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RESEARCH ARTICLE

ASSESSING THE INTEGRATION OF BUILDING INFORMATION MODELING AND E-PROCUREMENT IN PUBLIC PROCUREMENT PROJECTS IN AKWA IBOM STATE

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ABSTRACT

The Nigerian construction industry faces challenges in adopting Building Information Modelling (BIM) and Electronic Procurement (e-procurement), essential for improving project efficiency. This study investigated their adoption among professionals in Akwa Ibom using questionnaire-based data, analysed through regression, descriptive statistics, and the Relative Severity Index. Findings revealed that only 37% of respondents use BIM, while 83 percent use e-procurement. About 51 percent reported partial integration, and 31 percent achieved full integration. Despite challenges, 57 percent recognised benefits such as improved time and cost management, efficiency, and collaboration, whereas 14 percent were sceptical. A significant 84 percent reported issues like price instability, supply chain disruptions, fraud, and technological difficulties. Barriers included poor infrastructure, regulatory constraints, and high implementation costs. Recent government reforms were perceived as beneficial. WhatsApp (24 percent) was the most used procurement platform, followed by email (22 percent) and Facebook (21 percent). The study recommends for adequate personnel training, increase investment in infrastructure, and sustainable provision of government incentives to support wider technology adoption.

Keywords: Assessing, integration, building information modelling (BIM), E-procurement, construction project.

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INTRODUCTION

The construction industry is undergoing digital transformation, driven by Building Information Modelling (BIM) and e-procurement platforms. These technologies enhance collaboration, streamline processes, and improve project outcomes. In Nigeria, public procurement faces critical issues, including inefficiency, leakages, and corruption. This study examines the integration of BIM and e-procurement in Akwa Ibom State's construction industry. The objectives are to: (i) identify the current adoption rate of BIM and e-procurement, (ii) examine economic barriers to adoption, (iii) investigate the impact on project planning and design, and (iv) assess stakeholder perceptions. The study aims to provide insights that support procurement reform, promote transparency, and encourage digitalisation. The findings will inform policy and support more efficient, accountable, and technologically advanced construction procurement systems, benefiting industry stakeholders, government agencies, and the public. The study addresses a knowledge gap in the integration of BIM and e-procurement in Akwa Ibom State.

MATERIALS AND METHODS

The materials and methods employed in the course of this research are presented in what follow.

Questionnaires: Structured questionnaires were used to obtain responses from the different categories of professionals across the state. A questionnaire survey was used to collect data using the quantitative method

Microsoft Excel: MS Excel was used for the data analysis and presentation, as well as the regression modelling.

Population and Sampling Method

The targeted population consisted of construction professionals in Akwa Ibom State, including Project Managers, Procurement Officials, Architects, Engineers, Quantity Surveyors, Contractors, and other relevant stakeholders. A stratified random sampling technique was employed to select participants.

Methods of Data Analysis and Testing of Hypotheses

Descriptive and inferential statistics were used, including mean, standard deviation, correlation, and regression analysis. Multiple regression analysis was used to test the hypothesis and examine variable relationships.

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PRESENTATION OF RESULTS AND DISCUSSIONS

Presentation of Results

The results obtain in the course of this study are sequentially presented in the Figures, Tables, and Charts in the subsections that follow.

The dimensions at which respondents utilized E-procurement platforms in the study area is presented in Figure 1. The result clearly illustrates that respondents in the construction industry utilize a range of digital platforms for procurement, but the levels differ based on the indicators.

