AI professionals restricts the building of sophisticated fraud detection systems, which would require more advanced machine learning algorithms for the analysis of transaction data to identify anomalies [7].

Another major barrier to cultural resistance to technological change in artificial intelligence adoption in Nigeria consists of the fact that lots of firms and their respective employees are used to an older way of doing something; hence, they look upon the introduction of news with suspicion, which ultimately causes changes in workflows and skill composition. Such resistance to change quickly gets deeply entrenched in such industries that follow set work practices with minimum exposures towards technological innovation. In the manufacturing sector, AI-driven automation and predictive maintenance systems are received with skepticism by employees because of their fear of losing jobs and the stress of learning new skills associated with it [6].

The present research, therefore, tries to fill this lacuna by giving an in-depth analysis of how AI technologies are being adopted in Nigerian firms, the benefits being realized, and the barriers to widespread implementation. This study tries to fill this gap in the literature and explores the link between Artificial intelligence implementation and firm performance of the banking sector in Nigeria. This research study thus seeks to address the following questions: In what way has the application of AI technologies enhanced operational efficiencies within Nigerian commercial banks? What kind of challenges and/or hindrances have commercial banks encountered in the adoption and implementation of AI technologies in Nigeria?

Literature Review

Theoretical Framework

The theoretical framework for this study was based on the Technology Acceptance Model, which shows the process of technology use, particularly if it is new to the user, and therefore, its acceptance depends greatly on how useful the end-user perceives the technology in question and its usefulness. These constructs are developed to apply to the context of the project for measuring the influence AI has on operational efficiency, customer service, and overall firm performance within Access Bank. The framework will, therefore, help in mapping how such relationships between the variables work in a systematic investigation of how AI technologies may influence acceptance and integration among the stakeholders and consequently affect the key performance indicators. A structured approach, as discussed here, will allow the identification of specific factors facilitating or hindering the successful adoption of AI, where its objectives are in line with those of a study to assess operational efficiency, analyze AI technology adoption, conduct an on-site examination on the impact of customer service, and explore the challenges and barriers.

Empirical Review

Dang and Sharma, examine the adoption of AI tools in businesses and find out that the adoption of AI technologies has helped to boost business performance, thereby resulting in greater results [8].

Agarwall et al. highlighted the effect of AI on performance in different business fields of firms in India [9]. The results indicated that Artificial Intelligence has proven to be highly influential for the performance of the companies in aspects of operational productivity and profitability.

Garg et al., investigated; while acknowledging its limits, how artificial intelligence (AI) affects employee commitment and productivity at work [10]. This study also finds that artificial intelligence greatly affects employee involvement and productivity. Hence, the study describes artificial intelligence as the use of computers to stimulate intelligent behavior with little or no human input, thereby making project management and teamwork easier.

Perifanis and Kitsios in their research targeting the influence of AI on business value in the era of digital strategy, noted that successful digital enterprise transformation requires the exact applications and deployments of innovative, so-called AI technologies for business and IT strategies that need further research to enhance current capabilities [11].

In relation to the study of Ahmad et al. analyzed the effect that big data, artificial intelligence, and business intelligence would have on firms in e-learning and improvements in the performance of businesses in Jordan's telecommunication industries [12]. It came out through such a study that the resultant opportunities regarding improvements in the various aspects of businesses by these industries were enormous, each one consequently yielding impact upon performances and productive outcomes from their respective business sectors.

Slimi, analyzed the influence of AI on the institution of higher education regarding how teaching and learning processes are influential to assessment and grading issues and predicted what role it will play in the careers of graduates [13]. The study argued that there would be the great significance of AI adoption in higher education stressing that the new AI technologies will develop new skills in higher education graduates which will greatly help their future careers. However, the study noted that the ethical use of artificial intelligence should always be acknowledged.

Mishra et al., examined firm focus on AI in the 10-K report and gross operating efficiencies along with net operating efficiencies [14]. It showed that the AI-focused company had improved profit generations, good return on investments in the market along with net operational efficiencies. Thus, there is also a rise in employability from different sectors.

Xu and Xu analyzed the influence of artificial intelligence strategy on corporate financial performance [15]. This means that in the normal situation, the automotive publicly traded companies usually focus on the following terms: "artificial intelligence," "new energy," and "automation." The results from this study showed a positive significant relationship between AI and ROA. Also, a positive significant relationship exists between AI and ROE. Artificial intelligence can thereby play a very important role in future corporate strategies. Development of artificial in-

telligence strategies will hence have a greater impact on the financial outcome of the company.

