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EFFECT OF ARTIFICIAL INTELLIGENCE ON THE FINANCIAL PERFORMANCE OF LISTED MANUFACTURING COMPANIES IN NIGERIA

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Abstract
This study examined the effect of Artificial Intelligence on the financial performance of listed manufacturing companies in Nigeria, with focus on Machine Learning Automation (MLA) and Robotic Process Automation (RPA). Return on Assets (ROA) and Return on Capital (ROC) were used as measures of financial performance. The study was motivated by the growing adoption of artificial intelligence technologies by manufacturing firms and the limited empirical evidence on their financial implications within the Nigerian manufacturing sector. Panel regression analysis was employed using data obtained from the annual reports and accounts of sampled listed manufacturing companies. The findings revealed that Machine Learning Automation has a significant negative effect on Return on Assets, while Robotic Process Automation has a significant positive effect on Return on Assets. Furthermore, Machine Learning Automation was found to have a negative but insignificant effect on Return on Capital, whereas Robotic Process Automation had a significant negative effect on Return on Capital. The results indicate that the financial effects of artificial intelligence are mixed and depend on the type of technology deployed and the performance indicator considered. The study concludes that although AI adoption offers opportunities for operational improvement, its financial benefits may be constrained by high implementation costs, inadequate technical expertise, infrastructural limitations and difficulties associated with organizational integration. The study recommends strategic implementation of AI, increased investment in employee training and digital skills, and greater emphasis on RPA in operational processes where it can improve efficiency and asset utilization.

KEYWORDS: ARTIFICIAL INTELLIGENCE, MACHINE LEARNING AUTOMATION, ROBOTIC PROCESS AUTOMATION, RETURN ON ASSETS, RETURN ON CAPITAL, MANUFACTURING COMPANIES, NIGERIA.

Introduction

The failure or poor performance of manufacturing businesses is often attributed to managerial inefficiency. Consequently, managers are frequently held responsible for declining organizational performance, despite the increasing number of business and management graduates produced annually by higher institutions to manage manufacturing enterprises. In response to persistent performance challenges, managers have continued to search for effective cost-cutting mechanisms and innovative strategies aimed at improving operational efficiency and overall organizational performance.

One of the prominent strategies adopted in recent times is the application of Artificial Intelligence (AI) to manufacturing operations, with the expectation that automation, data-driven decision-making, and predictive analytics will reduce operational costs and enhance firm performance. However, in many Nigerian manufacturing organizations, managerial focus on AI adoption has often neglected the human component of the organizational process. This imbalance poses a significant challenge to the effective realization of the benefits associated with AI implementation. The emergence of adversarial relationships between employees and AI-driven systems has become increasingly evident, particularly where workers perceive AI as a threat to job security rather than a complementary tool for improved productivity.

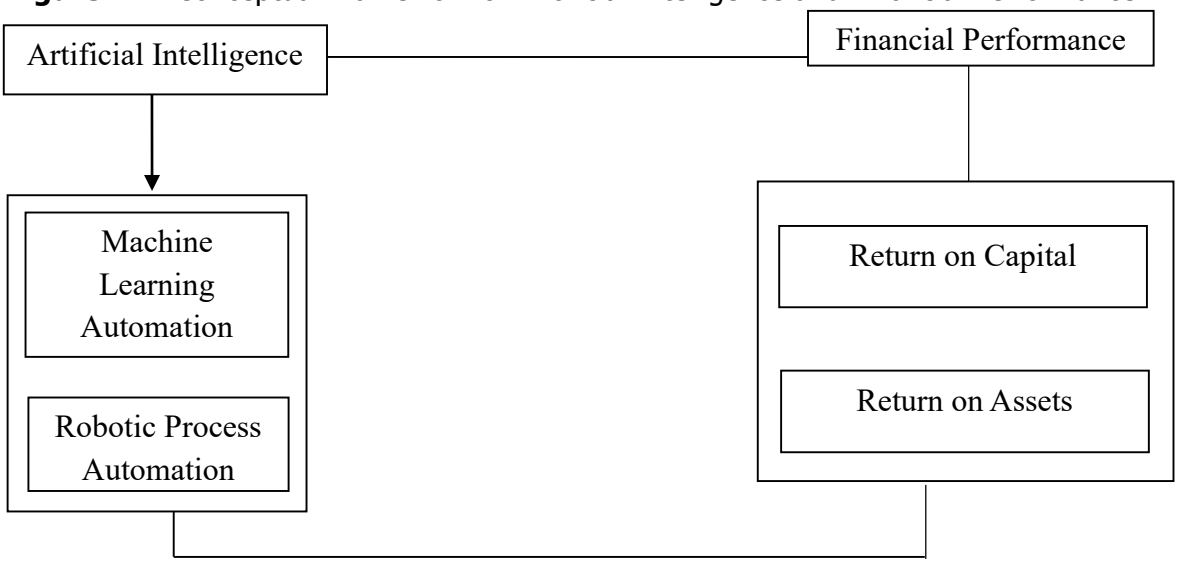
In addition to human-related challenges, cultural resistance to technological change remains a major barrier to effective AI adoption in Nigeria. Many firms and employees are accustomed to traditional modes of operation and often view technological innovations with suspicion. This resistance is particularly pronounced in industries with rigid work practices and limited exposure to technological advancements. In the manufacturing sector, AI-driven automation and predictive maintenance systems are frequently met with skepticism due to employees' fear of job displacement and the perceived difficulty of acquiring new technological skills (Aji Ajide, 2020). Such resistance undermines the potential efficiency and performance gains expected from AI investments.

