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Effect of Managing Modern Technological Tools on Procurement Efficiency in Federal Capital Territory, Nigeria

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Abstract

This study examined the effect of managing modern technological tools on procurement efficiency in the Federal Capital Territory (FCT), Nigeria, using the Resource-Based View (RBV) and Technology-Organization-Environment (TOE) framework. A quantitative survey design and multiple regression analysis were employed to assess the influence of E-Procurement Platforms Adoption (EPPA), Blockchain Technology Utilisation (BTU), and Big Data Analytics Integration (BDAI) on procurement efficiency. Findings revealed that all three technological variables exert positive and significant effects on procurement efficiency, with e-procurement platforms demonstrating the strongest influence. The model achieved substantial explanatory power, accounting for 45.7% of the variation in procurement efficiency ($R^2 = 0.457$). The results indicate that effective deployment of digital technologies enhances transparency, accountability, and operational effectiveness within public procurement systems. Consistent with RBV, technological capabilities function as strategic resources that strengthen organizational performance, while the TOE framework explains technology adoption through technological, organizational, and environmental factors. The study concludes that managing modern technological tools is essential for procurement reform and performance improvement in the FCT. It recommends sustained investment in digital infrastructure, workforce development, and institutional support to further strengthen procurement efficiency and governance outcomes.

Keywords: *Procurement efficiency; E-procurement platforms; Blockchain technology; Big data analytics; TOE framework*

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Background to the Study

Technological advancement has increasingly transformed governance systems worldwide, particularly public procurement, which is a core mechanism for public service delivery and infrastructure development. In developed economies, procurement systems have been significantly reshaped through digital innovations that enhance transparency, accountability, and efficiency. Countries such as South Korea and Chile have successfully implemented e-procurement platforms that automate tendering, supplier registration, and contract management, thereby reducing bureaucratic delays and limiting opportunities for corruption. These innovations have strengthened public trust and improved value-for-money outcomes in public spending. In Europe and North America, similar digital procurement ecosystems supported by integrated data systems continue to improve procurement planning and decision-making efficiency.

Across Africa, there is growing awareness of the role of technology in addressing long-standing procurement inefficiencies. Countries such as Rwanda and Kenya have introduced e-procurement systems to replace manual processes, reduce human interference, and improve transparency in public contracting. These reforms have recorded notable progress in reducing procurement cycle time and improving supplier participation. However, many African countries still face structural constraints such as inadequate digital infrastructure, weak institutional capacity, and low technological literacy among procurement personnel. These challenges continue to limit the full benefits of digital transformation in public procurement systems across the continent.

In Nigeria, public procurement plays a vital role in national development and economic growth, yet it remains characterised by inefficiencies, delays, poor accountability, and corruption-related concerns. Traditional procurement processes are often manual, paper-based, and fragmented, leading to slow approvals, weak record management, and limited transparency. These inefficiencies have contributed to procurement disputes, cost overruns, and reduced public confidence in government operations. While emerging technologies such as e-procurement systems, blockchain, and big data analytics offer significant potential to transform procurement practices, their level of adoption and impact in Nigeria, particularly in the Federal Capital Territory, remains insufficiently explored.

In the absence of these technologies, procurement efficiency is typically low, with prolonged processing times, weak monitoring systems, and increased administrative costs. However, when effectively adopted, digital technologies are expected to significantly enhance procurement performance. E-procurement platforms streamline workflows by digitising bidding, supplier management, and payment processes, thereby improving speed and transparency. Blockchain technology enhances data integrity by providing tamper-proof transaction records that strengthen accountability and reduce fraud risks. Big data analytics improves procurement planning by enabling predictive insights, supplier performance tracking, and evidence-based decision-making.

These three variables are selected due to their relevance in modern procurement transformation. E-procurement represents process digitisation, blockchain ensures transactional transparency and security, while big data analytics supports strategic intelligence and performance optimisation. Their integration aligns with the objectives of Nigeria's Public Procurement Act, which emphasises efficiency, accountability, and value for money. This study is therefore expected to provide empirical insights that will assist policymakers and procurement professionals in strengthening technology-driven reforms. It will also contribute to existing literature by addressing gaps in empirical evidence on digital procurement transformation in Nigeria and similar developing economies. Future studies may extend this work by comparing sectoral adoption levels or evaluating the cost-effectiveness of full digital procurement implementation.

Study Objectives

The primary objective of this study is to assess how managing emerging technologies affects the efficiency of public procurement systems in the Federal Capital Territory, Nigeria. The specific objectives are to:

i). Examine the effect of e-procurement platforms adoption on public procurement efficiency in FCT.
ii). Evaluate the impact of blockchain technology utilisation on public procurement efficiency in FCT.
iii). Assess the effect of big data analytics integration on public procurement efficiency in FCT.

