PROCUREMENT

The Influence of Procurement Planning on the Performance of Public Infrastructure Projects in Jos, Plateau State

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Abstract

This study assessed procurement planning practices, challenges, and improvement strategies in public infrastructure projects in Jos, Plateau State, and examined their implications for project performance. Despite public procurement reforms, infrastructure projects in Nigeria continue to suffer cost overruns, delays, and quality deficiencies. Using a quantitative design, structured questionnaires were administered to 141 procurement professionals, engineers, and project managers. Data were analyzed using descriptive statistics, correlation analysis, reliability testing, and multiple regression. The constructs demonstrated good to excellent internal reliability (Cronbach's alpha: Key Elements = 0.831; Challenges = 0.898; Strategies = 0.814). Correlation analysis revealed a significant positive relationship between key planning elements and strategy adoption ($r = 0.419$, $p < 0.01$). Multiple regression showed that key planning elements and challenges jointly explained 21.6% of the variance in strategy adoption ($R^2 = 0.216$, $F = 18.98$, $p < 0.001$). Key elements emerged as the strongest predictor ($\beta = 0.426$, $p < 0.001$), while challenges also showed a significant positive effect ($\beta = 0.201$, $p = 0.009$). The study was limited by the absence of direct project performance measures in the instrument, which prevented empirical testing of the performance relationship. Nevertheless, the findings provide evidence-based insights into the planning conditions that shape infrastructure delivery in Jos, and offer a validated framework for future research linking these antecedents to cost, time, and quality outcomes.

Keywords: Procurement; planning; performance; public infrastructure; projects

1 Introduction

Projects focused on the development of public infrastructure like roads, hospitals, schools, power supply amongst others are necessary for national economic growth and development. They do not only stimulate economic growth but also enhance service delivery and poverty reduction. The success of these projects depends on proper procurement planning, execution, and not availability of funds alone. Procurement planning—defined as the process of identifying what to procure, how, when, and from what source (OECD, 2016) is a key factor in project outcomes and determines speed of delivery, cost and quality of projects. Nigeria has been bedeviled with poor project delivery due to mismanagement, waste, corruption, which has led to increased attention on procurement activities.

The enactment of the Public Procurement Act in 2007 was a key reform effort aimed at curbing these challenges by ensuring transparency, accountability, and value for money (Bureau of Public Procurement 2021). Despite this legislative framework and the PPA act, several public projects in the country continue to suffer from budget overruns, delays, and poor quality, which is a reflection of poor procurement planning. Poor Procurement planning is a root cause of poor project delivery in the public sector. For instance, Obansa and Maduekwe (2019) argue that procurement decisions

taken without adequate planning often result in inaccurate cost estimations, unrealistic timelines, and inappropriate procurement methods, all of which jeopardize project performance. Similarly, Olatunji (2018) found that inefficiencies in procurement planning were directly linked to delays and cost escalations in road construction projects across several Nigerian states. Lack of effective procurement planning could lead to project delays, cost overrun, and contractual disputes and ultimately poor project delivery. The Nigerian government has an infrastructure plan under the Economic Recovery and Growth Plan (ERGP) and the National Development Plan (2021–2025). The success of these plans is hinged on effective procurement systems that will guarantee project delivery.

Public infrastructure projects in Nigeria usually experience delays, cost overruns, and poor quality due to poor procurement planning. These challenges include poor needs assessment, poor cost estimation, inadequate budgeting, lack of skilled procurement personnel, political interference, weak regulatory compliance, lack of transparency. These factors usually undermine procurement planning processes in public institutions. These challenges reduce the efficiency and effectiveness of infrastructure project delivery and contribute to the increasing number of failed public projects across the country. It is therefore necessary to examine the influence of procurement planning on the performance of public infrastructure projects in Jos, Plateau state. There is limited research on this relationship. Further research is needed to produce local evidence which will aid policy and practice in the state's public sector.

Procurement planning is increasingly recognized as a fundamental and major determinant of public infrastructure project performance. Across the globe, infrastructure projects continue to experience cost overruns, time delays, and quality deficiencies, often linked to weaknesses and inefficiencies in early-stage planning processes (Love & Irani, 2020; Osei-Kyei & Chan, 2020). In public sector environments, procurement planning ensures alignment between project objectives, available resources, regulatory frameworks, and stakeholder expectations. Public infrastructure project performance is conventionally assessed using three interrelated indicators: cost performance (adherence to approved budget), time performance (adherence to scheduled completion), and quality performance (conformance to technical specifications and stakeholder satisfaction). These indicators constitute the "iron triangle" of project management (Project Management Institute, 2021). Procurement planning the process of identifying what to procure, how, when, and from what source (OECD, 2016) is widely recognized in the literature as a critical antecedent of these performance outcomes. When these planning elements are inadequate, or when planning is undermined by political interference, poor budgeting, and weak capacity, projects are predisposed to cost overruns, delays, and quality failures. This study examines the state of these planning conditions in Jos, Plateau State, and assesses how they interact to shape the environment within which infrastructure projects are delivered.

Despite the enactment of the Public Procurement Act (2007) and ongoing reform efforts, public infrastructure projects in Nigeria continue to underperform. In Jos, Plateau State, roads, public buildings, and utilities frequently experience delays, cost escalation, and quality deficiencies. While existing literature has established that procurement planning influences project performance at the national level, there is limited empirical evidence from Jos regarding the specific planning conditions elements, challenges, and strategies that create the environment for success or failure.. This study addresses this gap by assessing these three dimensions of procurement planning in Jos and examining how they relate to one another, thereby providing a foundation for understanding their expected implications for project performance.