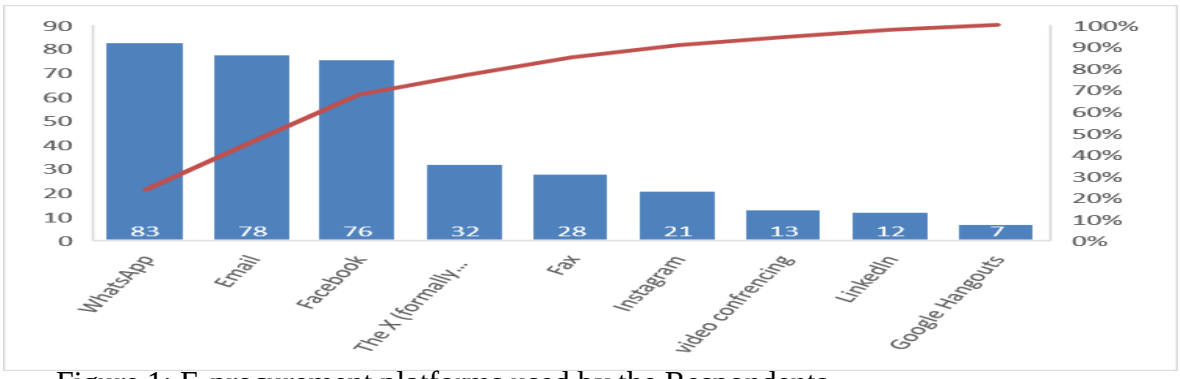

Figure 1: E-procurement platforms used by the Respondents.

Level of gains using e-procurement platforms in the construction sector

The findings on the level of gains from using e-procurement platforms in the construction sector are presented in Figure 2

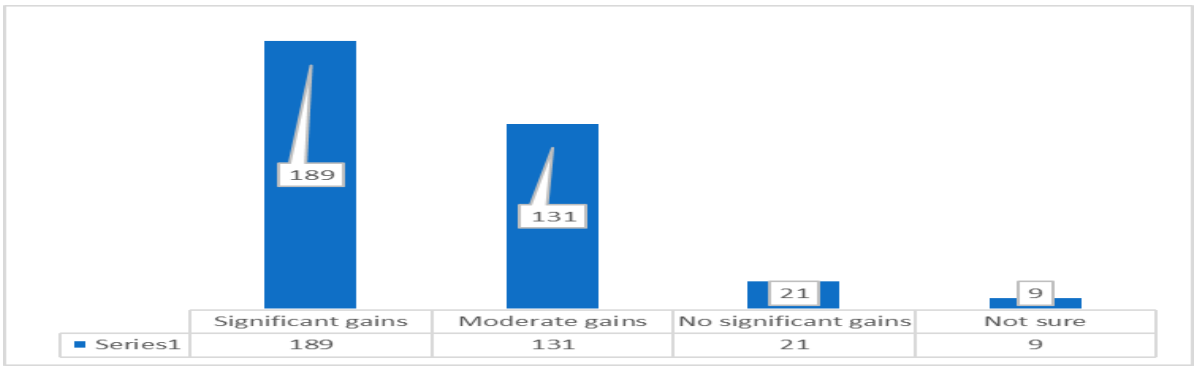

Figure 2: Level of gains using e-procurement platforms in the construction sector. Source: Researcher's Computation (2024).

Extent of Usage of BIM and E-procurement in Akwa Ibom State

The results regarding the extent of BIM and e-procurement usage as presented in Figure 3

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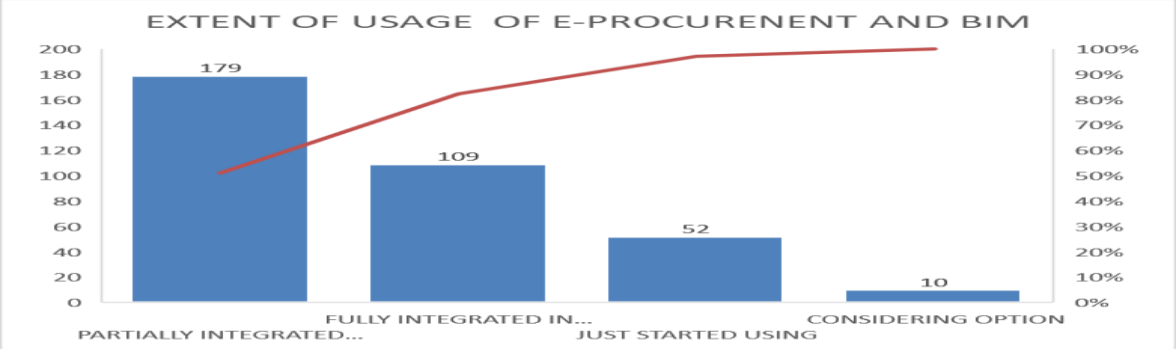

Figure 3: Extent of Usage of BIM and E-procurement in Akwa Ibom State

Current Adoption of BIM in the study Area.