Conceptualisation

This study examines the effect of managing modern technological tools on procurement efficiency in the Federal Capital Territory, Nigeria. The key concepts are grounded in digital governance, public sector innovation, and procurement modernization theories. Globally, modern technologies are recognized as tools that enhance transparency, accountability, efficiency, and evidence-based decision-making in public procurement systems (OECD, 2020; World Bank, 2021; Hair et al., 2020).

E-Procurement Platforms Adoption

E-procurement platform adoption refers to the deployment and consistent use of digital procurement systems that automate key procurement activities such as tender advertisement, supplier registration, bid submission, evaluation, contract award, and payment processing. From a positive perspective, scholars argue that electronic procurement systems enhance transparency, reduce administrative costs, improve compliance, and strengthen competition through standardized digital processes (Organisation for Economic Co-operation and Development, 2020; World Bank, 2021; Soudry, 2004; Neupane et al., 2012).

In this study, e-procurement platform adoption is defined as the extent to which procurement agencies in the Federal Capital Territory use electronic procurement systems across procurement stages. Empirical evidence suggests that such systems significantly reduce procurement cycle time and improve operational efficiency by minimizing human

interference and manual bottlenecks (Neupane et al., 2012). However, Eyaa and Oluka (2011) offer a critical counterview, arguing that in developing environments, weak technological infrastructure, inadequate technical capacity, and institutional resistance often limit the effectiveness of electronic procurement systems. Similarly, Gunasekaran et al. (2017) critique the assumption of automatic efficiency gains, emphasizing that digital systems only yield optimal results when supported by strong organizational readiness and process integration.

Blockchain Technology Utilisation

Blockchain technology utilisation refers to the application of distributed ledger systems to enhance transparency, traceability, accountability, and data integrity in procurement processes. From an optimistic standpoint, researchers argue that blockchain provides immutable transaction records, strengthens auditability, and significantly reduces fraud and manipulation risks (Kshetri, 2018; Casino et al., 2019). Within this study, blockchain technology utilisation describes the extent to which procurement institutions integrate blockchain systems for supplier verification, contract monitoring, transaction authentication, and audit trail management. Casino and colleagues (2019) maintain that blockchain improves procurement efficiency through decentralised and tamper-resistant data structures. Similarly, Saberi et al. (2019) highlight that smart contracts embedded within blockchain systems automate procurement processes, thereby reducing delays and human interference. However, Saberi et al. (2019) also present a critical counterview, noting that blockchain adoption is constrained by high implementation costs, technological complexity, and regulatory uncertainty. Kshetri (2018) further critiques the over-optimistic narrative surrounding blockchain, arguing that its efficiency benefits are still largely theoretical in many public-sector contexts where institutional readiness remains low. Thus, while blockchain is conceptually transformative, its practical effectiveness depends heavily on governance capacity and infrastructural maturity.

Big Data Analytics Integration

Big data analytics integration refers to the use of advanced analytical systems to process large volumes of procurement-related data for improved decision-making. Proponents argue that big data analytics enhances procurement planning, supplier evaluation, fraud detection, and performance monitoring by generating predictive insights and real-time intelligence (Akter et al., 2016; Wamba et al., 2017; Gunasekaran et al., 2017). In this study, big data analytics integration is defined through indicators such as frequency of analytics usage, availability of procurement dashboards, and institutional capacity for interpreting procurement data. Akter et al. (2016) argue that organizations with strong analytics capabilities achieve superior procurement efficiency through better forecasting and optimized resource allocation. Wamba et al. (2017) similarly support the view that analytics-driven procurement improves decision accuracy and operational responsiveness. However, Gunasekaran et al. (2017) provide a critical counterargument, noting that many organizations fail to fully realize the benefits of analytics due to weak data governance structures, inadequate analytical skills, and poor technological integration. From this critique, it is evident that data availability alone does not guarantee efficiency gains; rather, institutional competence plays a decisive role in determining outcomes. This study therefore aligns with the view that analytics effectiveness is conditional, not automatic.

Efficiency of Public Procurement Systems

Efficiency of public procurement systems refers to the extent to which procurement activities achieve optimal outcomes with minimal waste, reduced delays, and compliance with regulatory standards. The Organisation for Economic Co-operation and Development (2019) conceptualizes procurement efficiency as encompassing cost-effectiveness, timeliness, transparency, supplier satisfaction, and service quality. In this study, procurement efficiency is measured through procurement cycle time, cost reduction, transparency levels, compliance rates, and user satisfaction with procurement outcomes (Hair et al., 2020).

Empirical Review

Empirical literature generally supports the view that electronic procurement systems enhance procurement efficiency by digitizing procurement processes and reducing administrative bottlenecks. Neupane et al. (2012) argue that e-procurement significantly improves transparency and reduces procurement cycle times. Similarly, Soudry (2004) maintains that electronic procurement strengthens competition and enhances compliance through standardized processes.