To assess procurement planning practices, challenges, and improvement strategies in public infrastructure projects in Jos, Plateau State, and examine their implications for project performance with objectives below:

1. To examine the adequacy of key procurement planning elements in public infrastructure projects in Jos, Plateau State.
2. To identify the challenges affecting procurement planning in public infrastructure projects in Jos, Plateau State.
3. To assess the adoption of procurement planning improvement strategies and determine the factors that predict their uptake.
4. What is the level of adequacy of key procurement planning elements in public infrastructure projects in Jos, Plateau State?
5. What challenges affect procurement planning in public infrastructure projects in Jos, Plateau State?
6. What improvement strategies are adopted, and what factors predict their uptake?
7. What are the implications of these planning conditions for infrastructure project performance?

2 Literature review

2.1 Theoretical review

2.1.1 Project management theory

Project Management Theory emanated from the scientific management movement of the early twentieth century led by Frederick Winslow Taylor and later expanded through systems theory and operations research during and after World War II. This theory became more prominent in the 1950s and 1960s with the development of project scheduling tools such as the Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT). Modern project management theory was later institutionalized through professional bodies such as the Project Management Institute (PMI), which produces standardized project management frameworks and methodologies for planning, execution, monitoring, and control of projects. The theory focuses on the efficient management of project resources, time, cost, quality, procurement, communication, and risk to achieve project objectives. This theory is widely applied in construction and infrastructure projects because such projects involve multiple stakeholders, procurement activities, and resource coordination (De Araújo et al., 2017). The theory assumes that projects are initiated and executed to achieve predefined objectives within scope, cost, quality, and time constraints. Meanwhile, project management theory is highly relevant to procurement planning and public infrastructure project performance because it shows how planning and coordination of procurement activities contribute to successful project execution. Large infrastructure projects are usually dynamic and complex. Traditional project management approaches may not adequately respond to this changing project conditions and uncertainties.

2.1.2 Agency theory

Agency Theory emanated from the field of economics and organizational management in the 1970s. This theory was formally developed by Michael C. Jensen and William H. Meckling in their seminal 1976 work titled Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. This theory explains the relationship between a principal (owner or employer) and an agent (employee or contractor) where the agent is delegated authority to perform tasks on behalf of the

principal. Agency theory emerged because of increased organizational challenges relating to information asymmetry, conflicting interests, corruption, opportunistic behavior, and monitoring difficulties between parties involved in contractual relationships. In public procurement and infrastructure projects, the government serves as the principal while contractors, consultants, procurement officers, and suppliers serve as agents. This theory assumes that principals delegate responsibilities to agents who perform tasks on their behalf. In public infrastructure procurement, government ministries or agencies usually delegate procurement responsibilities to contractors and procurement officers. Agency Theory is relevant to procurement planning and public infrastructure project performance because procurement activities involve relationships between government institutions, contractors, consultants, suppliers, and project managers. Critics argue that the theory assumes all agents are self-interested and opportunistic, ignoring ethical behavior, trust, professionalism, and collaboration in some procurement relationships.

2.1.3 Institutional theory

This Theory emanated from sociology and organizational studies and was developed to explain how organizations conform to rules, norms, values, and societal expectations within their environments. In public procurement and infrastructure management, this theory shows how procurement systems, regulations, legal frameworks, professional standards, and government policies shape procurement planning and project performance. The theory is commonly used or applied in public sector procurement because procurement activities are governed by institutional rules, procurement laws, accountability systems, and cultural expectations (Scott, 2004). The theory assumes that organizations are influenced by external institutional pressures such as laws, regulations, norms, policies, and professional standards by supervisory or regulatory bodies. Organizations adopt acceptable procurement practices and structures to gain legitimacy, public trust, and stakeholder support.

Critics argue that the theory focuses too much on conformity and institutional stability while neglecting innovation, flexibility, and organizational creativity which are vital for project success.

This theory tends to portray organizations as passive actors responding to institutional pressures, ignoring the active role of managers and procurement professionals in shaping change.

2.2 Conceptual review

Public procurement refers to the purchase by governments and state-owned enterprises of goods, services and works. It is a crucial pillar of service delivery for governments. Public procurement accounts for a large share of the taxpayers' money. Governments are expected to carry it out efficiently and with high standards of integrity to ensure quality service delivery and safeguard the public interest. Procurement planning is the systematic process of identifying project needs, estimating costs, determining procurement methods, scheduling procurement activities, managing risks, and preparing tender documentation before contract award (Larson & Gray, 2020). Recent literature further conceptualizes procurement planning as a strategic capability that affects supplier relationships, contract design, sustainability integration, and stakeholder engagement (Jefferies & Runeson, 2022; Wanasinghe & Siriwardena, 2023). The delivery of any public service relies on public procurement processes from health to environmental protection, public order and economic affairs (comprising infrastructure, transport, communication, energy). The process starts with the identification of a need and continues through planning, preparation of specifications/ requirements, budget considerations, selection, contract award, and contract management. It ends on the last day of the

warranty period. (World Bank 2023-Supply Chain Management). This position by World Bank identifies planning as a key process in procurement activities.

An effective procurement plan will always allow procuring entities to understand and define procurement requirements early, select the right vendors and ensure that sourcing strategies align with the organization's objectives. Key performance Indicators are employed in strategic procurement planning for monitoring and review in order to meet project objectives. Procurement planning is a critical aspect of project management, and it involves the process of identifying the goods and services required for a project, determining the best sources of those goods and services, and developing a plan for acquiring them. Effective procurement planning is essential for ensuring that projects are completed on time, within budget, and with the desired quality. Procurement planning is a critical component of the procurement process that involves identifying, evaluating, and selecting suppliers for the acquisition of goods or services. Effective procurement planning is essential for ensuring that the procurement process runs smoothly, meets the organization's needs, and achieves value for money. In Nigeria, Public procurement planning is one of the requirements for public works. Poor implementation of this process has led to lack of satisfactory outcomes in project delivery. This process is vital and must be complied with to ensure successful project delivery. Recent African studies confirm the importance of procurement planning in public project performance and outcomes. Nyajowi, Kising'u, and Omwenga (2024) found a strong relationship between procurement planning practices and road construction performance in Kenya, which is also applicable in the Nigerian context.