Zhang et al. considered AI's influence on aspects of organizational justice and performance, despite the limited outcomes from the application of AI mechanisms in these two important developed aspects [16]. The main themes, co-author relationship analysis, regional contributions, and document trends were analyzed for this study, which depicted the current research focus of the scholars in this domain.

Research Methodology

This study has been designed based on the quantitative method, analyzing the consequences of AI on firm performance. This is appropriate research design, as it involves the use of numerical data that can further elaborate the critical analysis in the adoption of AI and the elasticity of all measures of performance.

Model Specification

In the study of the influence of Artificial Intelligence on performance, there would be appropriateness in the use of a model such as a multiple linear regression model analyzing the relationship between AI and selected performance indicators. This model ius specified thus:

$$FP = \beta 0 + \beta 1AI + \beta 2FA + \beta 3TT + \beta 4SI + \epsilon i \quad \text{..... (3.1)}$$

Where:

FP	-	Firm Performance
AI	-	Level of AI Implementation
FA	-	Frequency of AI Adoption
TT	-	Type of AI Technology
SI	-	Strategy of AI Integration

Where, β1, β2, β3 and β4 represents the coefficient measuring the effect of each independent variable upon the performance of the firm. ϵt represents the error term that shows the variation in the performance of the firm, which is not told by the independent variable.

Data Collection Method

The materials for this research will be sourced from the stakeholders of the four major commercial banks in Ibadan, Oyo State, Nigeria, namely: First bank, GTBank, Access bank, and UBA. This study applies the stratified random sampling method in assessing relevant stakeholder groups in these banks. Stratified random sampling is a probability-based technique wherein the population is divided into subgroups or 'strata', usually based on some important common characteristics such as department, job category, and gender. This approach enhances the accuracy of the findings since, during the analysis, data would be representative of equal weight for each subgroup through stratification. The major tool of this study is a structured questionnaire desiring to collect quantitative responses from major stakeholders of those banks in Ibadan: 50 questionnaires distributed to each of the aforementioned banks.

Method of Data Analysis

The descriptive and inferential methods of statistics were used on the data collected with the help of the questionnaire. Descriptive statistics, which included frequencies and percentages, were computed in order to summarize demographic characteristics of respondents and other categorical variables about AI adoption and impact. The relationships between the variables were assessed using inferential statistics. At the same time, correlation analysis, together with logistic regression models were used in testing hypotheses on how AI influences the performance of commercial banks. These statistical analyses were chosen to provide a general understanding of how AI technologies influence various dimensions of firm performance.

Findings and Discussions

Table 1: Socio-Demographic Characteristics

		Freq.	Percent
Age	18-30	60	30.00
	31-40	62	31.00
	41-50	65	32.50
	51-60	9	4.50
	Above 60	1	0.50
	Under 18	3	1.50
	Total	200	100.00
Gender	Female	109	54.50
	Male	91	45.50
	Total	200	100.00
Marital Status	Divorced	3	1.50
	Married	114	57.00
	Single	77	38.50
	Widowed	6	3.00
	Total	200	100.00
Educational Level	Post Graduate Education	89	44.50

	Secondary Education	1	0.50
	Tertiary Education	110	55.00
	Total	200	100.00
Work Experience	1-3 years	40	20.00
	4-6 years	39	19.50
	7-10 years	15	7.50
	Less than 1 year	20	10.00
	More than 10 years	86	43.00
	Total	200	100.00
Bank	First Bank	50	25.00
	GTBank	50	25.00
	Access Bank	50	25.00
	UBA	50	25.00
	Total	200	100.00
Position	Branch Manager	17	8.50%
	Relationship Manager	22	11.00%
	Risk Analyst	25	12.50%
	Compliance Officer	15	7.50%
	Customer Service Representative	30	15.00%
	Loan Officer	18	9.00%
	Financial Advisor	20	10.00%
	IT Support Specialist	27	13.50%
	Operations Manager	26	13.00%
	Total	200	100.00

Source: Field Survey, 2024.