Furthermore, existing empirical studies on Artificial Intelligence within the Nigerian context have largely emphasized its operational benefits, such as cost reduction, enhanced transaction speed, improved accuracy, fraud detection, and risk management. However, most of these studies have focused predominantly on the banking and financial sectors, with limited attention given to the manufacturing sector. More importantly, existing studies have failed to empirically establish the effect of AI adoption on the financial performance of manufacturing firms in Nigeria (Aishwaryal et al., 2020; Netra & Divenede, 2019; Martin & Alexander, 2020; Richman, 2019). This gap in the literature implies the absence of a robust performance measurement framework upon which stakeholders can base investment decisions.

As a result, corporate stakeholders, policymakers, investors, and researchers remain uncertain about whether the substantial investments in AI technologies by manufacturing firms yield commensurate financial returns. This uncertainty limits informed investment decisions and constrains effective assessment of firm growth and sustainability over time. Against this backdrop, this study seeks to fill the identified gaps by empirically examining the relationship between Artificial Intelligence adoption and the financial performance of listed manufacturing companies in Nigeria.

Conceptual Framework

Figure 2.1: Conceptual Framework on Artificial Intelligence and Financial Performance



Source: Researcher (2026).

Aim/ Objectives of the Study

The main aim of this study is to examine the effect of artificial intelligence on the financial performance of listed manufacturing companies in Nigeria. The specific objectives are to:

1. Examine the effect of Machine Learning Automation on Return on capital of listed manufacturing companies in Nigeria.
2. Examine the effect of Machine Learning Automation on Return on Assets of listed manufacturing companies in Nigeria.

3. Determine the effect of Robotic Process Automation on Return on capital of listed manufacturing companies in Nigeria.
4. Determine the effect of Robotic Process Automation on Return on Assets of listed manufacturing companies in Nigeria.

Research Questions

Based on the above objectives, the following research questions has been asked to guide this study

1. What is the effect of Machine Learning Automation on Return on Capital of listed manufacturing companies in Nigeria?
2. What is the effect of Machine Learning Automation on Return on Assets of listed manufacturing firms in Nigeria?
3. What is the effect of Robotic Process Automation on Return on Capital of listed manufacturing companies in Nigeria?
4. What is the effect of Robotic Process Automation on Return on Assets of listed manufacturing companies in Nigeria?

Research Hypotheses

The following research hypotheses shall be tested at a 0.05% level of significance

1. Machine Learning Automation has no significant effect on Return on Capital of listed manufacturing companies in Nigeria
2. Machine Learning Automation has no significant effect on Return on Assets of listed manufacturing companies in Nigeria
3. Robotic Process Automation has no significant effect on Return on Capital of listed manufacturing companies in Nigeria
4. Robotic Process Automation has no significant effect on Return on Assets of listed manufacturing companies in Nigeria.

REVIEW OF RELATED LITERATURE

Conceptual Review: Artificial Intelligence

Artificial Intelligence is a system that is programmed to think and work as human intelligence does, better than humans, through the experimental aspect of computer science involved in programming an intelligent machine that can operate on various tasks by using its intelligence (Bashir & Kalu, 2024). Ezeribe (2019) viewed Artificial Intelligence as a method of making a computer, a computer-controlled robot, or software think intelligently like the human mind. Artificial intelligence is a program that has the ability of software to carry out activities that only the human brain is expected to carry out. These activities include the capacity for knowledge and the ability to acquire it. It also comprises the ability to judge, understand relationships, and produce original thoughts. In another perspective, Artificial intelligence is the ability of a computer system to be able to observe and learn from its experiences and simulate human intelligence in decision-making (Ezeribe, 2019).