2.2.1 Needs assessment

Needs assessment is the systematic process of identifying, analyzing and prioritizing project requirements before project implementation. It consists of determining what is required, why it is required, and how those requirements align with organizational objectives and stakeholder expectations (Kerzner, 2017). In project management, needs assessment is a critical early-stage activity that defines scope of project, budget required and risk management. A well-conducted needs assessment ensures that projects are grounded in actual demand and need based rather than mere assumptions, thereby reducing inefficiencies and enhancing overall project performance.

2.2.2 Cost estimation and budgeting

Cost estimation and budgeting are major components of project cost management, rooted in project management theory, economic forecasting theory, and control theory. These frameworks focus on planning, predicting, and controlling financial resources to ensure overall project success.

From the perspective of project management, cost estimation involves forecasting the financial resources required to complete a project, while budgeting allocates these resources across several project activities (Kerzner, 2017).

2.2.3 Risk identification

Risk identification is the most critical stage in the project risk management process. It involves recognizing potential events or conditions that may adversely or positively affect project outcomes and objectives. It is based on risk management theory, systems theory, and uncertainty theory.

According to project management theory, identifying risks early allows project managers to develop mitigation plans, allocate contingencies to address such possibilities, and improve decision-making (Project Management Institute, 2017). Systems theory supports this position by seeing projects as

interconnected systems where risks in one component can affect the entire system. Meanwhile, uncertainty theory emphasizes that proactive identification of eventualities reduces unpredictability and improves control over project outcomes.

2.2.4 Market analysis

Market analysis in project procurement involves evaluating market conditions, supplier capabilities, pricing trends, and demand–supply dynamics in order to make right decisions. It is based on market theory, competitive strategy theory, and supply chain management theory.

Market theory suggests that adequate understanding supply and demand dynamics helps organizations to make efficient procurement decisions. Competitive strategy theory (Porter, 2008) reveals that market knowledge enhances bargaining power and appropriate supplier selection. Meanwhile, supply chain theory emphasizes that market intelligence will improve coordination, reduce project uncertainty, and enhance outcomes.

2.3 Hypothesis development

2.3.1 Public infrastructure projects in Nigeria

Nigeria, Africa's most populous nation and largest economy, has long faced significant infrastructure deficits. However, in recent years, the Nigerian government and private sector have embarked on numerous infrastructure projects aimed at fostering economic growth, enhancing connectivity, and improving the quality of life for its citizens. Many projects face delays due to inadequate financing. The government often relies on loans from international financial institutions and public-private partnerships (PPPs). Misallocations of funds and project inefficiencies have hindered progress. Effective Procurement planning is very vital to ensure optimization of resources and position the country on the path of continuous development. . For years, Nigeria has been plagued by abandoned projects, large and small, which have significantly hindered the country's infrastructure development. These Unfinished projects, once filled with high expectations, now stand as symbols of waste and unfulfilled promises, highlighting Nigeria's ongoing struggles with underdevelopment. According to punch newspaper (2024), the Chartered Institute of Project Managers of Nigeria says the total value of abandoned projects in Nigeria is N17 trillion. This is obvious. Project performance in public infrastructure is usually measured using indicators like cost efficiency, timely completion, satisfaction of stakeholders. Unegbu, Yawas and Dan-Asabe (2024) revealed that procurement planning enhances coordination among the stakeholders involved in projects, reduces uncertainties when projects are executed. Their study shows that projects with well-structured plans are more likely to meet performance expectations than those not properly planned. Similarly, Oji, Kpelai and Abanyam (2025) observed that strategic procurement planning has a positive impact on project performance by ensuring that resources are properly allocated and ensuring reduction in procurement related disruptions. Empirical evidence from Plateau State remains limited; however, Lalu, Jugu and Owolabi (2024) conducted a study that focused on the effect of procurement planning on procurement cost in Plateau State Nigeria. The study showed a statistically significant relationship between procurement planning and cost efficiency in the execution of public sector projects. They revealed that inadequate planning usually led to emergency procurement price inflation deviations from approved budgets all of which adversely affect the performance of projects. Based on the above the study proposed the following hypothesis;

H_{01}: Key procurement planning elements do not have a significant positive effect on the adoption of improvement strategies.

2.3.2 Needs assessment and project performance

Several empirical studies and literature reviews conducted between 2000 and 2026 have established a strong relationship between needs assessment and project outcomes. Araújo et al. (2017) conducted a structured literature review on project procurement management and established that clearly defined project requirements improve supplier selection and project outcomes. The study emphasized that needs assessment is vital and enhances procurement efficiency and reduces project uncertainties. Suleiman et al. (2024) examined construction projects in Nigeria and submitted that inadequate needs assessment leads to cost overruns, delays, and poor-quality delivery of projects. However, projects with effective needs assessment showed improved performance in terms of time, cost, and quality. Offiong and Ogwueleka (2025) identified needs assessment as a major determinant of procurement planning effectiveness. Their findings revealed that projects with clearly defined requirements had fewer variations and better adherence to project timelines. Matenge and Juma (2024) found that effective needs assessment practices improve procurement performance, particularly in ensuring timely delivery and quality compliance of projects. Kayitesi (2024) submitted that needs assessment positively influences public sector project performance by aligning procurement plans with organizational objectives and reducing inefficiencies in projects. The study proposed the following hypothesis.

H_{02}: Procurement planning challenges do not have a significant effect on the adoption of improvement strategies.

