Educational Administration: Theory and Practice
2024, 30(3), 3118-3130
ISSN: 2148-2403
https://kuey.net/
Research Article

Effect Of Cost Variance And Schedule Management On The Performance Of Construction Companies In Northcentral Nigeria

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Citation: Alu, Abani Joseph et al. (2024), Effect Of Cost Variance And Schedule Management On The Performance Of Construction Companies In Northcentral Nigeria, *Educational Administration: Theory and Practice, 30(3)* 3118-3130
Doi: 10.53555/kuey.v30i3.9269

ARTICLE INFO

ABSTRACT

The continued need for better performance of construction organisations stemming from their excellent analysis of cost variance and schedule management remains integral to their success and the nation's infrastructural development. This study, thus, investigated the impact of cost variance and schedule management on the time and cost performance of construction companies within the Nigerian North-Central region. The specific objectives include determining the impact of cost variance and schedule management on the time performance of construction companies and investigating the impact of cost variance and schedule management on the cost performance of construction companies. One hundred two semi-structured questionnaires were distributed to construction professionals, which was required for this study, and a 100 per cent response rate was achieved. The method of analysis involved descriptive and inferential statistics of regression analysis. The outcome showed a regression model of TPCC = -.012 + 0.605(CVA) + 0.746(SMA) and CPCC = .213 - 0.871(CVA) - .025(SMA) indicating that both CVA and SMA are positive predictors of TPCC and they are both negative predictors of CPCC. This study concluded that cost variance and schedule management significantly impact the time and cost performance of the construction organisations selected for this study, as outlined by their R-Square of .855 and .791 for both TPCC and CPCC, respectively. This study recommended that the factors influencing building costs and time performance must be rigorously evaluated, and local contractors should accurately quantify their effects on projects. This facilitates enhanced construction performance on their projects.

Key words: Construction Companies, Cost Variance, North-Central Nigeria, Performance, Schedule Management,

1.0 INTRODUCTION

The construction sector constitutes 13% of the worldwide Gross Domestic Product (GDP) and employs 7% of the workforce (Fayad et al., 2019; Cleary et al., 2022). The importance of the building sector to sustainable development and economic advancement worldwide cannot be underestimated. Almost every sector of a nation's economy relies partially or entirely on the building industry for its viability (Grandage, 2022). Furthermore, the synergistic impact of rapid population increases and urbanisation in developing nations is the heightened need for infrastructural facilities (Bandara et al., 2021). Consequently, the building business in Nigeria is more crucial than ever, given the recent surge in population growth and urbanisation (Kermanshachi & Pamidimukkala, 2023).

Numerous historical instances illustrate the challenges of significant delays and budget overruns. Examples of budget overruns are presented below, illustrating the magnitude of the issue, including the Pune Metro in 2009, which estimated the project cost at $1.2 billion—amended to $1.7 billion (Delhi Metro Corporation Ltd, 2022). Of the 332 facility projects financed by the US Air Force, 72% were not finished on schedule (Hoffman et al., 2007). Comprehensive building projects in the UK are expected to be completed over six months behind schedule (CIOB, 2008). The average cost overrun for road development in Norway is 7.88% (Yap et al., 2022). Government and commercial construction projects in Hong Kong experienced time overruns of 9% and 17%

(Cho & Lim, 2020). Nigeria: The average time overrun for construction projects may vary from 59.23% to 92.64%, contingent upon the project's worth (Gutman & Goldmeier, 2021). A study of 359 finalised projects in Malaysia revealed that 55% saw cost overruns (Shehu et al., 2014). These examples demonstrate that cost management is a crucial instrument that may assist stockholders in the construction sector, including architects, planners, engineers, and clients.

Notwithstanding the substantial advancement of project management tools and methodologies to enhance project execution over the years, the global construction sector's schedule delays and expense overruns remain prevalent. The ongoing prevalence of building time and expense overruns has garnered significant attention in recent decades, prompting the identification of underlying causative variables. Zidane and Andersen (2018) evaluate 104 studies published over the past 30 years (1990 to 2017) across 45 countries to identify universal factors contributing to delays. They conclude that completion delays are a fundamental risk in most construction projects and that recognising the root causes is essential for formulating effective preventive measures. Trigunarsyah and Islam (2017) examined 28 pertinent studies published from 2006 to 2016 within the context of the developing world, concluding that although project delays are prevalent, most of these studies did not offer constructive guidance for effectively managing the critical issues involved. Kermanshachi and Pamidimukkala (2023) critically evaluated construction delay studies in developing countries in Asia and Africa, revealing that the predominant reason for delayed completion is the inadequate application of project management practices and controls. Furthermore, a significant limitation of these studies is their inability to propose feasible solutions for addressing the causes of prevalent delay. Furthermore, many studies fail to address the issues they highlight, as insufficient research has been conducted to uncover the underlying causes. Yap et al. (2019) conducted a factor analysis of 23 significant issues affecting construction project management in developing countries, revealing that a substantial fraction of these issues are attributable to human and managerial factors.