Artificial intelligence is recognized as software programs that attempt to copy human experts' behaviour and expertise, and then store human knowledge and experience, and transform it into commands it uses to solve accounting problems and perform some accounting tasks. Artificial intelligence aims to make an intelligent machine that can react in ways similar to humans. It also comprises the ability to judge, understand relationships, and produce original thoughts. AI is rapidly changing how financial organization operated functions and increasing operational efficiency level with the minimum efforts (Bashir & Kalu, 2024). The difference between artificial intelligence and other developing technologies is its ability to understand its environment and perform tasks that normally require human intelligence in only a relatively short time (Almustafa et al. 2023)

Machine Learning Automation

Machine Learning (ML) automation refers to the process by which algorithms and statistical models are employed to allow machines to learn from data without being explicitly programmed for every task (Mahesh, 2020). Machine learning automation enables systems to identify patterns, make predictions, and continuously improve their performance as they are exposed to more data. This capacity for learning and adaptation distinguishes machine learning from traditional forms of automation, which are based on rigid, pre-defined rules. Machine learning relies on historical data to train models, and once these models are trained, they can automatically apply the learned knowledge to new, unseen data. Over time, machine learning algorithms refine their accuracy, becoming more reliable in performing their designated tasks (Zhou, 2021).

Robotic Process Automation

Robotic Process Automation (RPA) refers to the use of software robots, or "bots," to automate repetitive and rule-based tasks that were traditionally performed by humans (Durão & dos Reis, 2024). These tasks often involve routine activities such as data entry, invoice processing, generating reports, or interacting with multiple systems to transfer data. RPA mimics human interactions with digital systems, using predefined rules and logic to complete tasks faster, more accurately, and without fatigue. Unlike traditional automation systems, which often require complex coding and integration with existing software, RPA can be deployed quickly, leveraging the existing IT infrastructure to perform tasks with minimal disruption to business processes.

Financial Performance

Financial performance is the achievement of economic objectives reflected in financial and market indicators (Lassala et al. 2021). It is a measure of the change in an organization's financial state or the financial outcomes that result from management decisions and their execution by organization members. Profit margins, return on asset (ROA), return on equity (ROE), growth, costs, return on investment (ROI), and sales growth are financial metrics (Ajao & Ogieriakhi, 2018). Financial measures of performance, such as sales and profit, may not clearly reflect the quality of the firm's performance. Financial measures are objective, simple, and easy to understand and compute, but in most cases, they suffer from being historical and are sometimes not readily available in the public domain (Banmore et al., 2023).

Return on Capital

Return on Capital (ROC) is a key indicator used to determine how well a company is using the money invested in it to generate profit. It shows whether the funds provided by shareholders and lenders are being used effectively to produce earnings. When a firm invests capital into its operations, such as purchasing equipment, expanding production, or financing new projects, ROC helps to reveal how much profit is generated from those investments. It is commonly calculated by dividing operating profit (or earnings before interest and tax) by total capital employed. A high ROC suggests that management is efficiently utilizing available resources, while a low ROC may indicate poor investment decisions or operational inefficiencies (Brigham & Ehrhardt, 2022; Ross et al., 2022).

Return on Assets

Return on Assets (ROA) is a profitability ratio that provides how much profit a company can generate from its assets. ROA measures the return on all assets of the company and is often used as an overall index of profitability. In other words, return on assets (ROA) measures how efficient a company's management is in earning a profit from their economic resources or assets on their balance sheet (Boyte-White, 2022). The return on assets (ROA) is a profitability metric that measures the efficiency at which a company can utilize its assets to generate more net earnings. Return on assets (ROA) refers to a financial ratio that indicates how profitable a company is in relation to its total assets. Corporate management, analysts, and investors can use ROA to determine how efficiently a company uses its assets to generate a profit. A higher ROA means a

company is more efficient and productive at managing its statement of financial position to generate profits while a lower ROA indicates there is room for improvement. ROA can be increased by increasing profit margin or asset turnover. ROA is expressed in percentage, the result of dividing the net profit by the average total assets multiplied by 100 (Tamplin, 2022).

Artificial Intelligence and Financial Performance

According to Xie (2019) the effect of artificial intelligence on financial performance of an organization has made many establishments to embrace artificial intelligence. Artificial intelligence is generally representing in the automated processing of "programmable software thereby enhancing revenue by reducing labour costs and improving production efficiency in an organization. However, Xie (2019) opined that AI can lead to cost reduction in non-automated sector, which will equally reduce the share of capital employed in an organization. Artificial intelligence can also affect the return of assets of an organization. Artificial Intelligence is based computer programme which replace the activities of human beings with that of machine. The AI reduces the cost of labour and other necessary expenses associated with human activities. If robots or machines replace the human activities, this can enhance the return on assets of an organization. Although the return on assets of firms increases with the usage of Artificial intelligence techniques but have some peculiar challenges which affects the labour market (Chukwu & Nwachukwu, 2022).

Theoretical Review

Innovation Diffusion Theory

The Innovation Diffusion Theory (IDT) was first propounded by Everett Rogers in 1962. The theory originated in the fields of sociology and communication, and it seeks to explain how, why, and at what rate new ideas and technologies spread within a society or an organization (Seidu et al. 2024). Rogers' work built on earlier research in rural sociology, which studied how agricultural innovations were adopted by farmers. His seminal work, Diffusion of Innovations, emphasized that innovations, whether technological or conceptual, follow a predictable pattern of adoption over time. The diffusion process begins with innovators, followed by early adopters, the early majority, the late majority, and finally the laggards. Rogers' theory highlights the role of communication channels, social systems, and time in the diffusion of an innovation, emphasizing that for any new technology or idea to be adopted, it must be perceived as better than the existing alternative (Yadegari et al. 2024).