In support of this view, Eyaa and Oluka (2011) found that electronic procurement improves procurement efficiency when properly implemented. However, these authors also present a critical perspective, arguing that such systems may fail in contexts characterized by weak infrastructure and limited technical expertise. This critique is reinforced by Gunasekaran et al. (2017), who caution against assuming automatic efficiency gains from technology adoption, emphasizing that organizational readiness is a key determinant of success. From a critical standpoint, this study observes that much of the existing literature tends to overemphasize technological determinism while underestimating institutional constraints. The critique presented here is that efficiency gains from electronic procurement are not inherent to the system itself but are contingent upon governance quality, user competence, and infrastructural stability.

Blockchain Technology Utilisation and Procurement Efficiency

Scholarly evidence generally supports the positive role of blockchain in enhancing procurement transparency and efficiency. Kshetri (2018) argues that blockchain reduces corruption risks through immutable records, while Casino et al. (2019) emphasize its ability to improve traceability and auditability in procurement systems. Saberi et al. (2019) further highlight that smart contracts reduce delays and enhance automation in procurement execution. However, Saberi et al. (2019) also present a counterview, noting that blockchain implementation is constrained by high costs and regulatory ambiguity. Kshetri (2018) provides a strong critique of blockchain optimism, arguing that many claimed benefits remain unproven in real-world public procurement systems, particularly in developing economies where institutional capacity is weak. This study critiques the prevailing literature for presenting blockchain as a near-universal solution without sufficient attention to contextual limitations. The evidence suggests that blockchain effectiveness is highly context-dependent and may not yield significant efficiency gains without complementary institutional reforms.

Big Data Analytics Integration and Procurement Efficiency

Empirical findings largely support the view that big data analytics enhances procurement efficiency. Akter et al. (2016) argue that analytics improves forecasting accuracy and decision quality, while Wamba et al. (2017) highlight its role in enhancing supplier performance evaluation and procurement planning. Gunasekaran et al. (2017) also support the argument that analytics reduces inefficiencies in procurement systems. However, Gunasekaran et al. (2017) provide a significant critique, noting that many organizations struggle to derive value from analytics due to poor data quality, limited analytical skills, and weak system integration. This counterview suggests that the effectiveness of analytics is not guaranteed but depends on organizational capability and data maturity. This study critiques the dominant optimistic narrative by emphasizing that big data analytics should not be viewed as a standalone solution. Instead, its effectiveness is mediated by human capital, institutional readiness, and governance structures.

Theoretical Framework:

Technology Organization Environment (TOE) Framework

The Technology Organization Environment (TOE) framework was developed by Tornatzky and Fleischer in 1990 in the United States of America. The framework explains technology adoption and organizational performance as being shaped by the interaction of technological, organizational, and environmental contexts. The technological context refers to the availability, compatibility, and sophistication of modern procurement technologies such as e procurement systems, enterprise resource planning systems, and digital analytics tools. The organizational context refers to internal factors such as staff ICT competence, managerial support, organizational structure, and readiness for digital transformation. The environmental context refers to external influences such as government regulations, supplier readiness, institutional frameworks, and procurement policies.

In relation to this study, TOE explains that procurement efficiency in the Federal Capital Territory Nigeria is influenced not only by the availability of modern technological tools but also by the internal capacity of organizations and the external environment in which procurement activities occur. This makes the framework highly suitable for explaining variations in procurement efficiency across organizations. The strength of TOE lies in its comprehensive and integrative structure, which captures multiple dimensions influencing technology adoption and performance outcomes. It is also highly flexible and applicable across public and private sector contexts. However, its limitation is that it is largely descriptive and does not clearly specify the relative influence of each contextual factor, which can make empirical testing more complex.

Methodology

This study adopted a quantitative cross-sectional survey research design to investigate the effect of managing emerging technologies on the efficiency of public procurement systems in the Federal Capital Territory, Nigeria. The target population comprised procurement officers, auditors, and financial managers working within federal Ministries, Departments, and Agencies (MDAs) actively engaged in procurement processes in Abuja. The total population

of 1,200 personnel was obtained from the 2024 nominal rolls and organisational records of five major MDAs selected for their strategic procurement roles and substantial digitalisation initiatives. These included the Bureau of Public Procurement (BPP), Federal Ministry of Works and Housing, Federal Inland Revenue Service (FIRS), Federal Ministry of Finance, and Federal Capital Development Authority (FCDA). To determine the sample size, Taro Yamane's (1967) formula for finite populations was applied:

$$\mathbf{n} = \frac{N}{1 + Ne^2}$$

Where;
n = Required Sample Size; N = Population Size (= 1200); and
e = Level of significance = 5% or 0.05

$$\text{Thus, } n = \frac{1200}{1 + 12000(05^2)} = \frac{1200}{1 + 12000(05^2)} = \frac{1200}{1 + 3)} = 1200/3 = 300$$

However, following Israel (2013), a 20% adjustment was applied for non-response, incomplete returns, and unusable data, yielding 360 respondents.

