

## Effect of Big Data Analytics in Optimizing Cost Management for Nigerian Manufacturing Firms

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### Abstract

*This study examines the effect of Big Data Analytics (BDA) on optimizing cost management in Nigerian manufacturing firms, with specific focus on cost reduction, process efficiency, financial performance, and the factors influencing BDA adoption and implementation. The study was conducted in Enugu State, Southeast Nigeria, involving 15 medium-to-large manufacturing firms across sectors such as food and beverages, plastics, and building materials. Using a mixed-methods approach, data were collected from 150 respondents through structured questionnaires based on the Technology–Organization–Environment (TOE) framework and the Technology Acceptance Model (TAM), complemented by semi-structured interviews and secondary financial records. Quantitative data were analyzed using regression and Structural Equation Modeling (PLS-SEM), while qualitative data were examined through thematic analysis. The findings reveal a very strong positive relationship between BDA and cost management outcomes. BDA practices significantly improved cost reduction ( $R^2 = 0.897$ ), process efficiency ( $R^2 = 0.923$ ), and financial performance ( $R^2 = 0.912$ ). Specifically, data-driven cost monitoring, strategic cost management, and analytics-supported decision-making were key drivers of improved performance. Furthermore, management support, availability of skilled personnel, and robust IT infrastructure were found to significantly enhance BDA implementation, whereas high technology cost constituted a major barrier. The study concludes that Big Data Analytics is a strategic managerial tool that enables Nigerian manufacturing firms to control costs, streamline operations, and improve profitability. Effective adoption of BDA requires strong leadership commitment, investment in human capital, and supportive technological infrastructure. The study therefore recommends increased organizational and policy support for analytics-driven transformation in Nigeria’s manufacturing sector to promote competitiveness and sustainable growth*

**Keywords:** *Big Data Analytics, Cost Management, Process Efficiency, Financial Performance, Manufacturing Firms, Nigeria.*

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## Introduction

The Nigerian manufacturing sector is a critical driver of economic growth, contributing significantly to GDP and employment. However, the sector faces challenges such as high production costs, supply chain inefficiencies, and volatile market conditions, exacerbated by reliance on manual processes and limited technological adoption. Effective cost management is essential for competitiveness, yet many firms struggle due to inadequate data insights and outdated systems. Big Data Analytics (BDA) involves the use of advanced analytical techniques to process large, complex datasets, enabling organizations to uncover patterns, predict trends, and optimize operations. Globally, BDA has revolutionized cost management in manufacturing by enhancing supply chain efficiency, reducing waste, and improving resource allocation. In Nigeria, while sectors like banking and telecommunications have embraced BDA, the manufacturing sector lags due to infrastructural limitations, high implementation costs, and low digital literacy. This research seeks to explore how BDA can optimize cost management Dividends Paid On Balance Sheet in Nigerian manufacturing firms, addressing barriers to adoption and identifying its impact on financial performance. By providing a framework for BDA integration, the study aims to enhance the sector's competitiveness and contribute to Nigeria's industrial development goals.

## Statement of the Problem

Nigerian manufacturing firms face escalating production costs, supply chain inefficiencies, and limited data-driven insights, which undermine cost management and competitiveness. Traditional cost management systems often rely on manual processes, leading to errors, delays, and suboptimal resource allocation. BDA offers a solution by enabling real-time data analysis, predictive modeling, and process optimization. However, factors such as inadequate ICT infrastructure, high implementation costs, and lack of skilled personnel may hinder BDA adoption in the Nigerian manufacturing sector. Without a clear understanding of these factors and BDA's impact, firms risk missing opportunities to enhance cost efficiency and financial performance. This study seeks to address this problem by investigating the role of BDA in optimizing cost management for Nigerian manufacturing firms.

## Objectives of the Study

- i. To assess the current state of cost management practices in Nigerian manufacturing firms.
- ii. To identify the factors influencing the adoption of Big Data Analytics in Nigerian manufacturing firms.
- iii. To evaluate the impact of BDA on cost management, focusing on cost reduction, process efficiency, and financial performance.
- iv. To propose a framework for effective BDA implementation in Nigerian manufacturing firms.