The findings regarding the adoption of BIM are presented in Table 1.

Table 1: Adoption of BIM in Akwa Ibom State

Respondents	Frequency	Percentage
Yes	129	37
No	200	57
Not sure	21	6
Total	350	100

Usage of e-procurement in the study Area

The results regarding the use of e-procurement in the study area are presented in Figure 4

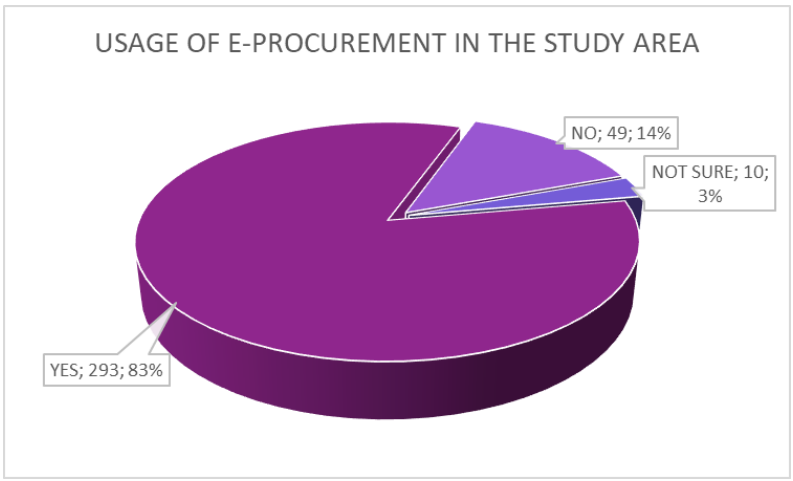

Figure 4: Usage of e-procurement in the study Area.

Barriers to the Adoption of BIM and e-procurement in the study Area

The findings are presented in Figure 5.

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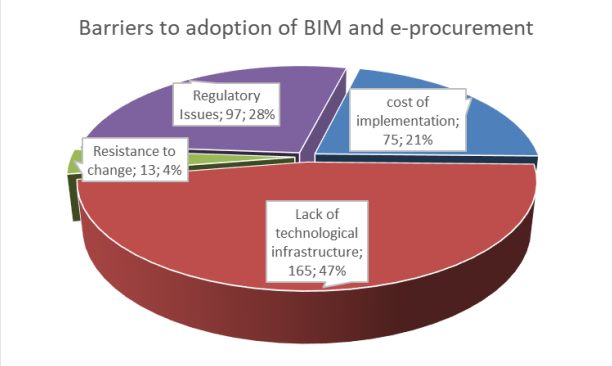

Figure 5: Barriers to the Adoption of BIM and e-procurement in the study Area

Challenges to the use of BIM and E-procurement in the study Area.
The findings are presented in Figure 6

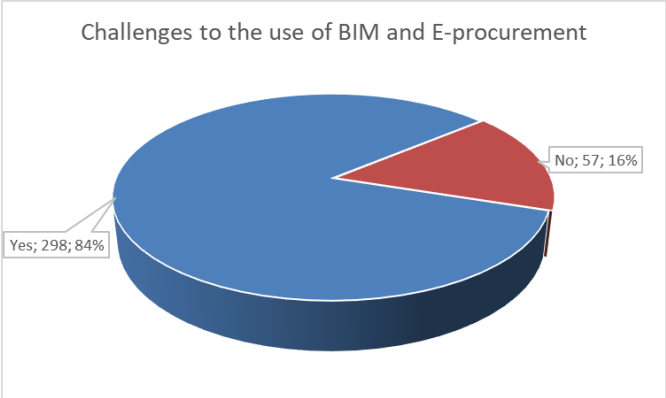

Figure 6: Challenges to the use of BIM and E-procurement in the study Area

Influence of BIM and E-procurement on project planning and design in construction procurement
The correlation analysis is presented in table 2.