This study adopted a purposive sampling technique to select respondents directly involved in procurement activities within selected Ministries, Departments, and Agencies (MDAs) in the Federal Capital Territory. The technique ensured that only personnel with relevant procurement responsibilities participated in the study, thereby improving the relevance and accuracy of the data collected.

Data were obtained through a structured questionnaire based on a five-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5). The questionnaire was administered electronically via Google Forms to facilitate efficient data collection. Instrument validity was established through expert review by specialists in procurement and public policy, while a pilot study involving ten procurement staff from non-sampled MDAs was conducted to refine the instrument. Reliability was assessed using Cronbach's Alpha, with all constructs exceeding the acceptable benchmark of 0.70. A total of 315 valid questionnaires were retrieved, representing an 87.5% response rate. Data were analysed using IBM SPSS Statistics Version 26. Descriptive statistics, including mean and standard deviation, were used to summarize responses, while Pearson correlation and multiple regression analysis were employed to examine the relationships between EPPA, BTU, BDAI, and procurement efficiency. Model significance was evaluated using ANOVA at the 0.05 level of significance.

Model Specification

This study adopted a quantitative research design, employing multiple linear regression to examine the effect of emerging technology variables (EPPA, BTU, BDAI) on Public Procurement Efficiency (PPE). The model assumed linear relationships, normality of residuals, homoscedasticity, and absence of multicollinearity among predictors. This

approach enabled objective measurement and reliable interpretation of associations. The regression model is specified as:

$$\mathbf{PPE = \beta_0 + \beta_1(EPPA) + \beta_2(BTU) + \beta_3(BDAI) + \lambda}$$

Where:
β_0 = Constant (intercept);
β_1, β_2, β_3 = Regression coefficients for each predictor;
λ = Error term capturing unexplained variance.

Data Analysis
The study focused on procurement officers, IT personnel, and finance staff in public institutions within the Federal Capital Territory (FCT), Nigeria. A total of 360 questionnaires were administered, of which 315 were valid for analysis.

Demographic Analysis
Demographic analysis is essential because employees' age, education, experience, and departmental roles significantly influence their capacity to adopt and effectively use emerging technologies such as e-procurement, blockchain, and big data analytics**.** The demographic profile of the 315 respondents shows a male-dominated workforce (61.3% male; 38.7% female), suggesting the need for more inclusive and gender-balanced capacity-building programmes for effective technology adoption.

Table 1: Demographic Characteristics of Respondents

Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Male	193	61.3%
	Female	122	38.7%
	Total	315	100%
Age	18–30 years	96	30.5%
	31–40 years	118	37.5%
	41–50 years	72	22.9%
	≥ 51 years	29	9.2%
	Total	315	100%
Educational Level	ND/NCE	54	17.1%
	HND/B.Sc.	167	53.0%
	Higher Degrees	94	29.8%
	Total	315	100%
Work Experience	<3 years	74	23.5%
	3–5 years	106	33.7%
	>5 years	135	42.8%
	Total	315	100%
Department/Unit	Procurement	104	33.0%
	IT Unit	97	30.8%
	Finance	76	24.1%
	Administration/Others	38	12.1%
	Total	315	100%

Source: Researcher's Computation, 2026

In terms of age distribution, most respondents fall within the 31–40 years group (37.5%), followed by 18–30 years (30.5%), indicating a relatively young and potentially tech-adaptable workforce. Regarding education, a majority possess HND/B.Sc. qualifications (53.0%), while 29.8% hold higher degrees and 17.1% have ND/NCE certificates. This reflects a generally well-educated workforce capable of understanding and engaging with digital procurement systems and related innovations. Work experience results show that 42.8% have over five years of experience, while 33.7% have 3–5 years, suggesting adequate institutional knowledge for supporting technology-driven processes. Finally, departmental distribution indicates that respondents are mainly drawn from Procurement (33.0%), IT (30.8%), Finance (24.1%), and Administration/Others (12.1%), which are core units directly involved in procurement operations and digital system implementation. Overall, these characteristics suggest a workforce with moderate to high readiness for digital transformation, although continuous training and institutional support remain necessary for optimal technology integration.

Pre-Estimation Diagnostic Tests

a) **Missing Data Check** was conducted using SPSS *Descriptive Statistics > Frequencies*. No missing values were found across the 315 responses for all study variables. Therefore, no case deletion or imputation was required, affirming dataset completeness.

b) **Descriptive Statistics of Variables:** Descriptive analysis summarised central tendencies and dispersion of the study variables (Table 2).