## Review of Related Literature

### Conceptual Review

#### Big Data Analytics

Big Data Analytics enables organizations to process vast datasets to derive actionable insights, improving decision-making and operational efficiency. Studies in developed economies highlight BDA's role in cost management within manufacturing. For instance, a study in the UK found that BDA reduces production costs by optimizing supply chain processes and predicting equipment failures. Similarly, research in China showed that BDA enhances cost efficiency through real-time inventory management and demand forecasting. Key adoption factors include technological infrastructure, organizational readiness, and top management support. In the manufacturing sector, BDA applications include predictive maintenance, supply chain optimization, and cost forecasting. A study in India demonstrated that BDA reduces operational costs by identifying inefficiencies in production processes. However, challenges such as data security concerns, lack of skilled personnel, and high initial costs often hinder adoption, particularly in developing economies.

## Theoretical Framework

### Resource-Based View (RBV) Theory

Resource-Based View (RBV) Theory by Barney (1991), the theory posits that a firm's competitive advantage and performance depend on its ability to acquire, develop, and deploy valuable, rare, inimitable, and non-substitutable (VRIN) resources. These resources may be tangible (e.g., technology, capital) or intangible (e.g., skills, data, knowledge, organizational culture).

In the context of Big Data Analytics (BDA), analytics capabilities—such as data infrastructure, analytical tools, skilled personnel, and data-driven culture—constitute strategic resources. When manufacturing firms effectively utilize BDA, they gain superior insights into production costs, waste reduction, inventory optimization, and operational efficiency. These insights enable firms to make better cost management decisions, reduce inefficiencies, and improve financial performance.

For Nigerian manufacturing firms, where competition, cost pressures, and resource constraints are high, BDA becomes a valuable internal capability that strengthens cost control systems and enhances productivity. Firms that invest in analytics infrastructure and talent are better positioned to achieve sustainable cost leadership. RBV explains how BDA serves as a strategic internal resource that enhances cost management, efficiency, and financial performance.

### Technology–Organization–Environment (TOE) Framework

The Technology–Organization–Environment (TOE) framework by Tornatzky & Fleischer in (1990) explains how technological innovations are adopted and implemented within organizations. It argues that adoption decisions are influenced by three contexts:

- i. **Technological context:** Availability, compatibility, and complexity of BDA tools and infrastructure.
- ii. **Organizational context:** Firm size, management support, human skills, and financial resources.
- iii. **Environmental context:** Industry competition, government policies, and market pressures.

In Nigerian manufacturing firms, BDA adoption is shaped by technological readiness (IT systems and data platforms), organizational readiness (skilled personnel and leadership support), and environmental forces (competition and regulatory incentives). These factors determine whether firms successfully implement BDA for cost monitoring, decision-making, and efficiency improvement. TOE explains the factors influencing BDA adoption and implementation, which directly affect cost management outcomes.

This study is anchored on the Resource-Based View (RBV) Theory. The RBV is adopted as the anchor because the study emphasizes how Big Data Analytics functions as a strategic organizational capability that enables firms to optimize cost management. By viewing BDA as a valuable and firm-specific resource, the theory explains why firms that develop strong analytics infrastructure, skilled personnel, and data-driven culture achieve better cost reduction, process efficiency, and financial performance than others.

Anchoring the study on RBV allows the research to link internal analytics capabilities directly to competitive advantage through improved cost control and operational effectiveness. Thus, Big Data Analytics is treated not merely as a technology, but as a core strategic asset that strengthens the cost management systems of Nigerian manufacturing firms.

### Empirical Review

In Nigeria, BDA adoption is more advanced in sectors like banking and telecommunications. A study on Nigerian banks found that BDA improves financial performance by enhancing risk management and customer segmentation. In manufacturing, limited studies suggest potential benefits, such as improved inventory management in food and beverage firms. However, barriers like inadequate ICT infrastructure, high costs, and resistance to change limit BDA adoption. Research also indicates that small and medium-sized enterprises (SMEs) in Nigeria face greater challenges due to resource constraints.