Table 2. Correlation Statistics

Variable	Correlation Coefficient (R)	P-value	Sig. Level
Integration of Bim and e-procurement	0.82	0.02	
project design and planning in construction procurement	0.75	0.04	0.05

Stakeholders Perception Toward BIM and E-Procurement in The Study Area
The findings are presented in Figure 7.

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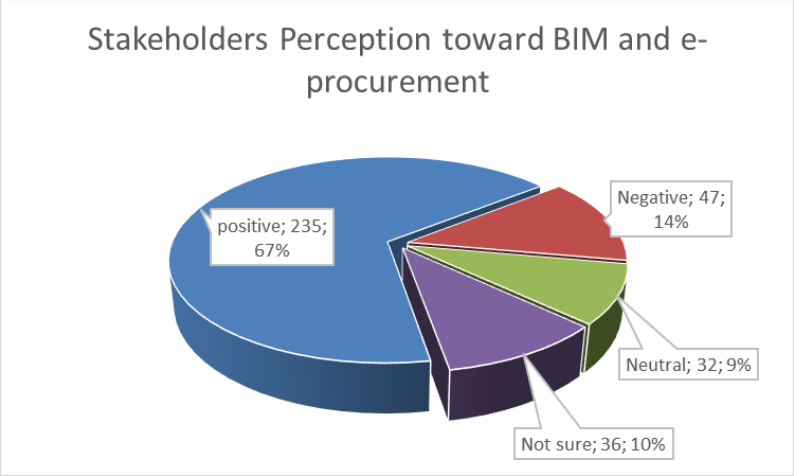

Figure 7: Stakeholders Perception Toward BIM and E-Procurement in The Study Area

Effect of procurement reforms implemented in the construction sector

The regression analysis is presented in Table 3.

Table 3: Regression results on the effect of procurement reforms implemented in the construction sector

Model	Unstandardized Coefficients		Standardized Coefficient		
	B	Std Error	B	t	Sig.
(Constant)	2.96	0.274		10.80	
Integration of Bim	0.448	0.187	0.366	2.395	0.038
Govt. Reforms	0.374	0.191	0.348	1.958	0.004

Discussion of Findings

E-procurement Platforms Used by the Respondents in the Study Area

The study finds WhatsApp (24 percent) is the most widely used platform for procurement, followed by email (22 percent) and Facebook (21 percent). Twitter (9 percent), fax (8 percent), and Instagram (6 percent) are less common. Video conferencing tools (4 percent) and LinkedIn (3 percent) are underused. Google Hangouts is the least used (2 percent). The findings suggest construction professionals use diverse platforms based on convenience and project needs. The results align with Ogunley and Ezeani (2021), who identified barriers and varying adoption levels in Nigeria's digital transformation landscape. The study highlights the importance of convenience and accessibility in platform adoption.

Level of Gains through the Use of E-procurement Platforms in the Construction Sector

Most respondents (54 percent) reported significant gains from e-procurement, citing improved efficiency, reduced costs, and enhanced collaboration. 37 percent reported

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moderate gains, while 6 percent saw no significant benefits, and 3 percent were unsure. The findings highlight e-procurement's potential and limitations in construction. Enhanced awareness, training, and system integration are needed to maximize impact. The results align with Durdyev, Endut, and Bakar (2020), who emphasized benefits and challenges of integrating BIM and e-procurement. The study underscores the importance of addressing implementation challenges to fully leverage e-procurement's benefits in the construction sector.