2.3.3 Cost estimation, budgeting and project performance

Shah et al. (2023) submit that projects with effective cost estimation, monitoring, and control mechanisms achieve better project performance in terms of cost efficiency, quality, and stakeholder satisfaction Ahiaga-Dagbui and Smith (2014) revealed that initial cost estimates in construction projects are usually underestimated by 20–30%, due to optimism bias, leading to poor project performance. Zhao et al. (2024) revealed that improved cost estimation practices, particularly in determining contingency reserves, significantly reduce overruns in cost and enhance infrastructure project performance. A wholistic review of cost overrun factors highlighted that poor estimation, weak planning, and inadequate budgeting primarily lead to project delays and financial inefficiencies. Ibrahim, Ayuba and Sani (2025) emphasized the role procurement officer's competencies in achieving effective procurement planning. Their Findings reveal that forecasting skills, procurement-scheduling skills, specification development skills have a positive impact in improving public sector project performance. It is vital that procurement officers are trained and highly skilled to ensure effective planning. Mukarram et al., (2024) further showed that structured procurement planning reduces delays and improves infrastructure project delivery performance in metropolitan areas in Jos. Their research aligns with national concerns regarding observed inefficiencies of public infrastructure delivery linked to deficient procurement planning. A systematic planning and execution will reduce inefficiencies and foster favorable project outcomes. Offiong and Ogwueleka (2025) identified also strategic procurement practices like early needs identification and collaboration between departments as critical success factors in public construction. These practices when imbibed will go a long way to ensure successful project delivery. Suleiman (2024) highlighted the significant role of need assessment as a component of procurement planning. The study concluded that that poor need assessment increases project risks leading to changes in scope and performance inefficiencies during project implementation. A proper needs assessment is foundational and fundamental for project delivery and social acceptance. Fagbemi (2025) assessed how procurement process risks influence the cost performance in public tertiary institution projects in Ondo State. The

results showed that inadequate planning and risk assessments led to significant cost variances, emphasizing the importance of integrating risk planning into procurement activities. Mukarram et al. (2024) examined overall procurement process factors in Kano metropolis and found significant positive correlations between procurement planning/design factors and project cost delivery, reinforcing the necessity of planning at project design stages. Hamidu et al.,(2024) while looking at the determinants of poor planning in public sector projects investigated planning deficiencies in public sector construction projects in Nigeria, identifying some factors such as weak forecasting mechanisms and poor coordination, which in turn affect procurement and project performance outcomes. Ogunseye & Oladipo, (2025) reveal that delays in procurement planning directly leads to poor time performance and extended completion periods in Nigerian public projects Studies reveal that higher compliance with public procurement regulations improves transparency and reduces procurement irregularities potentially leading to better infrastructure project outcomes (Yahaya et al., 2025). Assessments in the tertiary education sector show that risks from planning omissions significantly increase project costs (Fagbemi, 2025). The study proposed the following hypothesis

H_{03}: Improvement strategies and challenges do not have a significant combined effect on the adequacy of key procurement planning elements

2.4 Research gap

The reviews consistently show that procurement planning has a major influence on performance of public infrastructure projects. It is very vital for positive project outcomes. The effectiveness of procurement planning determines the success of infrastructure projects. Effective planning leads to more favorable outcomes by improving cost efficiency, reduction of delays, enhancing quality, supporting accountability in public project delivery. While studies across Nigeria provide substantial evidence of this relationship, research with focus on Jos, Plateau state is limited. Apart from the study by Lalu et al. (2024) there is limited empirical research that has examined the relationship between procurement planning and public infrastructure project performance in Plateau State. This Gap necessitates the need for further research to provide localized proof that can inform practice and policy within the state public sector. While existing literature has established a general relationship between procurement planning and project outcomes in Nigeria, three critical gaps remain. First, most studies aggregate procurement activities without isolating the planning phase, thereby obscuring its specific contribution. Second, few studies examine the interrelationships between planning elements, challenges, and strategies as a system; most treat them as isolated variables. Third, there is limited empirical evidence from north-central Nigeria, particularly Jos, where ethno-political dynamics and institutional fragility create unique procurement conditions. This study addresses these gaps by assessing all three dimensions simultaneously in the Jos context and examining how they interact to shape the planning environment.

3 Methodology

3.1 Study area

The study area is Jos, the capital of Plateau State, located in north-central part of Nigeria. Jos lies on the Jos Plateau at an elevation height of about 1,200–1,300 meters above sea level, with a relatively mild climate compared to other parts of the country. Plateau State is bordered by Kaduna and Bauchi States to the north, Taraba State to the east, and Nasarawa State to the south and west all in Nigeria. Jos area is made up of highlands, volcanic formations, and river systems such as the Kaduna and

Gongola rivers (Encyclopaedia Britannica, 2026a; 2026b). Socio-economically, Jos is a diverse and vibrant urban center with over 40 ethnic groups, including Berom, Afizere, Anaguta, Tarok, Angas, Ankwei. The city's economy historically developed around tin mining and other minerals but has expanded to include agriculture, livestock farming, commerce including small-scale industries.

3.2 Research design

This study adopted a quantitative research approach. Quantitative research is suitable due to the fact that it allows the measurement of relationships between procurement planning practices and project performance using numerical data. This approach will enable statistical testing of hypotheses, providing objective and generalizable findings (Creswell, 2014). The study is descriptive and-correlational. Descriptive study describes procurement planning practices used for public infrastructure projects in Jos and the co relational study examines the relationship and influence of procurement planning on cost, time and quality of project. The population comprises Engineers approximately 200 active members as provided by the Nigerian Engineers Society Jos Chapter, procurement officers- 5 officers in Bureau for Public Procurement Jos, 23 staff of budget and planning department in state ministry Jos, staff of ministry of works, housing and other stakeholders involved in public infrastructure projects in Jos, Plateau State. These stakeholders are directly involved in planning and executing procurement activities.