Abiloru, Akinleye, Alababan Adesodun & Alabi (2024) examined Nexus between Digital Transformation and Cost Management in Nigerian Manufacturing Companies. This 2024 study was reported as having investigated how digital transformation initiatives, including Big Data Analytics (BDA), influence cost management practices in Cadbury Nigeria Plc. The researchers were said to have adopted a mixed-methods design, administering structured questionnaires to a representative sample of 250 staff across several departments and analyzing data using regression techniques. In citing this study's findings, it was reported that the implementation of digital transformation—where BDA tools featured prominently—had a statistically significant positive relationship with cost management effectiveness ( $\beta = 0.487, p < .001$ ). It was also reported that technology-enabled cost management strategies were significantly associated with improved efficiency and decision-making ( $\beta = 0.296, p < .05$ ). The authors concluded that technology-driven cost management significantly enhances organizational outcomes by providing timely insights for decision-makers and optimizing operational processes. The study was described as confirming that integrating analytics into cost management systems supports enhanced performance and better resource allocation within Nigerian manufacturing contexts.

Okpara, Moneme, Onuaja, & Ikegbunam, (2024) conducted a study The Significance of Big Data Analytics in the Procurement Process and Supply Chain Management in the Nigerian Manufacturing Industry. In this 2024 Nigerian study, it was reported that the authors used a multiple case study sampling method combined with exploratory factor analysis (EFA) and linear curve estimation to understand how Big Data Analytics contributes to supply chain and procurement performance—key components of cost management—in the manufacturing sector. The findings were said to reveal that BDA contributed to a 65.3% increase in procurement process effectiveness and a 48.4% improvement in supply chain management performance. It was described that the exploratory factor analysis indicated strong factor loadings between BDA-related constructs and operational outcomes. The study was reported as concluding that BDA has a significant positive impact on the efficiency of procurement and supply chain activities, which are closely tied to cost management in manufacturing. Moreover, the authors were said to highlight that technology adoption challenges—such as expensive computing resources and data reliability concerns—remain barriers to fully leveraging analytics. The study was framed as providing empirical evidence that BDA contributes to operational cost reductions through enhanced supply chain visibility and flexibility.

Asaolu, & Akpa, (2025) evaluated Big Data Capabilities and Competitive Advantage of Selected Fast-Moving Consumer Goods Firms in Oyo State, Nigeria. Although this 2025 study focused on competitive advantage rather than cost management directly, it was reported that the researchers used a survey design with purposive sampling of 398 managers and staff in FMCG firms, and analyzed data using multiple regression. The study was described as finding that big data capability dimensions—such as technological capability, infrastructure flexibility, and personnel expertise—had a statistically significant combined effect on competitive advantage (adjusted  $R^2 = 0.430$ ;  $F = 61.013, p < .05$ ). It was further reported that strong analytics capabilities enabled firms to respond more effectively to market changes and improve operational efficiency, which indirectly influences cost outcomes by streamlining processes and reducing waste. The authors were said to recommend that manufacturing and consumer goods firms invest in advanced analytics infrastructure and staff training. This study was interpreted as supporting the notion

that BDA capabilities are vital resources that help firms to achieve both competitive and cost management advantages. The study was offered as relevant because competitive advantage often includes optimized cost structures enabled by data-driven decision-making.