The main postulations of the Innovation Diffusion Theory revolve around several key concepts. First, the theory suggests that the rate of adoption of an innovation depends on its perceived attributes, which include relative advantage, compatibility, complexity, trialability, and observability (Menon & Sujatha, 2021). Relative advantage refers to how much better the innovation is compared to the current practice, while compatibility assesses how well the innovation fits with the values, past experiences, and needs of the adopters. Complexity refers to how difficult the innovation is to understand and use, while trialability measures the degree to which an innovation can be experimented with before adoption. Lastly, observability is the extent to which the results of the innovation are visible to others. Additionally, Rogers' theory emphasizes the social system within which the innovation spreads, noting that peer influence, opinion leaders, and communication networks play critical roles in the adoption process. The theory also considers the decision-making process as a critical component of diffusion, typically involving knowledge acquisition, persuasion, and decision, implementation, and confirmation stages.

In the context of the topic "Artificial Intelligence on the financial performance Among Manufacturing Companies in Nigeria," the Innovation Diffusion Theory is highly relevant. The adoption of AI in accounting processes within manufacturing firms can be viewed as an innovation, and the diffusion of this technology is influenced by the perceived benefits it offers, such as enhanced accuracy, efficiency, and decision-making capabilities. AI in accounting provides a relative advantage by automating complex tasks, reducing human error, and enabling data-driven insights. Its

compatibility with existing financial systems and regulatory environments also determines its uptake among Nigerian manufacturing companies. Moreover, the complexity of AI technologies may pose a challenge, requiring firms to invest in training and infrastructure to fully harness their potential. The theory's focus on communication channels and social influence is also applicable, as firms are likely to adopt AI more rapidly when they observe successful implementation by industry leaders or competitors.

Review of Empirical Literature

Akinboyo (2025) 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 stake holders 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.

Audu and Aziwe (2025) investigates the influence of Artificial Intelligence (AI) on the performance of Manufacturing Firms in North-central Nigeria with Reward System as a moderator. The study labored to identify how AI technology has been leverage upon by Managers of Manufacturing Firms to cut-costs and improves performance of their organizations and the near futility in such application without factoring in the human elements whose work AI technology complements. Hence, the study factored in this missing link by introducing a moderator- Reward System. The study proved empirically that performance of the target manufacturing Firms has improved much more when the moderator was introduced. This is achieved by conducting test when AI technology is applied before the moderator and after the inclusion of the moderator respectively. The study adopted a descriptive research design. Data were gathered from the population of 200 respondents made up of Top, Senior and Middle level Executives of the target Manufacturing Firms using proportional sampling method. Primary data was used for the study, and it was gathered through questionnaire designed in five points Likert Scale of strongly agree to strongly disagree. Factor analysis was conducted to ascertain the content validity and reliability of the research instruments. All the factors were significant. Data gathered through questionnaire were analyzed using descriptive and parametric statistical instruments. Tables, percentages, and mean scores were the descriptive statistical tools used while simple linear regression was the parametric statistical tool used to test the hypotheses.

METHODOLOGY

Research Design

This study employed an ex-post facto research design since it engaged ready-made data that were extracted from the financial statements of manufacturing companies in Nigeria. An ex-post facto research design was adopted in carrying out this study to examine the

Population of the Study

The study covers all manufacturing companies listed on Nigeria Exchange Group (NGX) as at 2025. There are thirty-eight (38) listed manufacturing firms across different sectors. The manufacturing firms are divided into industrial goods (13), consumer goods (21), and conglomerates (4) categories

Sample Size and Sampling Techniques

This study used purposive sampling techniques: ten (10) manufacturing firms were selected out of the total population. The selected manufacturers are those who embraced Information and Communication Technology (ICT) and AI in Nigeria, and also based on the availability of financial statement

Table 3.1: List of sampled manufacturing companies listed on the Nigerian Exchange Group.

S/N	Company	Date of Incorporation
1	Dangote cement Plc	4th February, 1992
2	Nestle Nigeria Plc	25th August 1961
3	Nigerian Breweries Plc	16th November, 1946
4	Blue Cement	2nd September, 2008
5	Guinness Nigeria Plc	29th April, 1962
6	Honeywell flourmills Plc	9th June, 1983
7	Beta Glass Plc	26th June, 1974
8	Vitafoam Nigeria Plc	4th August, 1962
9	Cadbury Nigeria Plc	9th January, 1965
10	Lafarge Africa Plc	24 February, 1959

Source: Nigeria Exchange Group (NGX)

Methods of Data Collection

This study adopted the secondary method of data collection. The data for the study was collected from the annual reports of the 10 manufacturing companies in this study for a period of five (5) years, ranging from 2021 – 2025.