Extent of Usage of BIM and E-procurement in Akwa Ibom State

The study finds 51 percent of respondents have partially integrated BIM and e-procurement, while 31 percent have fully integrated them across all projects. 15% have recently started integrating, and 3 percent are considering it. The findings highlight the need for employee training, software investment, and clear policies to prioritize integration. Collaboration among stakeholders to create standards and training programs can support effective integration. The results align with Costal and Grilo (2015), who reported low adoption levels, emphasizing the need for continued research and development to enhance industry-wide implementation of BIM and e-procurement. Further education and resources are necessary.

Barriers to the Adoption of BIM and E-procurement in the Study Area

The study identifies key barriers to BIM and e-procurement adoption: lack of technological infrastructure (47 percent), regulatory challenges (28 percent), and cost of implementation (21 percent). Insufficient infrastructure, unclear policies, and high expenses hinder adoption. Resistance to change is a minor obstacle (3 percent). Addressing these challenges is crucial for successful implementation. Prioritizing infrastructure, regulatory clarity, and cost management can facilitate smoother adoption. The findings align with Sacks and Koskela (2022), who reported similar barriers. The study highlights the need for stakeholders to invest in infrastructure, develop clear policies, and provide training to support BIM and e-procurement adoption in the construction industry.

Influence of BIM and e-procurement on construction project design and planning

The study finds a strong positive correlation between BIM and e-procurement (V-value = 0.82, p = 0.02), indicating their integration enhances construction project outcomes. BIM's 3D modelling supports procurement with accurate, real-time information, improving decision-making and reducing errors. Project design and planning also strongly correlate with e-procurement (R = 0.75, p = 0.04). The findings suggest integrating BIM and e-procurement can improve efficiency, reduce delays, and enhance project delivery. Targeted training and government support are recommended to overcome adoption barriers. The results align with Ibem et al. (2016), who reported similar factors influencing e-procurement adoption in Nigeria.

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Stakeholders Perception toward BIM and E-Procurement in The Study Area

A majority of respondents (67 percent) hold a positive perception of BIM and e-procurement, recognizing their potential to improve efficiency, reduce costs, and enhance collaboration in construction. This optimism reflects enthusiasm for the technologies' transformative impact. However, 14 percent express negative perceptions, possibly due to concerns about challenges in implementation, while 10 percent are indifferent and 9 percent neutral, indicating uncertainty or limited experience. Despite some skepticism, the overall positive outlook suggests strong potential for BIM and e-procurement adoption. These findings contradict Afolabi et al. (2019), who reported different views on critical success factors for e-procurement.

Effect of Procurement Reforms Implemented in the Construction Sector

The multiple regression analysis reveals BIM integration and government reforms as key factors influencing e-procurement adoption. The model is statistically significant ($F = 51.672$, $p < 0.05$) and explains 73.3 percent of the variation in adoption (adjusted $R^2 = 0.733$). BIM integration (coefficient = 0.448, $p = 0.038$) and government reforms (coefficient = 0.374, $p = 0.004$) both positively impact adoption. The findings emphasize the importance of supportive policies and BIM integration in driving e-procurement adoption. This aligns with Bolpagni (2013), highlighting BIM's role in public procurement. Policymakers should prioritize these factors for enhanced procurement efficiency and digital transformation.

CONCLUSION

The study finds low BIM adoption (37 percent) in public procurement projects due to limited awareness, training, and support. Despite barriers like infrastructure and cost, 57 percent of respondents recognize the benefits of BIM and e-procurement integration, such as improved collaboration and efficiency. Most construction professionals (67 percent) have a positive perception of these technologies. Government reforms significantly impact e-procurement adoption (coefficient = 0.374, $p = 0.004$), highlighting the importance of policy in driving digital transformation. Enhancing awareness, training, and support is crucial to overcome adoption barriers and promote effective integration of BIM and e-procurement in the construction sector.

Competing Interest

The authors have declared that no conflicting interest exist in this manuscript.

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