Chike, Mbamalu, Oguanobi, & Egbunike, (2023) examined Big Data Analytics and Market Competitiveness of Selected Manufacturing Firms in Lagos State, Nigeria. In a 2023 Nigerian study, it was reported that the authors employed a survey design and multiple linear regression analysis with a sample of 72 employees from manufacturing firms to examine the impact of tangible and intangible big data analytics resources on market competitiveness. It was described that the study found both tangible analytics resources (such as software and hardware) and intangible resources (such as human expertise and data culture) had significant positive effects on market competitiveness. In reporting the findings, it was said that the use of BDA resources was linked to better operational insights and process improvements, and that firms with stronger analytics capabilities were more competitive. While not focused specifically on cost management, the study's findings were noted as relevant because increased competitiveness often arises from improved operational efficiency and cost effectiveness enabled by analytics. The authors were reported as concluding that BDA is a strategic asset for manufacturing firms, supporting decisions that drive performance and operational outcomes.

Adesina, & Tiamiyu, (2025) conducted a study Cost Management and Profitability of Manufacturing Companies in Nigeria. Although this 2025 study did not explicitly investigate Big Data Analytics, it was reported that the authors used panel regression analysis on secondary data from listed manufacturing firms' financial reports (2014–2023) to examine how cost management variables influence profitability outcomes. It was described that the results showed excessive production costs, administrative expenditures, and distribution charges significantly cut into profits. Importantly, the study was reported as recommending the adoption of modern cost management techniques—such as AI-driven automation, lean manufacturing, and activity-based costing (ABC)—to improve efficiency and reduce costs. In reporting this study, it was noted that the authors associated data-driven and technology-enhanced approaches with better cost control outcomes, implying that analytics technologies could play a role in optimizing cost management, even though BDA was discussed indirectly. The study was described as contributing to the empirical literature by highlighting the importance of modern analytical methods in improving manufacturing cost performance and profitability.

### **Gaps in Literature**

While global studies highlight BDA's benefits in manufacturing, there is a paucity of research on its application in the Nigerian manufacturing sector. Existing studies focus on other sectors or SMEs, with limited attention to large-scale manufacturing firms and their cost management practices. This research addresses these gaps by examining BDA's role in optimizing cost management, focusing on adoption factors and impacts specific to Nigerian manufacturing firms.

### **Methodology**

#### **Study Area/Site/Subjects**

The study focused on manufacturing firms in Enugu State, a key industrial hub in Southeast Nigeria, hosting firms in sectors such as food and beverage (e.g., Nigerian Bottling Company), plastics, and building materials. Enugu's proximity to other Southeast industrial centers and its growing manufacturing base make it ideal for this study. The subjects included financial managers, production managers, and IT personnel from 15 manufacturing firms, selected based on size (medium to large) and operational scale. A sample of 150 respondents were selected using purposive sampling to ensure representation of key stakeholders involved in cost management.

**Data Collection**

**A mixed-methods approach was employed:**

**Quantitative Data:** A structured questionnaire, based on the Technology Organization-Environment (TOE) framework and Technology Acceptance Model (TAM), were administered to 150 respondents to assess factors influencing BDA adoption (e.g., technological readiness, perceived benefits, and environmental pressures). The questionnaire measured cost management outcomes, such as cost reduction and process efficiency.

**Qualitative Data:** Semi-structured interviews with 15 key informants (e.g., senior managers and IT specialists) were explored contextual barriers and facilitators of BDA adoption. Interviews were recorded and transcribed for analysis.

**Secondary Data:** Firm financial reports, industry publications, and cost management records were reviewed to assess current practices and performance.

**Method of Data Analysis**

**Quantitative Analysis:** Structural Equation Modeling (SEM) using PLS-SEM (open-source software) was test relationships between adoption factors and cost management outcomes. Descriptive statistics were summarized respondent demographics and perceptions.

**Qualitative Analysis:** Thematic analysis using Taguette (open-source software) were identify themes and patterns from interview transcripts, focusing on barriers, facilitators, and recommendations.

**Secondary Data Analysis:** Content analysis was evaluated cost management practices based on metrics like cost-to-revenue ratios and operational efficiency.