Measurement of Variables

The Variable for this study are grouped into the independent and dependent variables. The dependent variable for this study is financial performance which was proxied by return on capital and return on assets. While the independent variable for this study is artificial intelligence, this was proxied by Machine Learning Automation and Robotic Process Automation.

Methods of Data Analysis

The panel data gathered were analyzed using the Panel Ordinary Least Square (POLS) regression techniques with the aid of E-views software to test the hypotheses and to establish the effect of artificial intelligence on financial performance of manufacturing firms in Nigeria. This technique was considered suitable for this study because the data for this study are cross-sectional in nature.

The study conducted several tests, including descriptive statistics, correlation matrix, diagnostic test such as normality test, Hausman specification test, and cross-sectional dependency test. The Hansen test was used for the validity of the instruments used. Diagnostic tests, such as normality test were performed to ascertain the nature of the relationship that exists between the dependent and independent variables. This analysis will be performed with the aid of E-View 12.

DATA PRESENTATION, ANALYSIS, AND DISCUSSION OF FINDINGS

Data Presentation

This study examines the effect of artificial intelligence on the financial performance of listed manufacturing companies in Nigeria. The data presentation below shows the data on Return on Assets (ROA), Return on Capital (ROC), Machine Learning Automation (MLA), and Robotic Process Automation (RPC) for a period of 5 years, ranging from 2021 to 2025. The data are presented in Table 4.1 below.

Table 4.1: Data Presentation on Artificial Intelligence and Financial Performance.

S/N	MANUFACTURING FIRMS	YEARS	ROA	ROC	MLA	RPA
1	Dangote cement Plc	2021	0.152356231	44.27784568	1794	0
		2022	0.146162625	36.75577332	1641	0.000421692
		2023	0.115667634	31.56653668	2855	0.001556595
		2024	0.078592581	30.05075575	3125	0.000725727
		2025	0.168013055	51.36049028	2824	-0.000102637
2	Nestle Nigeria Plc	2021	0.129053217	62.73153715	0	0
		2022	0.117976611	44.17550731	0	0
		2023	-0.136605839	42.51871951	0	0
		2024	-0.191679676	36.71260268	0	0
		2025	0.124049836	47.87413742	0	0
3	Nigerian Breweries Plc	2021	0.026099648	19.48182774	1266626	0
		2022	0.021272789	24.39204447	1516176	-0.001466763
		2023	-0.133573501	20.79554636	1163813	-0.001898724
		2024	-0.127283312	13.60684987	1573586	0.006966528
		2025	0.092954377	35.71995134	1474810	-0.001410374
4	Bue Cement	2021	0.123648712	17.87262647	53090	0
		2022	0.115571227	21.04301465	49266	0.002054481
		2023	0.057132128	8.905703945	12805925	0.004674528
		2024	0.047065398	14.49035037	13348477	0.000339656
		2025	0.191817841	43.56025511	17	7.70987E-05
5	Guinness Nigeria Plc	2021	0.00741021	11.41904857	2092	0
		2022	0.072574177	23.44807997	326	-8.18881E-06
		2023	-0.075152763	40.21866868	549950	0.00227354
		2024	-0.242191471	737.4450236	481120	-0.000304382
		2025	0.167889928	163.89419	6349764	0.023936385
6	Honeywell flourmills Plc	2021	0.007638432	0.164663851	136830	0
		2022	-0.006564473	0.409764107	186316	0.000330195
		2023	0.001552194	6.723937861	162543	-0.000144079
		2024	-0.067933498	47.19012251	92162	-0.000472464
		2025	0.087124384	26.76766612	38457	-0.00032073
7	Beta Glass Plc	2021	0.086475402	17.17205236	12563	0
		2022	0.061695196	15.39414266	8146	-5.81609E-05

		2023	0.060291142	13.76498906	3934	-3.9419E-05
		2024	0.101426179	33.93612235	0	-2.92812E-05
		2025	0.033833221	6.040750628	0	0
8	Vitafoam Nigeria Plc	2021	0.144608161	27.1033279	24486	0
		2022	0.114670897	39.6245817	21364	-7.91642E-05
		2023	0.088076166	37.14842286	58828	0.000754394
		2024	0.01854377	25.50141866	124654	0.001281952
		2025	0.222706003	62.43558005	42815	-0.00125375
9	Cadbury Nigeria Plc	2021	0.010293651	2.268636621	13075	0
		2022	0.009765115	0.857726288	6813	-0.000104867
		2023	-0.348252578	-83.12042331	141954	0.002096747
		2024	-0.306788128	114.5883748	105504	-0.000503148
		2025	0.147170459	118.6191942	70702	-0.00042367
10	Lafarge Africa Plc	2021	0.096810651	16.45014492	713746	0
		2022	0.089306528	19.47451189	91182	-0.001036378
		2023	0.075056066	21.59643098	1743322	0.002424727
		2024	0.101104808	33.18157426	1666681	-7.73753E-05
		2025	0.226088407	49.59133594	1625889	-3.37675E-05

Source: Manufacturing Firm Annual Report from 2021-2025

Summary of Findings

$H0_1$: Machine Learning Automation has no significant effect on Return on Assets of listed manufacturing companies in Nigeria.