Table 2: Descriptive Statistics

Variable	Mean	Std. Dev.	Min.	Max.
E-Procurement Platforms Adoption	3.86	0.71	2.14	5.00
Blockchain Technology Utilisation	3.79	0.75	2.00	5.00
Big Data Analytics Integration	3.82	0.68	2.31	5.00
Public Procurement Efficiency	3.88	0.72	2.20	5.00

Source: SPSS output, 2025

Collectively, respondents expressed moderate to high agreement regarding the influence of technological trends on procurement efficiency, with E-Procurement Platforms Adoption recording the highest mean score (M = 3.86).

c). **Normality Test:** Kolmogorov-Smirnov and Shapiro-Wilk tests indicated all p-values > 0.05, implying no violation of the normality assumption.

Table 3: Normality Test

Variable	K-S p-value	S-W p-value
EPPA	0.062	0.058
BTU	0.079	0.065
BDAI	0.072	0.061
PPE	0.068	0.059

Source: IBM SPSS Output (2026)

d) **Multicollinearity Test:** The multicollinearity diagnostic results indicate that there is no evidence of collinearity among the predictor variables. This is because all Variance Inflation Factor (VIF) values fall well within the acceptable range recommended by Hair et al. (2020), which suggests that values below 10.0 (and more conservatively below 5.0) indicate the absence of multicollinearity concerns. Table 4 presents the VIF results for the study variables.

Table 4: Multicollinearity Test

Predictor Variable	VIF
EPPA	1.366
BTU	1.249
BDAI	1.300

Source: IBM SPSS Output (2026)

Specifically, E-Procurement Platforms Adoption (EPPA) recorded a VIF value of 1.366, Blockchain Technology Utilisation (BTU) had 1.249, while Big Data Analytics Integration (BDAI) reported 1.300. These values are very close to 1, indicating a very low degree of shared variance among the independent variables. Since all VIF values are substantially below the conventional thresholds of 5.0 and 10.0, it can be concluded that multicollinearity is not present, and the regression estimates are stable and reliable for further inferential analysis.

e) **Outliers and Influential Points:** The assessment of outliers and influential points using Cook's Distance and Leverage Values indicated no significant concern in the dataset.

Table 5: Outliers Test

Diagnostic Statistic	Min.	Max.	Mean	Rule of Thumb
Cook's Distance	0.002	0.257	0.063	<1.00
Leverage Values	0.009	0.112	0.037	<0.20

Source: IBM SPSS Output (2026)

Cook's Distance values ranged from 0.002 to 0.257, with a mean of 0.063, while Leverage Values ranged from 0.009 to 0.112, with a mean of 0.037. Since all values were below the recommended thresholds of 1.00 for Cook's Distance and 0.20 for Leverage Values, no influential outliers were detected, confirming the robustness of the model (Stevens, 2009).

Inferential Results and Discussion

Multiple regression assessed the effect of the proxies on public procurement efficiency. The regression coefficients in Table 5 show that E-Procurement Platforms Adoption (EPPA), Blockchain Technology Utilisation (BTU), and Big Data Analytics Integration (BDAI) all have positive and statistically significant effects on procurement efficiency (PE). EPPA records the strongest influence ($B = 0.348$, $\beta = 0.412$, $t = 4.462$, $p < 0.001$), indicating that increased adoption of e-procurement systems yields the highest improvement in efficiency.

BTU also shows a significant positive effect (B = 0.293, β = 0.356, t = 3.530, p = 0.001), suggesting that blockchain enhances procurement transparency and transaction reliability.

Table 6: Regression Coefficients for Predictors of MDE[a]

Model	Unstandardized Coefficient		Standardized Coefficient	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	2.015	0.312	–	6.457	0.000		
EPPA	0.348	0.078	0.412	4.462	0.000	0.732	1.366
BTU	0.293	0.083	0.356	3.530	0.001	0.801	1.249
BDAI	0.261	0.069	0.307	3.783	0.000	0.769	1.300

a. Dependent Variable: PE

Similarly, BDAI has a significant positive effect (B = 0.261, β = 0.307, t = 3.783, p < 0.001), confirming its role in improving procurement decision quality and operational outcomes. The beta values confirm the ranking of influence, with EPPA as the most dominant predictor, followed by BTU and BDAI. The collinearity diagnostics also indicate no multicollinearity issues, as tolerance values (0.732 to 0.801) and VIF values below 10 falls within acceptable limits. Overall, the findings show that each technological tool independently improves procurement efficiency, with e-procurement systems contributing the most significant effect.