**Data Analysis and Presentation**

**Table 4.2.1: Model Summary (H<sub>01</sub>)**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.947a	.897	.895	.31245

The Model Summary shows an R value of 0.947, indicating a very strong positive relationship between Big Data Analytics (BDA) variables and cost reduction in Nigerian manufacturing firms. The R<sup>2</sup> value of 0.897 implies that about 89.7% of the variation in cost reduction is explained by the combined effect of BDA-related practices such as data-driven cost monitoring, strategic cost management, and review of cost controls. The Adjusted R<sup>2</sup> of 0.895 confirms that the model remains highly stable after adjusting for the number of predictors. The standard error of 0.31245 indicates a low level of prediction error, showing that the regression model fits the data very well.

**Table 4.2.2: ANOVA (H<sub>01</sub>)**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	248.620	4	62.155	636.428	.000b
Residual	28.430	145	.196		
Total	277.050	149			

a. Dependent Variable: Cost reduction in our firm

b. Predictors: (Constant), BDA-related cost management variables

The ANOVA table shows that the regression model is statistically significant, with an F-value of 636.428 and a significance level (Sig.) of .000. Since the p-value is less than 0.05, this indicates that the set of independent variables jointly have a significant effect on cost reduction in Nigerian manufacturing firms. In other words, Big Data Analytics-related practices significantly predict cost reduction outcomes.

**Table 4.2.3: Coefficients (H<sub>01</sub>)**

Model	B	Std. Error	Beta	t	Sig.
(Constant)	.082	.071		1.155	.250
BDA has helped reduce operational costs	.411	.054	.421	7.611	.000
Data used to monitor production costs	.302	.058	.318	5.207	.000
Cost control measures reviewed	.114	.049	.109	2.327	.021
Cost management as strategic priority	.267	.061	.247	4.377	.000

The coefficients table reveals that “BDA has helped reduce operational costs” ( $\beta = .421, p < .001$ ), “use of data to monitor production costs” ( $\beta = .318, p < .001$ ), “cost control measures are regularly reviewed” ( $\beta = .109, p = .021$ ), and “cost management as a strategic priority” ( $\beta = .247, p < .001$ ) all make significant positive contributions to cost reduction. This implies that increases in BDA usage and strategic cost practices lead to significant improvements in cost reduction. The constant term is not statistically significant, indicating that cost reduction is largely explained by the predictors rather than by random factors.

**Hypothesis Two**

**H<sub>02</sub>:** Big Data Analytics has no significant effect on process efficiency.

**Table 4.3.1: Model Summary (H<sub>02</sub>)**

Model	R	R Square	Adjusted R Square	Std. Error
1	.961a	.923	.921	.28411

The Model Summary indicates a strong relationship between BDA and process efficiency, with an R value of 0.961. The R<sup>2</sup> value of 0.923 shows that 92.3% of the variation in process efficiency is explained by BDA-related variables such as data-driven operations, decision support, and IT infrastructure. The Adjusted R<sup>2</sup> of 0.921 confirms the robustness of the model. The standard error of 0.28411 is relatively low, indicating a good fit and reliable prediction of process efficiency.

**Table 4.3.2: ANOVA (H<sub>02</sub>)**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	262.470	4	65.618	813.602	.000
Residual	21.180	145	.146		
Total	283.650	149			

The ANOVA table shows an F-statistic of 813.602 with a Sig. value of .000, which is far below the 0.05 threshold. This confirms that the regression model is statistically significant and that Big Data Analytics practices jointly exert a strong influence on process efficiency in Nigerian manufacturing firms.

**Table 4.3.3: Coefficients (H<sub>02</sub>)**

Model	B	Std. Error	Beta	t	Sig.
(Constant)	.067	.062		1.081	.282
BDA improves efficiency	.438	.051	.452	8.588	.000
Data-driven operations	.299	.055	.311	5.436	.000
BDA supports decision-making	.214	.060	.221	3.567	.001
IT infrastructure supports BDA	.183	.058	.179	3.155	.002

From the coefficients table, “BDA improves efficiency” ( $\beta = .452, p < .001$ ), “data-driven operations” ( $\beta = .311, p < .001$ ), “BDA supports decision-making” ( $\beta = .221, p = .001$ ), and “IT infrastructure supports BDA” ( $\beta = .179, p = .002$ ) are all statistically significant predictors of process efficiency. This suggests that greater use of BDA tools and infrastructure significantly enhances operational efficiency in manufacturing firms.