The population comprises professionals directly involved in public infrastructure procurement and delivery in Jos, Plateau State: registered engineers (approximately 200), procurement officers in the State Bureau of Public Procurement (N = 5), budget and planning staff (N = 23), quantity surveyors and other professionals in projects (approximately 45), and project managers in the Ministry of Works (approximately 27), yielding an estimated population of N ≈ 300. Using the Yamane formula with a 5% margin of error, the required sample is 171. One hundred and seventy-one questionnaires were administered, with 141 valid responses retained for analysis.

The sample size was obtained as $n = N/(1 + Ne^2) = 300/(1 + 300 \times 0.05^2) = 300/1.75 \approx 171$.

3.3 Sampling technique

Purposive sampling was used to select professionals with direct knowledge of procurement planning. To access hard-to-reach experts, a limited snowball referral was employed, capped at two waves. While snowball sampling may introduce network bias, this was mitigated by initiating contacts across diverse ministries and professional bodies rather than a single network.

3.4 Data analysis

The study adopted a quantitative data analysis method using regression analysis. Multiple regression analysis was used to determine the extent to which procurement planning influences project performance and assess the contribution of components of procurement planning like needs assessment, budgeting, schedule.

4 Results and discussion

In order to achieve the objectives of the study, this chapter explained the data and analysis that was collected. The data collected was subjected to out-of-range value test, missing value and normality tests, in order to validate the data and also establish its reliability. The hypotheses were tested by the application of multiple regression analysis.

4.1 Response rate

One hundred and seventy-one (171) copies of the questionnaire were administered to the study respondents and 141 valid responses were used for the analysis, a return rate of 82.5%. The result of the administered and response rate of the questionnaire is presented in Table 1.

Table 1. Questionnaires distributed and returned.

Respondents	Questionnaires distributed	Questionnaires returned	Response rate (%)
Professionals	171	141	82.5

Source: Field work (2026).

4.2 Respondents' profile

The socio-economic factors aspect is important in linking investigating the influence of Procurement Planning on the Performance of Public Infrastructure Projects in Nigeria. Based on this, attributes such as gender, age, years of service, educational qualification an position/rank of the respondents. The result of the socio-economic attributes of the respondents is presented in Table 2 below.

Table 2. Profile of the respondents.

Attribute	Frequency	Percentage (%)
Gender		
Male	61	43.6
Female	79	56.4
Total	140	100.0
Age		
Less than 25years	2	1.4
25-39years	92	65.7
40-59years	22	15.7
60years and above	24	17.1
Total	140	100.0
Years of Service		
1-5 years	20	14.3
6-10 years	31	22.1
11-15 years	35	25.0
16 years and above	54	38.6
Total	140	100.0
Educational Qualification		
Primary	0.	0
WAEC	15	10.7
Diploma/NCE	0	0
B.Sc/HND	24	17.1

Attribute	Frequency	Percentage (%)
M.Sc /Ph.D	78	55.7
Below First degree	23	16.4
Total	140	100.0
Position/ Rank		
Procurement officer	2	1.4
Procurement manager	26	18.6
Procurement director	9	6.4
Non-procurement personnel	2	1.4
Purchases and Supply	36	25.7
Architect	13	9.3
Building	16	11.4
Project	11	7.9
Quantity Surveyor	15	10.7
Others	10	7.1
Total	140	100.0

Source: Field work (2026).

Table 2 showed the result for gender of respondents, for the male has 61 respondents representing with 43.6%, while for female 79 respondent representing with 56.4%, meaning that female has the highest numbers of response. For age of the respondents, less than 25 years had only 2 respondents with (1.4%), 25-39years had 92 respondents with 65.7%, 40-59years had 22 respondents with 15.7%, while 60years and above had 24 respondents with 17.1%. Based on years of service for 1-5 years had 20 respondents with 14.3%, for 6-10years had 31 respondents with 22.1%. 11-15years had 35 respondents with 25.0%, while above 16years and above had 54 respondents with 38.6%. Based on educational qualification, primary and diploma/ NCE had no respondents, respondents that had WAEC are 15 respondents with 10.7%, B.Sc/HND had 24 respondents with 17.1%. M.Sc/Ph.D had 78 respondents with 55.7%, Based on position/rank of the respondents procurement officer and non-procurement personnel had 2 respondents with 1.4% each, procurement manager had 26 respondents with 18.6%, procurement director had 9 respondents with 6.4%, purchases and supply had 36 respondents with 25.7%, Architect had 13 respondents with 9.3%, building had 16 respondents with 11.4%, project had 11 respondents with 7.9%, quantity surveyors had 15 respondents with 10.7% while others had 10 respondents with 7.1%.

4.3 Data analysis

4.3.1 Normality of dependent variables

The Normality test was used to describe a symmetrical, bell-shaped curve, which has the greatest frequency of scores around in the middle combined with smaller frequencies towards the extremes (Pallant, 2015).

4.3.2 Multicollinearity test

In this study multicollinearity was checked with tolerance and Variance Inflation Factor (VIF) statistics, also it is referring to the situation in which the independent/predictor variables are highly correlated. De-Winter (2025) suggests that a tolerance value less than 0.1 almost certainly describes a serious collinearity problem. Badawaire et al. (2024), also stated that a VIF value greater than 10 is also a concern. Similarly, De-Winter (2025), underlines that, values for tolerance below 0.1 indicate serious problems, although several statisticians suggest that values for tolerance below 0.2 are worthy of concern. In this study, all of the independent variables found to have a tolerance of more than 0.1 and a VIF value of less than 10 (Table 3).

Table 3. Multicollinearity test results.

Variable	Tolerance	VIF	Interpretation
Key elements	0.999	1.001	No multicollinearity
Challenges	0.999	1.001	No multicollinearity
Strategies	0.827	1.209	No multicollinearity

Source: SPSS output of own survey (2026).