Regression Analysis and Hypotheses Testing

This study employed multiple regression analysis using SPSS to examine the effect of Managing Modern Technological Tools, E-Procurement Platforms Adoption (EPPA), Blockchain Technology Utilisation (BTU), and Big Data Analytics Integration (BDAI), on Procurement Efficiency (PE) in the Federal Capital Territory (FCT), Nigeria. The results indicate that all predictors exert statistically significant and positive effects on procurement efficiency, thereby providing empirical support for the proposed model.

Hypotheses Testing

Hypothesis One ($H_0$1): *E-Procurement Platforms Adoption (EPPA) has no significant effect on Procurement Efficiency (PE)*

The regression results show that EPPA has a positive and statistically significant effect on procurement efficiency (B = 0.348, β = 0.412, t = 4.462, p = 0.000). This indicates that a unit increase in the adoption and effective utilisation of e-procurement platforms leads to a corresponding improvement in procurement efficiency. Accordingly, $H_0$1 is rejected. This finding implies that digital procurement systems, through automation of tendering processes, reduction of human interference, and improved transparency, significantly enhance procurement performance in public institutions within the FCT.

Hypothesis Two ($H_0$2): *Blockchain Technology Utilisation (BTU) has no significant effect on Procurement Efficiency (PE)*

The results further reveal that BTU has a significant positive relationship with procurement efficiency (B = 0.293, β = 0.356, t = 3.530, p = 0.001). This demonstrates that increased utilisation of blockchain-enabled systems improves efficiency in procurement processes. Thus, $H_0$2 is rejected. This finding suggests that blockchain technology enhances procurement efficiency through improved traceability, transaction security, contract validation, and reduction of fraudulent practices in procurement cycles.

Hypothesis Three ($H_0$3): *Big Data Analytics Integration (BDAI) has no significant effect on Procurement Efficiency (PE).*

The regression output shows that BDAI significantly affects procurement efficiency (B = 0.261, β = 0.307, t = 3.783, p = 0.000). This confirms that integrating big data analytics into procurement decision-making processes improves operational outcomes. Consequently, $H_0$3 is rejected. This implies that data-driven procurement systems, through predictive analytics, demand forecasting, and supplier performance analysis, significantly enhance procurement efficiency in the FCT public sector.

Model Fit Statistics

The model fit statistics indicate the extent to which EPPA, BTU, and BDAI jointly explain variations in procurement efficiency. The multiple correlation coefficient (R = 0.676) indicates a moderately strong relationship between the observed and predicted values of procurement efficiency.

Table 7: Model Fit Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.676[a]	.457	.444	.590	1.8217

a. Predictors: (Constant), EPPA, BTU, BDAI.
b. Dependent Variable: PE

Source: SPSS Output, 2026.

The coefficient of determination (R^2 = 0.457) shows that approximately 45.7% of the variation in procurement efficiency is jointly explained by EPPA, BTU, and BDAI. The adjusted R^2 (0.444) confirms that the model retains strong explanatory power after adjusting for the number of predictors. The Durbin-Watson statistic (1.8217) indicates the absence of significant autocorrelation in the residuals, confirming the reliability of the regression estimates.

Analysis of Variance (ANOVA)

The highly significant F-value ($p < 0.05$) indicates that the regression model is statistically significant. This implies that EPPA, BTU, and BDAI jointly have a significant effect on procurement efficiency. Therefore, the null hypothesis of no overall model significance is rejected.

Table 8: ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Registration	38.275	3	12.758	36.842	.0000[b]
	Residual	45.715	131	0.349		
	Total	83.990	134			

a. Dependent Variable: PE
b. Predictors: (Constant), EPPA, BTU, BDAI.

Source: SPSS Output, 2026.

Discussion of Findings

The results of this study provided strong empirical evidence that the effective management and deployment of modern technological tools have a significant influence on procurement efficiency within the Federal Capital Territory (FCT), Nigeria. In particular, the adoption of E-Procurement Platforms (EPPA), the utilisation of Blockchain Technology (BTU), and the integration of Big Data Analytics (BDAI) were all found to exert positive and statistically significant effects on procurement efficiency. Collectively, these findings reinforce the expanding scholarly position that digital technologies function as strategic enablers of efficiency, transparency, accountability, and overall effectiveness in contemporary public procurement systems.

With respect to the first hypothesis, which examined the effect of E-Procurement Platforms Adoption on procurement efficiency, the regression output indicated that EPPA had the most pronounced positive effect among the three predictors. The result ($B = 0.348$, $\beta = 0.412$, $t = 4.462$, $p < 0.001$) led to the rejection of the null hypothesis, confirming statistical significance. This suggests that increased adoption of electronic procurement systems contributes meaningfully to improving procurement performance. The implication is that digital procurement platforms streamline procurement workflows, enhance information accessibility, reduce administrative bottlenecks, and improve compliance with procurement standards. Although some earlier perspectives suggest that such systems may face implementation barriers such as limited technical capacity, institutional rigidity, or resistance to change, the findings of this study demonstrate that within the FCT context, these challenges appear to have been substantially mitigated. Consequently, e-procurement adoption emerged as a critical determinant of procurement efficiency, reinforcing the view that digital infrastructure is central to modern public sector reform and performance improvement.