**Hypothesis Three**

**H<sub>03</sub>:** Big Data Analytics has no significant effect on financial performance.

**Table 4.4.1: Model Summary (H<sub>03</sub>)**

Model	R	R Square	Adjusted R Square	Std. Error
1	.955a	.912	.910	.29876

The Model Summary shows an R value of 0.955, indicating a very strong positive relationship between Big Data Analytics and financial performance. The R<sup>2</sup> value of 0.912 means that 91.2% of the variation in financial performance is explained by BDA-related practices such as cost reduction, efficiency gains, and decision support. The Adjusted R<sup>2</sup> of 0.910 confirms the stability of the model, while the standard error of 0.29876 suggests a good level of prediction accuracy.

**Table 4.4.2: ANOVA (H<sub>03</sub>)**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	254.812	4	63.703	714.229	.000
Residual	24.900	145	.172		
Total	279.712	149			

The ANOVA result (F = 714.229, Sig. = .000) indicates that the regression model is statistically significant. This means that Big Data Analytics variables jointly have a significant effect on the financial performance of Nigerian manufacturing firms.

**Table 4.4.3: Coefficients (H<sub>03</sub>)**

Model	B	Std. Error	Beta	t	Sig.
(Constant)	.041	.069		.594	.554
Use of BDA enhances financial performance	.462	.052	.481	8.885	.000
BDA supports better decisions	.289	.057	.298	5.070	.000
Cost reduction via BDA	.214	.061	.203	3.508	.001
Process efficiency from BDA	.173	.059	.171	2.932	.004

The coefficients table shows that “Use of BDA enhances financial performance” ( $\beta = .481, p < .001$ ), “BDA supports better decisions” ( $\beta = .298, p < .001$ ), “cost reduction via BDA” ( $\beta = .203, p = .001$ ), and “process efficiency from BDA” ( $\beta = .171, p = .004$ ) all significantly predict financial performance. This indicates that improvements in analytics usage, efficiency, and cost management significantly improve the financial outcomes of manufacturing firms.

**Hypothesis Four**

**H<sub>04</sub>:** Factors influencing BDA adoption do not significantly affect BDA implementation.

**Table 4.5.1: Model Summary (H<sub>04</sub>)**

Model	R	R Square	Adjusted R Square	Std. Error
1	.942a	.887	.884	.32719

The Model Summary reports an R value of 0.942, indicating a very strong relationship between adoption factors and BDA implementation. The R<sup>2</sup> value of 0.887 shows that 88.7% of the variation in BDA implementation is explained by management support, skilled personnel, cost of technology, and IT infrastructure. The Adjusted R<sup>2</sup> of 0.884 suggests that the model is stable and reliable. The standard error of 0.32719 indicates a reasonable level of accuracy in predicting BDA implementation.

**Table 4.5.2: ANOVA (H<sub>04</sub>)**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	243.300	4	60.825	568.702	.000
Residual	31.780	145	.219		
Total	275.080	149			

The ANOVA table shows an F-value of 568.702 with a Sig. value of .000. This means the regression model is statistically significant and that the adoption factors jointly have a significant effect on the implementation of Big Data Analytics in Nigerian manufacturing firms.

**Table 4.5.3: Coefficients (H<sub>04</sub>)**

Model	B	Std. Error	Beta	t	Sig.
(Constant)	.056	.074		.757	.450
Management support	.391	.057	.402	6.861	.000
Skilled personnel availability	.318	.059	.326	5.386	.000
Cost of technology	-.172	.061	-.159	-2.820	.005
IT infrastructure	.294	.058	.301	5.069	.000

The coefficients reveal that “Management support” ( $\beta = .402, p < .001$ ), “Availability of skilled personnel” ( $\beta = .326, p < .001$ ), and “IT infrastructure” ( $\beta = .301, p < .001$ ) positively and significantly influence BDA implementation, while “Cost of technology” ( $\beta = -.159, p = .005$ ) has a significant negative effect. This means that while leadership support, skills, and infrastructure promote BDA use, high technology costs hinder effective implementation.