Based on Table 3, If the value of Tolerance is very small (less than .10), it indicates that the multiple correlation with other variables is high, suggesting the possibility of multicollinearity. The second value given is the VIF (Variance inflation factor), which is just the inverse of the Tolerance value (1 divided by Tolerance). If VIF values shows above 10 would indicating multicollinearity. Hence, multicollinearity assumption was fulfilled in this study, all of the independent variables found to have a tolerance of more than 0.1 and a VIF value of less than 10 (Table 3).

4.3.3 Multiple regression

Multiple regression analysis describes and evaluates the relationships between a specified dependent variable and independent variables. In the case of this study, two models with one dependent variable and two independent variables each were estimated (Models A and B below).

4.3.4 Correlation matrix

The correlation coefficient is ordinarily adopted as index that controls the strength of the linear association between two sets of scores. This study employed Pearson's correlation coefficient to assess the strength and direction of the linear relationship between two continuous variables as from initial checks for normality, the data appeared to suggest that independent and dependent variables follow a normal distribution and did not violate any of the normality assumption. Pearson's correlation is most appropriate in these circumstances. The study sought to find out the influence of procurement planning on the Performance of Public Infrastructure Projects in Nigeria as a dependent variable. To determine how the independent variable related to the dependent variable and to what extent, a correlation analysis was carried out and the findings presented in Table 4.

Table 4. Correlation matrix for the study variables.

Variable	1	2	3
1. Key Elements	1		
2. Challenges	–0.036 (p = 0.675)	1	

Variable	1	2	3
3. Strategies	0.419*** (p < 0.001)	0.186** (p = 0.027)	1

Note: *** significant at the 1% level; ** significant at the 5% level (two-tailed). Source: Researcher (2026).

p < 0.01, p < 0.05 (two-tailed). Key Elements and Strategies share a moderate positive relationship, while Challenges and Strategies show a weak positive relationship. Challenges are statistically independent of Key Elements.

4.3.5 Test of hypotheses

Multiple regression analysis was used to examine the relationships among key procurement planning elements, procurement planning challenges, and improvement strategies. Model A assessed whether Key Elements and Challenges significantly predicted Improvement Strategies. Model B was estimated as a supplementary analysis, with Key Elements as the dependent variable and Challenges and Improvement Strategies as the predictors. Statistical decisions were made at the 0.05 significance level. For consistency with standard statistical reporting, values displayed by statistical software as 0.000 are presented as p < .001; a p-value is not interpreted as exactly zero.

4.3.6 Model A: Determinants of improvement strategy adoption

Model A examined the predictive contributions of Key Elements and Challenges to Improvement Strategies. The model summary is presented in Table 5.

Table 5. Model summary (Model A).

Model	R	R^2	Adjusted R^2	Std. Error of Estimate
1	0.464	0.216	0.204	0.417

Note. N = 141. R^2 indicates that the predictors jointly account for 21.6% of the observed variance in Improvement Strategies; the adjusted R^2 is 20.4%.

As shown in Table 5, the model produced an R value of 0.464 and an R^2 of 0.216. This means that Key Elements and Challenges jointly explained 21.6% of the variance in Improvement Strategies. After adjustment for the number of predictors, the model explained 20.4% of the variance. The overall model significance was assessed using the ANOVA results in Table 6.

Table 6. ANOVA (Model A).

Source	Sum of Squares	Df	Mean Square	F	Sig.
Regression	6.609	2	3.305	18.978	< .001
Residual	24.030	138	0.174		
Total	30.639	140			

Note. N = 141. Regression df = 2; residual df = 141 − 2 − 1 = 138; total df = 140. The reported significance value of 0.000 is expressed as p < .001.

The ANOVA results indicate that Model A was statistically significant, F(2, 138) = 18.978, p < .001. Therefore, the predictors, considered jointly, significantly predicted Improvement Strategies. The individual contribution of each predictor is shown in Table 7.

Table 7. Regression coefficients (Model A).

Variable	Unstandardized B	Std. Error	Standardized Beta (β)	t	Sig.
Constant	2.113	0.342	—	6.182	< .001
Key Elements	0.402	0.071	0.426	5.646	< .001
Challenges	0.114	0.043	0.201	2.666	0.009

Note. Dependent variable: Improvement Strategies. B = unstandardized coefficient; β = standardized coefficient. The software output displayed 0.000 for the first two significance values; these are reported as p < .001.

4.3.7 Decision on Hypothesis 1

Key Elements was a statistically significant positive predictor of Improvement Strategies (B = 0.402, β = 0.426, t = 5.646, p < .001). Since the p-value is below 0.05, the null hypothesis (H_{01}) is rejected. The result indicates that higher ratings of key procurement planning elements were associated with higher reported adoption of improvement strategies, controlling for Challenges.

4.3.8 Decision on Hypothesis 2

Challenges was also a statistically significant positive predictor of Improvement Strategies (B = 0.114, β = 0.201, t = 2.666, p = 0.009). Since p < 0.05, the null hypothesis (H_{02}) is rejected. The positive coefficient suggests that respondents reporting greater procurement planning challenges also tended to report stronger adoption of improvement strategies. This pattern may indicate a reactive response to operational difficulties, although the regression result alone does not establish causation. The standardized coefficient for Key Elements (β = 0.426) was larger than that for Challenges (β = 0.201), identifying Key Elements as the stronger predictor in Model A.

4.3.9 Model B: Determinants of key element adequacy (supplementary analysis)

Model B was estimated as a supplementary analysis to examine whether Challenges and Improvement Strategies predicted ratings of Key Elements. The model summary is presented in Table 8.

Table 8. Model summary (Model B).

Model	R	R^2	Adjusted R^2	Std. Error of Estimate
1	0.434	0.189	0.177	0.449

Note. N = 141. R^2 indicates that the predictors jointly account for 18.9% of the observed variance in Key Elements; the adjusted R^2 is 17.7%.

Table 8 shows an R^2 of 0.189, indicating that Challenges and Improvement Strategies jointly explained 18.9% of the variance in Key Elements. The adjusted R^2 was 0.177. The overall statistical significance of the model is reported in Table 9.