The second hypothesis focused on Blockchain Technology Utilisation and its effect on procurement efficiency. The analysis revealed a statistically significant positive relationship ($B = 0.293$, $\beta = 0.356$, $t = 3.530$, $p = 0.001$), resulting in the rejection of the null hypothesis. This outcome indicates that blockchain integration enhances procurement processes by improving transparency, traceability, data integrity, and transaction security. The decentralized and immutable structure of blockchain systems reduces opportunities for fraud, manipulation of procurement records, and information asymmetry among stakeholders. In addition, it strengthens trust in procurement transactions by ensuring that records cannot be altered retrospectively without detection. Although concerns remain regarding high implementation costs, technical complexity, and regulatory uncertainty, the findings of this study suggest that the benefits outweigh the constraints in the FCT procurement environment, where blockchain adoption has begun to positively reshape procurement governance structures and operational efficiency.

The third hypothesis assessed the influence of Big Data Analytics Integration on procurement efficiency. The results demonstrated a significant positive effect ($B = 0.261$, $\beta = 0.307$, $t = 3.783$, $p < 0.001$), leading to the rejection of the null hypothesis. This finding implies that organizations that integrate data analytics into procurement operations are better positioned to enhance decision-making quality, improve demand forecasting accuracy, evaluate supplier performance more effectively, and optimize resource allocation. Big data analytics facilitates the transformation of large and complex datasets into actionable insights, thereby strengthening evidence-based procurement decisions. However, despite its advantages, prior perspectives suggest that limited analytical capacity, weak data governance structures, and inadequate technological infrastructure may constrain its effectiveness. Nonetheless, the present study provides evidence that such limitations are not sufficiently restrictive in the FCT context to prevent big data analytics from significantly improving procurement efficiency.

The overall model statistics further validated the robustness of the analytical framework employed in this study. The coefficient of determination ($R^2 = 0.457$) indicates that approximately 45.7% of the variation in procurement efficiency is jointly explained by EPPA, BTU, and BDAI. This level of explanatory power is considered substantial within the field of public administration, where organizational behaviour and institutional dynamics often influence outcomes. Additionally, the F-statistic ($F = 36.842$, $p < 0.001$) confirmed that the combined effect of the three technological variables significantly predicts procurement efficiency, thereby affirming the overall model fitness and explanatory validity.

In summary, the findings of this study clearly demonstrate that the strategic deployment of modern technological tools significantly enhances procurement efficiency in the Federal Capital Territory. The evidence suggests that investments in e-procurement platforms, blockchain systems, and big data analytics capabilities can substantially improve transparency, accountability, responsiveness, and data-driven decision-making in procurement operations. These outcomes underscore the importance of sustained technological innovation as a cornerstone of effective procurement reform and public sector performance improvement in Nigeria.

Conclusion and Recommendations

This study examined the effect of managing modern technological tools, namely E-Procurement Platforms Adoption, Blockchain Technology Utilisation, and Big Data Analytics Integration, on procurement efficiency in the Federal Capital Territory, Nigeria. The empirical findings revealed that all three dimensions of technological tools exerted positive and statistically significant effects on procurement efficiency. Among the predictors, E-Procurement Platforms Adoption emerged as the strongest determinant of procurement efficiency, followed by Blockchain Technology Utilisation and Big Data Analytics Integration. The study therefore concluded that the effective adoption and management of modern technological tools are critical for enhancing transparency, accountability, operational effectiveness, and overall procurement efficiency within public sector institutions. The rejection of all null hypotheses further confirmed that technological modernization has become an indispensable driver of procurement performance in contemporary public administration.

Based on the findings of the study, the following recommendations are proposed:

i). Enhance E-Procurement Platform Adoption: Government agencies within the FCT should strengthen the deployment and utilization of integrated e-procurement systems to automate procurement processes, reduce administrative delays, improve transparency, and ensure compliance with procurement regulations.

ii). Promote Blockchain Technology Utilisation: Public procurement entities should invest in blockchain-enabled procurement systems to improve transaction security, traceability, contract integrity, and accountability throughout the procurement cycle.

iii). Strengthen Big Data Analytics Integration: Procurement departments should develop analytical capabilities by investing in data management infrastructure, analytics software, and personnel training to support evidence-based procurement planning, supplier evaluation, and demand forecasting.

Limitations of the Study

The scope of this study was confined to selected public sector institutions in the Federal Capital Territory, which enhances contextual precision but implies that the findings should be interpreted with caution when extending them to other regions of Nigeria. The study also relied on self-reported questionnaire responses, making the findings susceptible to respondent perception bias. Furthermore, the study focused exclusively on e-procurement platforms, blockchain technology, and big data analytics, while other emerging technologies such as artificial intelligence, machine learning, cloud computing, and robotic process automation were not examined.