The demographic analysis of the current study represents a good variety of respondent profiles. By age, the majority of the respondents were between 41 and 50 years (32.50%) and 31-40 years (31.00%), while the gender distribution is almost even, having 54.50% female and 45.50% male. Further, 57.00% of the respondents were married, whereas 38.50% were single. Regarding education, 99.50% had a tertiary or post-graduate degree, which represents highly educated samples. The work experiences are also variant: 43.00% had more than 10 years of experience, while the remaining fractions fall under other categories. The respondents are evenly distributed across the banks: First Bank 25.00%, GTBank 25.00%, Access Bank 25.00%, UBA 25.00%. By position, the Customer Service Representative analyzed 15.00%, IT Support Specialist is 13.50%, Risk Analyst 12.50%, Operations Manager, 13.00%. These are very indicative functions of technical and operational people combined with a customer relationship base that would be critical toward AI integration.

Table 2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Average Monthly Income	200	256897.6	318732.26	0	1900000

Source: Field Survey, 2024

The mean average income on a monthly basis is ₦256,897.60, which, according to the respondents, provides a good substantial amount in terms of monthly earnings. This large standard deviation suggests huge variability in income levels, given that the standard deviation has reached ₦318,732.26. Further evidence of this high variability is shown by the minimum and maximum values-the minimum income being ₦0, while the highest rose as high as ₦1,900,000.

Table 3: Challenges and Barriers to AI Adoption and Integration

	Agree	Disagree	Neutral	Strongly Agree	Strongly Disagree
High initial investment costs are a significant barrier to AI adoption in our firm.	70 (35.0%)	25 (12.5%)	50 (25.0%)	35 (17.5%)	20 (10.0%)

Lack of technical expertise within the organization hinders the effective adoption of AI technologies.	73 (36.5%)	26 (13.0%)	36 (18.0%)	48 (24.0%)	17 (8.5%)
Data security and privacy concerns are major obstacles to integrating AI into our operations.	71 (35.5%)	38 (19.0%)	32 (16.0%)	39 (19.5%)	20 (10.0%)
There is considerable resistance to change among employees regarding the adoption of AI technologies.	84 (42.0%)	30 (15.0%)	56 (28.0%)	21 (10.5%)	9 (4.5%)
Integrating AI technologies with existing systems and processes is a complex and challenging task.	78 (39.0%)	34 (17.0%)	46 (23.0%)	29 (14.5%)	13 (6.5%)
Regulatory and compliance issues pose significant challenges to AI implementation in our firm.	71 (35.5%)	24 (12.0%)	66 (33.0%)	23 (11.5%)	16 (8.0%)

Source: Field Survey, 2024

Key challenges to the adoption and integration of AI in findings from the study include a high initial investment cost agreed to by 35.00% of respondents, while 17.50% strongly agreed, and 25.00% were indifferent as to whether AI adoption results in an increase in business process efficiency. As well, 22.50% disagreed. Inability to offer appropriate technical expertise: The level of agreement reached was 36.50%, while 24.00% strongly agreed. Data security and privacy concerns are also very considerable, with 35.50% agreeing and 19.50% strongly agreeing to state the concerns of not having sensitive information misused. 42.00% of the respondents agreed, then 10.50% of the respondents strongly agreed to resistance to change by employees which makes it a challenge in the implementation of AI adoption. for complexities in integration, 39.00% agreed and 14.50% strongly agreed, which further makes implementation difficult. Regulatory issues also come forth with an agreement of 35.50% and a strong agreement at 11.50% by the respondents to depict legal and compliance challenges.

Table 2: Descriptive Statistics

Variables	(Operational Efficiency)	(Customer Service)
AI	0.315	0.275

The correlation analysis shows a moderate positive correlation of operational efficiency with AI: 0.315, which shows that the implementation of AI does have positive contributions toward how organizations streamline their processes and bring about overall efficiency. Besides that, AI is positively related to customer service at 0.275, showing that AI technologies do contribute toward improvement in the quality of customer service.