Table 9. ANOVA (Model B).

Source	Sum of Squares	Df	Mean Square	F	Sig.
Regression	6.477	2	3.239	16.045	< .001
Residual	27.855	138	0.202		
Total	34.332	140			

Note. N = 141. Regression df = 2; residual df = 138; total df = 140. The reported significance value of 0.000 is expressed as p < .001.

The ANOVA results show that Model B was statistically significant, $F(2, 138) = 16.045$, $p < .001$. Thus, Challenges and Improvement Strategies jointly predicted Key Elements. However, statistical significance of the overall model does not mean that every predictor is independently significant. The individual coefficients are presented in Table 10.

Table 10. Regression coefficients (Model B).

Variable	Unstandardized B	Std. Error	Standardized Beta (β)	t	Sig.
Constant	2.449	0.360	—	6.805	< .001
Challenges	−0.071	0.047	−0.118	−1.506	0.134
Improvement Strategies	0.466	0.083	0.441	5.646	< .001

Note. Dependent variable: Key Elements. B = unstandardized coefficient; β = standardized coefficient. The software output displayed 0.000 for the constant and Improvement Strategies significance values; these are reported as $p < .001$.

4.3.10 *Decision on Hypothesis 3*

At the overall model level, the regression was statistically significant, $F(2, 138) = 16.045$, $p < .001$. At the individual-predictor level, Improvement Strategies was a significant positive predictor of Key Elements ($B = 0.466$, $\beta = 0.441$, $t = 5.646$, $p < .001$), whereas Challenges was not statistically significant ($B = -0.071$, $\beta = -0.118$, $t = -1.506$, $p = 0.134$). Accordingly, the evidence supports a positive predictive relationship between Improvement Strategies and Key Elements, but it does not provide sufficient evidence of an independent relationship between Challenges and Key Elements after controlling for Improvement Strategies. The formal decision on H_{03} should be aligned with the precise wording of Hypothesis 3 in Chapter One: the model-level null is rejected, while the individual null associated with Challenges is not rejected.

4.4 Discussion of findings

The findings provide insight into procurement planning practices among infrastructure professionals in Jos, Plateau State. The discussion is organised around the perceived adequacy of key planning elements, the severity of procurement challenges, the adoption of improvement strategies, the regression results, and the implications for infrastructure project performance.

4.4.1 *Adequacy of key procurement planning elements*

The overall mean score of 4.15 suggests that respondents generally perceived the key procurement planning elements as present and reasonably adequate. Needs assessment recorded the highest mean ($M = 4.41$), highlighting its perceived importance at the early stage of procurement planning. This finding is consistent with the emphasis placed on needs assessment in procurement research, including Suleiman et al. (2024). In contrast, market analysis and contract strategy recorded the lowest mean score ($M = 3.96$). Although this score remains relatively high, it points to areas where planning practice could be strengthened, particularly in understanding market conditions and selecting contract approaches that fit project requirements. From an Institutional Theory perspective, formal rules such as the Public Procurement Act 2007 may encourage procedural compliance, while more advanced practices can also depend on professional norms, organisational capacity, and effective implementation. This theoretical interpretation should not be treated as a causal finding established by the survey alone.

4.4.2 Severity of procurement planning challenges

The overall mean score for procurement planning challenges was 3.68, indicating that respondents viewed the challenges as moderately to highly present. Delayed budget approval recorded a mean of 4.00, followed by corruption (M = 3.89) and political interference (M = 3.82). These results suggest that funding timelines and governance-related concerns are prominent constraints in the study area. The findings are broadly consistent with Boniface, Nnadi, and Eze (2024), who identified corruption and lack of transparency among the challenges affecting public procurement in Nigeria's construction industry. Agency Theory offers one possible explanation: conflicts between the public interest and the actions of decision-makers or intermediaries may weaken accountability and value-for-money objectives. However, the survey measures respondents' perceptions of these challenges; it does not, by itself, establish the motives of specific actors or quantify the direct effect of each challenge on project outcomes.

The overall mean of 4.20 indicates a strong stated willingness among respondents to adopt the proposed improvement strategies. Early needs assessment (M = 4.50) and timely budgeting (M = 4.43) received the highest mean scores, suggesting that respondents place particular importance on addressing planning fundamentals early. E-procurement (M = 3.99) and risk-based planning (M = 3.85) received comparatively lower scores. These lower ratings may signal implementation constraints, such as limited digital infrastructure, skills, or organisational capacity, but the reasons were not directly tested by the reported descriptive statistics. The lower ratings are also consistent with the challenges to digital transformation in public procurement discussed by Silva and Costa (2025).

Model A was statistically significant and explained 21.6% of the variance in Improvement Strategies (R^2 = 0.216; adjusted R^2 = 0.204). Key Elements was the strongest predictor (β = 0.426, p < .001), indicating that respondents who rated procurement planning elements more favourably also tended to report greater adoption of improvement strategies, after accounting for Challenges. This association is consistent with the proposition in project management literature that systematic planning supports more deliberate management and improvement practices (Kerzner, 2017).

Challenges also showed a positive, statistically significant association with Improvement Strategies (β = 0.201, p = 0.009). One possible interpretation is a reactive adoption pattern: respondents experiencing more severe challenges may be more inclined to support or adopt measures intended to address them. Nevertheless, the standardized coefficient was smaller than that of Key Elements, suggesting that the presence of planning elements had the stronger predictive relationship in this model. Because the analysis is observational, the result should be interpreted as an association rather than proof that challenges cause strategy adoption.