The regression result reveals that Machine Learning Automation (MLA) has a coefficient value of -5.37E-09 and a probability value of 0.0001. The negative coefficient indicates that Machine Learning Automation has an inverse relationship with Return on Assets. This implies that increases in machine learning automation are associated with decreases in return on assets of the sampled manufacturing firms. The probability value of 0.0001 is less than the 0.05 level of significance, indicating that the effect is statistically significant. Therefore, the null hypothesis which states that Machine Learning Automation has no significant effect on Return on Assets of listed manufacturing companies in Nigeria is rejected. The study therefore concludes that Machine Learning Automation has a significant negative effect on Return on Assets of listed manufacturing companies in Nigeria.

$H0_2$: Robotic Process Automation has no significant effect on Return on Assets of listed manufacturing companies in Nigeria.

The result further shows that Robotic Process Automation (RPA) has a coefficient value of 5.899108 and a probability value of 0.0473. The positive coefficient indicates that Robotic Process Automation has a direct relationship with Return on Assets, implying that increases in robotic process automation lead to increases in return on assets among the sampled firms. Since the probability value of 0.0473 is less than the 0.05 significance level, the effect is statistically significant. Consequently, the null hypothesis which states that Robotic Process Automation has no significant effect on Return on Assets of listed manufacturing companies in Nigeria is rejected. The study therefore concludes that Robotic Process Automation has a significant positive effect on Return on Assets of listed manufacturing companies in Nigeria.

Table 4.7: Panel Regression Result for ROC model

Model 2: ROCit = β0+ β1MLAit + β2RPAit + μit……(2)

Dependent Variable: ROC
Method: Panel EGLS (Cross-section weights)
Sample: 2021 2025
Periods included: 5
Cross-sections included: 10
Total panel (balanced) observations: 50
Linear estimation after one-step weighting matrix
White cross-section standard errors & covariance (no d.f. correction)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RPA	-2635.798	1024.641	-2.572411	0.0141
MLA	-5.62E-07	4.53E-07	-1.240252	0.2225
C	48.19668	2.851152	16.90428	0.0000

Effects Specification			
Cross-section fixed (dummy variables)			
Weighted Statistics			
R-squared	0.542841	Mean dependent var	229.1594
Adjusted R-squared	0.410505	S.D. dependent var	194.4820
S.E. of regression	100.3993	Sum squared resid	383041.0
F-statistic	4.102005	Durbin-Watson stat	1.958487
Prob(F-statistic)	0.000537		
Unweighted Statistics			
R-squared	0.246717	Mean dependent var	45.54404
Sum squared resid	411439.6	Durbin-Watson stat	2.320302

Source: *E-views 10.*

Table 4.7 presents the panel regression result for the Return on Capital (ROC) model using the Panel Estimated Generalized Least Squares (EGLS) estimation technique with cross-section weights and fixed effects. The model examines the effect of Machine Learning Automation (MLA) and Robotic Process Automation (RPA) on the Return on Capital of listed manufacturing companies in Nigeria.

The weighted R-squared value of 0.542841 indicates that approximately 54.28 percent of the variations in Return on Capital are jointly explained by Machine Learning Automation and Robotic Process Automation included in the model. This suggests that the explanatory variables have a moderate explanatory power on the financial performance of the sampled manufacturing firms, while the remaining 45.72 percent of the variations are explained by other factors not included in the model. The adjusted R-squared value of 0.410505 further indicates that after adjusting for the degrees of freedom, the explanatory variables explain about 41.05 percent of the variations in Return on Capital. The F-statistic value of 4.102005 with a probability value of 0.000537 indicates that the overall model is statistically significant at the 5 percent level. This implies that the independent variables jointly have significant explanatory power on Return on Capital. Furthermore,

the Durbin-Watson statistic of 1.958487 is approximately equal to 2, indicating the absence of serious autocorrelation problem in the model.

$H0_3$: Machine Learning Automation has no significant effect on Return on Capital of listed manufacturing companies in Nigeria.

The regression result shows that Machine Learning Automation (MLA) has a coefficient value of -5.62E-07 and a probability value of 0.2225. The negative coefficient indicates that Machine Learning Automation has an inverse relationship with Return on Capital, implying that increases in machine learning automation is associated with decreases in return on capital among the sampled manufacturing firms. However, the probability value of 0.2225 is greater than the 0.05 significance level, indicating that the effect is statistically insignificant. Therefore, the null hypothesis, which states that Machine Learning Automation has no significant effect on Return on Capital of listed manufacturing companies in Nigeria, is accepted. The study, therefore concludes that Machine Learning Automation has a negative but insignificant effect on Return on Capital of listed manufacturing companies in Nigeria.