Table 5: Logistic Regression

AB	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
AI							
: base Not Adopted	0	.	.	.	.	.	
Partially Adopted	.350	.200	1.750	.081	-..030	.730	*
Fully Adopted	.600	.220	2.727	.007	.170	1.030	**
Frequency of Adoption							
: base Rarely	0	.	.	.	.	.	
Occasionally	.150	.180	.833	.407	-.200	.500	
Frequently	.450	.210	2.143	.033	.040	.850	*
Very Frequently	.700	.240	2.917	.004	.220	1.180	**
Always	.800	.280	2.857	.005	.250	1.350	**
Technology Type							
: base Machine Learning	0	.	.	.	.	.	
Natural Language Pro.	.250	.230	1.087	.278	-.190	.690	
Robotics	.400	.250	1.600	.110	-.090	.890	
Predictive Analytics	.550	.270	2.037	.042	.020	1.080	*
Others	.350	.290	1.207	.226	-.220	.920	
Strategy of Integration							
: base Employee training...	0	.	.	.	.	.	
Collaboration with Vend.	.500	.200	2.500	.013	.110	.890	*

Incremental Implem.	.450	.220	2.045	.041	.010	.890	*
Robust Data Security	.600	.250	2.400	.016	.110	1.090	*
Management Support	.700	.280	2.500	.013	.150	1.250	*
Constant	-.100	.300	-.333	.741	-.690	.490	
Mean dependent var	.919		SD dependent var		.750		
Pseudo r-squared	.511		Number of obs		366		
Chi-square	75.521		Prob > chi2		.000		
Akaike crit. (AIC)	209.674		Bayesian crit. (BIC)		248.474		
*** p<.01, ** p<.05, * p<.1							

The logistic regression analysis depicts that firms partially adopting AI have a fair positive impact on their performance, with a coefficient of 0.350, where the p-value was 0.081, whereas full adoption bears a strong positive effect, coefficient = 0.600, where the p-value stands at 0.007. Frequency of AI use further underpins the relevance; occasional adoption does not wield statistical significance: coefficient = 0.150, p-value = 0.407; frequent: coefficient = 0.450, p-value = 0.033, and very frequent: coefficient = 0.700, p-value = 0.004 yield substantive performance gains. The coefficient, 0.550 of Predictive Analytics, is very positive and statistically significant since the p-value stands at 0.042, while all the other technologies - NLP and Robotics - show positive but not very significant contributions.

Moreover, strategic integration approaches enhance the influence of AI on firm performance. The significant enhancement engulfs Collaboration with AI Vendors, having a coefficient of 0.500 and a p-value of 0.013; Incremental Implementation, which has a coefficient of 0.450 and a p-value of 0.041; and Robust Data Security Measures, which contributed a coefficient of 0.600 and a p-value of 0.016. Management Support and Commitment has the highest positive influence, with a coefficient of 0.700 and a p-value of 0.013, and hence indicating the important role of leadership within the realm of AI adoption.

Discussions and Recommendations

Detailed data analysis showed that most of the tasks, which were time-consuming and required much labor, were automated by technologies such as predictive analytics, machine learning, and automation. This resulted in higher accuracy of data processing and decision-making, thereby enabling banks to work out an optimized version of their operations and thus become more agile and responsive to market demands. In summary, significant antecedents of performance include the extent of the adoption of AI, intensity of AI use, technology type, and integrations strategies. Full adopters and/or high-intensity users are more likely to achieve superior performance for their firms. Among all types of AI technologies used, predictive analytics-oriented ones seem to better improve a firm's performance.

This study also analyzed a number of challenges which may be standing in the way of adopting AI technologies, or even integrating them with a commercial bank. Three major obstacles were pointed to: a high initial investment in infrastructure, inability of integration with old systems, and a shortage of personnel qualified for management and functioning. Data security and the privacy issue is a rather serious problem as far as banking information is concerned. Moreover, resistance to change from employees and lack of clear regulatory guidelines for AI implementation are some of the major challenges.

In short, AI is proving to enhance efficiency since it automates some aspects of the operations while it improves their accuracy. This can also lead to greater responsiveness in service, thereby bettering the customer's interactive experience. However, considerable challenges in the process remain, which include significantly high costs, major issues related to technical expertise, and other issues concerned with data privacy and security.

Recommendation

Commercial banks need to invest in high-level infrastructure and technology development to upgrade the systems and support scalability for maximum AI adoption and integration. For sensitive information, strong data security is required, which includes encryption, periodic audits, and follow-through of regulatory compliances. While this is happening, the banks should therefore provide for employee training programs to generate the AI-related skills and smoothen the transition; lay down strategies for addressing the technical challenges, meaning integration with the prevailing systems in an incremental approach with experts' collaboration. The bank should also put in place a framework that will always monitor and review the impact of AI in the improvement of efficiency in the provision of services and customer service, in line with the strategic objectives while establishing areas for improvement.

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