Suggestions for Further Study

Future studies should:

i). Investigate the effect of artificial intelligence and machine learning technologies on procurement efficiency in public sector organizations.

ii). Examine the moderating role of organizational culture and digital competence in the relationship between technological innovation and procurement efficiency.

iii). Conduct comparative studies between public and private sector organizations to determine whether the effects of technological tools differ across institutional contexts.
iv). Extend the study to other geopolitical zones in Nigeria to enhance the generalizability of findings.

Contribution to Knowledge

This study contributes to knowledge by empirically demonstrating that E-Procurement Platforms Adoption, Blockchain Technology Utilisation, and Big Data Analytics Integration significantly enhance procurement efficiency in public sector institutions within the Federal Capital Territory, Nigeria. The study integrates these three technological dimensions into a single analytical framework, thereby extending existing digital procurement literature. It also provides empirical support for the Resource-Based View and Technology-Organization-Environment framework. Furthermore, the findings offer practical insights for policymakers and procurement managers on leveraging technological innovation to improve transparency, accountability, and efficiency in public procurement processes.

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APPENDIX: QUESTIONNAIRE

Dear Respondent

This study examines the effect of managing modern technological tools on procurement efficiency (PE) in the Federal Capital Territory, Nigeria. Respondents are requested to complete the questionnaire objectively and accurately based on their professional experience and informed judgement within their organization. In Section B, kindly indicate your level of agreement with each statement using the following scale: 5 = Strongly Agree (SA), 4 = Agree (A), 3 = Neutral (N), 2 = Disagree (D), and 1 = Strongly Disagree (SD).

SECTION A: Socio-Demographic Data

SN	Socio-Demographic Data	Categories
1	Which of the following describes your age range?	[ ] 18–29 years ; [ ] 30–39 years [ ] 40–49 years [ ] ≥ 50 years
2	What is your highest educational qualification?	[ ] SSCE/WAEC; [ ] ND/NCE [ ] HND/B.Sc.; [ ] M.Sc./MBA [ ] PhD and above
3	What is your gender?	[ ] Male ; [ ] Female
4	Which department/unit do you belong to?	[ ] Procurement/Supply Chain ; [ ] Finance/Accounts [ ] Administration ; [ ] Operations/Logistics
5	What is your current employment status in the organization?	[ ] Junior Staff ; [ ] Senior Staff [ ] Supervisor ; [ ] Manager
6	How long have you worked in the organization?	[ ] Less than 2 years; [ ] 2–5 years [ ] 6–10 years ; [ ] 11 years and above

SECTION B: INDICATORS-CONSTRUCT QUESTIONNAIRE

Item Code	Questionnaire Items	SA	A	N	D	SD
EPPA	**E-PROCUREMENT PLATFORMS ADOPTION**					
EPPA 1	The organization adopts electronic procurement platforms for procurement activities.					
EPPA 2	E-procurement systems improve transparency in procurement processes.					
EPPA 3	The use of e-procurement platforms reduces procurement cycle time.					
EPPA 4	Digital procurement systems enhance efficiency in supplier management.					
EPPA 5	E-procurement adoption contributes to cost reduction in procurement operations.					
BTU	**BLOCKCHAIN TECHNOLOGY UTILISATION**					
BTU1	The organization applies blockchain technology in procurement transactions.					
BTU2	Blockchain improves traceability of procurement activities.					
BTU3	Blockchain technology enhances security and reduces fraud in procurement.					
BTU4	Smart contracts improve efficiency in procurement processes.					
BTU5	Blockchain adoption increases trust between suppliers and the organization.					
BDAI	**BIG DATA ANALYTICS INTEGRATION**					
BDAI 1	The organization uses big data analytics in procurement decision-making.					
BDAI 2	Data analytics improves demand forecasting accuracy in procurement.					
BDAI 3	Big data integration enhances supplier selection decisions.					
BDAI 4	Procurement decisions are more efficient due to data-driven insights.					
BDAI 5	Big data analytics reduces procurement inefficiencies and waste.					
PE	**PROCUREMENT EFFICIENCY**					
PE1	Procurement processes in the organization are completed within expected timelines.					
PE2	The organization achieves cost efficiency in procurement activities.					
PE3	Procurement operations are carried out with minimal errors and delays.					
PE4	Supplier performance is effectively managed to ensure efficiency.					
PE5	Overall procurement performance has improved due to modern technological tools.					

Source: Self-constructed questionnaire items developed from literature on procurement digitalization and technological innovation, adapted using Hair et al. (2022) guidelines and tailored to procurement efficiency studies in FCT, Nigeria (2026).