$H0_4$: Robotic Process Automation has no significant effect on Return on Capital of listed manufacturing companies in Nigeria.

The result further reveals that Robotic Process Automation (RPA) has a coefficient value of -2635.798 and a probability value of 0.0141. The negative coefficient indicates that Robotic Process Automation has an inverse relationship with Return on Capital, suggesting that increases in robotic process automation lead to decreases in return on capital among the sampled firms. Since the probability value of 0.0141 is less than the 0.05 significance level, the effect is statistically significant. Consequently, the null hypothesis, which states that Robotic Process Automation has no significant effect on Return on Capital of listed manufacturing companies in Nigeria, is rejected. The study, therefore, concludes that Robotic Process Automation has a significant negative effect on Return on Capital of listed manufacturing companies in Nigeria.

Discussion of Findings

This study examined the effect of Artificial Intelligence on the financial performance of listed manufacturing companies in Nigeria using Machine Learning Automation (MLA) and Robotic Process Automation (RPA) as proxies for Artificial Intelligence, while Return on Assets (ROA) and Return on Capital (ROC) were used as measures of financial performance. The findings from the regression analysis are discussed in relation to previous empirical studies.The result of the first hypothesis revealed that Machine Learning Automation has a significant negative effect on Return on Assets of listed manufacturing companies in Nigeria. This implies that although firms are investing in machine learning technologies, such investments may initially reduce profitability due to the huge capital outlay, maintenance cost, employee training requirements, and integration challenges associated with AI systems. The finding suggests that manufacturing firms may not yet have attained the level of efficiency and optimization required to fully maximize the benefits of machine learning automation on asset utilization. The finding is consistent with the study of Ekpa et al. (2023) who found that deep learning machines had a negative but significant effect on Return on Assets of deposit money banks in Nigeria.

Similarly, Salemcity et al. (2023) reported that AI adoption increased operating expenses despite improving operational activities in Nigerian banks. The finding also aligns with Akinboyo (2025) who observed that high initial capital investment cost, skill shortages, and resistance to change constitute major challenges to AI adoption in Nigeria. However, the finding contradicts the studies of Omemgbeoji and Ofor (2024), Ifekanandu et al. (2023), and Chukwu and Nwachukwu (2022) who found positive and significant relationships between artificial intelligence adoption and organizational performance. The disparity may be attributed to sectoral differences, measurement approaches,

and the stage of AI adoption among Nigerian manufacturing firms, which is still relatively low compared to financial institutions and technologically advanced sectors.

The second hypothesis showed that Robotic Process Automation has a significant positive effect on Return on Assets of listed manufacturing companies in Nigeria. This indicates that the adoption of robotic process automation enhances operational efficiency, minimizes repetitive manual tasks, reduces errors, and improves firms' ability to generate profits from their assets. The finding supports the argument that automation technologies contribute positively to organizational efficiency and productivity. This result agrees with the findings of Omemgbeoji and Ofor (2024) who found that robotic process automation positively influences firm effectiveness in manufacturing companies in Nigeria. The finding is also in line with Mbachu et al. (2024) who documented that AI technologies such as automated chatbots and deep learning machines positively influenced the growth of Nigerian banks. Likewise, Mohammed and Ghaleb (2022) found that AI positively affects organizational performance in the tourism industry. The result further corroborates the findings of Wang et al. (2024) who reported that AI significantly enhances firms' innovation efficiency and productivity.

The third hypothesis revealed that Machine Learning Automation has a negative but insignificant effect on Return on Capital of listed manufacturing companies in Nigeria. This suggests that machine learning automation has not substantially improved the returns generated from capital employed by the sampled firms. The insignificance may be attributed to the early stage of AI adoption in the Nigerian manufacturing sector, poor infrastructural facilities, inadequate technical expertise, and the inability of firms to fully integrate machine learning systems into their operational framework. The finding supports the observations of Ebuka et al. (2023) who found that many Nigerian firms still operate manually and have not fully harnessed the benefits of AI deployment. The finding also agrees with Giovanni et al. (2023) who noted that machine learning deployment remains at an early stage with a gap between theory and practical application. Furthermore, the finding aligns with Fadishehab et al. (2023) who observed that AI implementation among banks is still weak and at an early developmental stage.