4.4.3 Determinants of key element adequacy (Model B)

Model B was statistically significant and explained 18.9% of the variance in Key Elements (R^2 = 0.189; adjusted R^2 = 0.177). Improvement Strategies was a significant positive predictor (β = 0.441, p < .001), whereas Challenges was not significant when both predictors were included in the model (β = −0.118, p = 0.134). The result suggests that higher reported adoption of improvement strategies was associated with higher ratings of key planning elements. By contrast, the analysis did not establish an independent relationship between Challenges and Key Elements after accounting for Improvement Strategies. The results should not be interpreted as demonstrating that improvement strategies cause planning elements to become more adequate, because the model does not establish temporal order and the data may reflect overlapping perceptions or reciprocal relationships.

4.4.4 Implications for infrastructure project performance

Project performance was not directly measured in this study; therefore, the findings do not demonstrate a statistical effect on project cost, schedule, quality, or stakeholder satisfaction. Nevertheless, the observed planning conditions have practical implications when considered alongside the wider project-management literature. Needs assessment, budgeting, and structured planning are commonly treated as important foundations for controlling project scope, cost, and time (Kerzner, 2017; Shah et al., 2023). Similarly, political interference, corruption, and delayed budgets may undermine procurement integrity and contribute to implementation difficulties, as discussed in the literature cited by this study (Boniface et al., 2024; Ogunseye & Oladipo, 2025). Strategies such as stakeholder engagement and compliance monitoring may also support accountability and quality management (Hernández & Alarcón, 2023). These connections are theoretical and literature-based implications rather than outcomes directly tested by the present data.

4.4.5 Objective 1: Influence of key elements on procurement planning

The study reveals a positive and significant relationship between key elements and procurement planning for public infrastructure projects in Nigeria, thereby rejecting the null hypothesis (H01), which posited that key elements do not significantly influence procurement planning as it relates to project performance. This indicates that the presence and adequacy of essential elements, such as clearly defined project requirements, legal frameworks, and organizational structures, directly impact the effectiveness of procurement planning and affects project delivery. These findings are consistent with the work of Lingegård et al. (2021), who emphasized that certain key elements must be satisfied before executing procurement in public offices to ensure organizational objectives are aligned. From a theoretical perspective, the results are supported by Institutional Theory, which submits that formal structures, regulations, and norms shape organizational behavior.This alignment with institutional theory suggests that improving procurement planning requires a deliberate focus on key elements of planning. Public agencies should standardize procedures and ensure that organizational structures facilitate compliance, accountability, and efficiency, which would result in improved infrastructure project delivery.

4.4.6 Objective 2: Influence of challenges on procurement planning

The analysis also revealed a positive and very significant relationship between challenges and procurement planning in public agencies, leading to the rejection of the null hypothesis (H02), which assumed no significant influence. Challenges such as red-tapism, bureaucratic delays, corruption, and the adoption of digital technologies were identified as factors that significantly affect procurement planning processes with its effect on project outcomes. This finding aligns with Silva and Costa (2025), who highlighted that the use of contemporary digital technologies in public procurement introduces challenges, particularly in contexts where bureaucratic inefficiencies persist. The results are theoretically underpinned by Agency Theory, which posits the importance of transparency, accountability, and proper oversight in mitigating principal-agent conflicts. In public infrastructure projects, misalignment of interests between decision-makers (agents) and the public (principals) can lead to procurement inefficiencies if challenges are not identified and addressed appropriately.

4.4.7 Objective 3: Influence of strategies on procurement planning

Regarding strategies, the study established a very positive and significant influence on procurement planning for enhanced project outcomes, thus rejecting the null hypothesis (H03), which stated that strategies do not significantly influence procurement planning. The findings reveal that the adoption

of strategic approaches—such as integrating sustainability criteria, engaging stakeholders during planning stages, and applying systematic project management practices—positively affects infrastructure project quality, environmental outcomes, and stakeholder acceptability. This finding agrees with Hernández and Alarcón (2023), who assert that sustainability integration and proactive stakeholder engagement enhances long-term infrastructure

performance. Furthermore, the results are supported by Project Management Theory, which emphasizes systematic planning, execution, monitoring, and control as a tool to achieve project objectives efficiently. Strategies serve as practical tools to translate planning into actionable steps that mitigate risks, timely project delivery and optimization of resources.

5 Conclusion and recommendations

5.1 Conclusions

The research concludes that successful procurement planning ensures that financial resources allocated to projects are utilized optimally. By applying adequate strategies, observing key elements and mitigating identified challenges, infrastructure projects will have a more favorable outcome. The study concluded that procurement planning allows project managers and others to identify potential risks with procurement processes, including supplier dependability, market changes, and compliance with regulations. This study assessed procurement planning practices, challenges, and improvement strategies among professionals involved in public infrastructure delivery in Jos, Plateau State. Based on the analysis of 141 valid responses, the following conclusions are drawn

Procurement planning elements are generally perceived as adequate (M = 4.15), with needs assessment receiving the highest rating. However, market analysis and contract strategy are relatively weaker, indicating scope for strengthening these components. Planning challenges are pervasive (M = 3.68), with delayed budget approval, political interference, and corruption identified as the most severe. These challenges reflect governance and institutional weaknesses that undermine planning effectiveness. .Improvement strategy adoption is high (M = 4.20), particularly for foundational strategies such as early needs assessment and timely budgeting. E-procurement and risk-based planning are less emphasized, reflecting capacity constraints.

5.2 Recommendations

- Strengthen Market Analysis and Contract Strategy: Public agencies in Jos should invest in market intelligence capabilities and strategic contract management training, as these elements scored lowest among the planning components.
- Address Budgetary and Political Challenges: The Plateau State government should streamline budget approval processes and establish procurement oversight mechanisms that insulate planning from political interference.
- Promote E-Procurement and Risk-Based Planning: Capacity-building programs should prioritize digital procurement tools and risk management frameworks, as these strategies received lower endorsement despite their proven performance benefits.
- Leverage Reactive Strategy Adoption: Since professionals facing challenges show higher strategy adoption, management should formalize channels through which frontline staff can propose and implement planning improvements.

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