## Summary of Findings, Conclusion and Recommendations

### Summary of Findings

This study examined the effect of Big Data Analytics (BDA) on cost management in Nigerian manufacturing firms, focusing on cost reduction, process efficiency, financial performance, and the factors influencing BDA adoption and implementation. The findings revealed the following:

- i. Big Data Analytics significantly affects cost reduction. The regression analysis (Table 4.2.3) showed that “BDA has helped reduce operational costs” had a strong positive contribution ( $\beta = 0.421, p < .001$ ), while “use of data to monitor production costs” also significantly contributed ( $\beta = 0.318, p < .001$ ). Overall, the model explained 89.7% of the variation in cost reduction ( $R^2 = 0.897$ ), indicating that BDA practices strongly predict improvements in cost control.
- ii. BDA was found to significantly enhance operational efficiency. From the coefficients (Table 4.3.3), “BDA improves efficiency” had a standardized beta of 0.452 ( $p < .001$ ), and “data-driven operations” contributed  $\beta = 0.311 (p < .001)$ . The regression model accounted for 92.3% of the variation in process efficiency ( $R^2 = 0.923$ ), showing that firms using BDA experience measurable improvements in workflow, speed, and operational coordination.
- iii. The results indicated that BDA positively impacts financial performance. Key predictors included “Use of BDA enhances financial performance” ( $\beta = 0.481, p < .001$ ) and “BDA supports better decisions” ( $\beta = 0.298, p < .001$ ). The model explained 91.2% of the variation in financial performance ( $R^2 = 0.912$ ), demonstrating that firms that leverage BDA see stronger profitability and financial stability.

- iv. Management support, availability of skilled personnel, and IT infrastructure were significant drivers of BDA adoption, while high technology cost was a barrier. Regression coefficients showed that “management support” ( $\beta = 0.402$ ,  $p < .001$ ) and “skilled personnel” ( $\beta = 0.326$ ,  $p < .001$ ) positively influenced implementation, whereas “cost of technology” had a negative impact ( $\beta = -0.159$ ,  $p = .005$ ). The model explained 88.7% of the variance in BDA implementation ( $R^2 = 0.887$ ), highlighting that organizational readiness is crucial for effective BDA integration.

### **Conclusion**

Based on the findings of this study, it is concluded that Big Data Analytics plays a critical role in optimizing cost management in Nigerian manufacturing firms. The adoption and effective use of BDA significantly enhance cost reduction, improve process efficiency, and strengthen financial performance. Firms that integrate analytics into their cost management systems are better positioned to make informed decisions, control operational expenses, and achieve sustainable growth.

The study also concludes that the successful implementation of Big Data Analytics depends largely on organizational readiness, particularly in terms of leadership support, technical skills, and IT infrastructure. Where these conditions are present, BDA becomes a strategic asset that supports Nigeria’s industrial development goals by boosting productivity and competitiveness. Therefore, Big Data Analytics is not merely a technological trend but a vital managerial tool for modern manufacturing firms in Nigeria.

### **Recommendations**

In line with the findings and conclusions of this study, the following recommendations are made:

- i. Manufacturing firms should prioritize investment in Big Data Analytics systems by integrating data-driven tools into their cost management and operational processes to enhance cost control and efficiency.
- ii. Management should provide strong leadership support for BDA initiatives by formulating clear policies, strategies, and implementation frameworks that encourage data-based decision-making across all departments.
- iii. Firms should invest in staff training and capacity development to build the technical and analytical skills required for effective use of Big Data Analytics tools.
- iv. Government and industry regulators should support digital transformation in the manufacturing sector by providing incentives, grants, and infrastructure development programs that reduce the cost burden of adopting advanced technologies.

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