The fourth hypothesis indicated that Robotic Process Automation has a significant negative effect on Return on Capital of listed manufacturing companies in Nigeria. This implies that although robotic process automation may improve operational processes, the cost associated with acquiring, implementing, and maintaining automation technologies may outweigh the returns generated from capital employed in the short run. The finding further suggests that manufacturing firms may experience adjustment costs and operational disruptions during the transition from manual to automated systems. This result is consistent with the study of Salemcity et al. (2023) which found that AI adoption increased operating costs among deposit money banks in Nigeria. The finding also supports the argument of Audu and Nwagbala (2024) that improper balancing of AI implementation with human resource management and reward systems may hinder organizational performance.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary of Findings

This study examined the effect of Artificial Intelligence on the financial performance of listed manufacturing companies in Nigeria using Machine Learning Automation (MLA) and Robotic Process Automation (RPA) as proxies for Artificial Intelligence, while Return on Assets (ROA) and Return on Capital (ROC) were used as measures of financial performance. Panel regression analysis was employed in analyzing the data obtained from the annual reports and accounts of the sampled firms. The findings from the study are summarized as follows:

1. Machine Learning Automation has a significant negative effect on Return on Assets of listed manufacturing companies in Nigeria.
2. Robotic Process Automation has a significant positive effect on Return on Assets of listed manufacturing companies in Nigeria.

3. Machine Learning Automation has a negative but insignificant effect on Return on Capital of listed manufacturing companies in Nigeria.
4. Robotic Process Automation has a significant negative effect on Return on Capital of listed manufacturing companies in Nigeria.

Conclusion

Based on the findings of this study, it is concluded that Artificial Intelligence, measured through Machine Learning Automation (MLA) and Robotic Process Automation (RPA), has a mixed but significant impact on the financial performance of listed manufacturing companies in Nigeria.

The study concludes that Machine Learning Automation does not contribute positively to the financial performance of listed manufacturing firms in Nigeria. Specifically, it was observed that MLA has a significant negative effect on Return on Assets and a negative but insignificant effect on Return on Capital. This implies that, at the current stage of adoption, machine learning technologies have not yet been fully optimized within the Nigerian manufacturing sector to translate into improved profitability and efficient capital utilization. The negative outcomes may be associated with high implementation costs, inadequate technical expertise, infrastructural challenges, and adjustment inefficiencies within firms.

On the other hand, the study concludes that Robotic Process Automation has a mixed effect on the financial performance of listed manufacturing companies in Nigeria. RPA was found to have a significant positive effect on Return on Assets, indicating that it enhances operational efficiency and improves firms' ability to generate profits from their assets. However, RPA was also found to have a significant negative effect on Return on Capital, suggesting that despite improving efficiency, the cost of deployment and maintenance may reduce overall returns on invested capital in the short run. The study concludes that while Artificial Intelligence has begun to influence the financial performance of listed manufacturing companies in Nigeria, its impact is not uniformly positive across all performance indicators. The effectiveness of AI in improving financial performance depends largely on the nature of the technology deployed, the level of integration within organizational processes, and the ability of firms to manage associated costs and structural adjustments.

Recommendations

Based on the findings of this study, the following recommendations are made in line with the results of the four hypotheses:

1. Since Machine Learning Automation (MLA) was found to have a significant negative effect on Return on Assets (ROA), management of listed manufacturing companies in Nigeria should ensure that machine learning systems are properly integrated into operational processes before full-scale adoption. Firms should invest more in employee training, digital skills development, and system optimization to ensure that machine learning technologies translate into improved asset utilization and profitability.
2. Given that Robotic Process Automation (RPA) has a significant positive effect on Return on Assets (ROA), manufacturing firms are encouraged to intensify the adoption of RPA in core operational activities such as production, inventory management, and administrative processes. This will help reduce operational inefficiencies, minimize errors, and improve overall profitability.
3. In view of the finding that Machine Learning Automation (MLA) has a negative but insignificant effect on Return on Capital (ROC), firms should adopt a gradual and strategic approach to machine learning implementation. Management should focus on aligning machine learning investments with clear performance targets and ensure that capital expenditure on AI is matched with measurable returns.
4. Considering that Robotic Process Automation (RPA) has a significant negative effect on Return on Capital (ROC), manufacturing firms should carefully evaluate the cost implications of automation before large-scale deployment. Organizations should conduct cost-benefit

analyses prior to implementation and adopt scalable automation models that reduce initial capital burden while still enhancing operational efficiency.

Contributions to Knowledge

This study contributes to existing literature by providing empirical evidence on the relationship between Artificial Intelligence and financial performance of listed manufacturing companies in Nigeria. Specifically, the study expands the frontier of knowledge by disaggregating Artificial Intelligence into Machine Learning Automation (MLA) and Robotic Process Automation (RPA), and examining their individual effects on financial performance measured by Return on Assets (ROA) and Return on Capital (ROC).

The study also contributes by establishing that Artificial Intelligence does not have a uniform effect on financial performance, as Machine Learning Automation was found to exert a negative effect on profitability indicators, while Robotic Process Automation showed a mixed effect across performance measures. This provides a more nuanced understanding of AI adoption in developing economies such as Nigeria.

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