Given its influence on the global economy, the construction sector must use rigorous cost management strategies. Nonetheless, clients regard the performance of most construction companies in completing projects within the set timeframe and budget as poor. The failure to deliver projects on schedule results in the allocation of excessive additional resources, rendering the projects prohibitively costly and unappealing to most buyers. Therefore, this study investigates the impact of cost variance and schedule management on construction companies' time and cost performance within the Nigerian North-Central region. The objectives of this study are to;

1. Determine the impact of cost variance and schedule management on the on-time performance of construction companies
2. Investigate the impact of cost variance and schedule management on cost performance of construction companies

Research Hypotheses

H_{01}: There is no significant statistical impact of cost variance and schedule management on the on-time performance of construction companies

H_{02}: There is no significant statistical impact of cost variance and schedule management on the cost performance of construction companies

2.0 LITERATURE REVIEW

Cost Analysis of Work Items

The amounts assessed during the quantity take-off process are attributed to specific work items called activities or tasks. The bill of quantities for products is detailed, including the activities required to install each item. These activities and tasks possess specific quantities that must be measured or computed by the BOQ item. Each activity undergoes a unit price analysis, and the necessary resource quantities are estimated. The actions enumerated underneath the BOQ item are utilised to calculate the unit price of that item. Aggregating all cost information can provide a detailed estimation of the project's total cost.

Budgeting

Budgeting is the subsequent phase in transforming a cost estimate into a manageable and controllable breakdown. The structure utilised for cost tracking predominantly diverges from the cost estimate (Hu et al., 2022). Budgets can be established to manage and account for project expenditures effectively. Cost components (resources) enumerated in the WBS are assigned cost codes based on various qualities. These features may include department ownership, resource kind, work area, etc. The total resource requirements can be encapsulated at the chosen level using cost codes, which can then be organised within that coding framework for the budgets.

Cost Codes and Cost Breakdown Structure

Cost codes may be assigned at any Work Breakdown Structure (WBS) level, encompassing the activities and resources detailed beneath them. Coding categorises cost aspects systematically, facilitating accurate cost tracking and performance measurement. A Cost Breakdown Structure (CBS) akin to a Work Breakdown Structure (WBS) is optimal for facilitating cost tracking and allocation to a timetable (Cleary et al., 2022). Since CBS can be implemented at any level, it is advisable to establish a CBS and cost codes at the resource level to monitor resources and analyse budget deviations.

Schedule Management in Construction Projects

Numerous studies concur that schedule management is a significant element of construction project management (Meng et al., 2022; Yu et al., 2021). It is characterised as the processes required to finalise the project punctually. The steps include planning schedule management, defining activities, sequencing activities, estimating activity durations, developing the schedule, and controlling the schedule (Project Management Institute, 2017). Executing these activities yields the Schedule Model, produced by implementing project scheduling tasks in the Schedule Development Process. This work encompasses tools, procedures, and the project team's expertise (Project Management Institute, 2019). The timetable model is thereafter regulated and observed according to predetermined circumstances outlined in the schedule project plan. In contrast to the PMI, the Association for the Advancement of Cost Engineering International (AACEi) delineates schedule management into three phases: planning, developing, and controlling project schedules (Stephenson, 2015). AACEi posits that defining, sequencing, and estimating activities are subprocesses of the Planning Project Schedule by aligning both perspectives on schedule management processes. Controlling Project Schedule involves measuring, reviewing performance, forecasting, and initiating the change management process as necessary for the project. The forecasting task is situated within the controlling schedule process of overall project schedule management in both frameworks, with its outcomes contingent upon the chosen scheduling technique, as various techniques account for different factors and constraints that can influence forecasting management. This examines the scheduling methodologies employed in the construction sector.

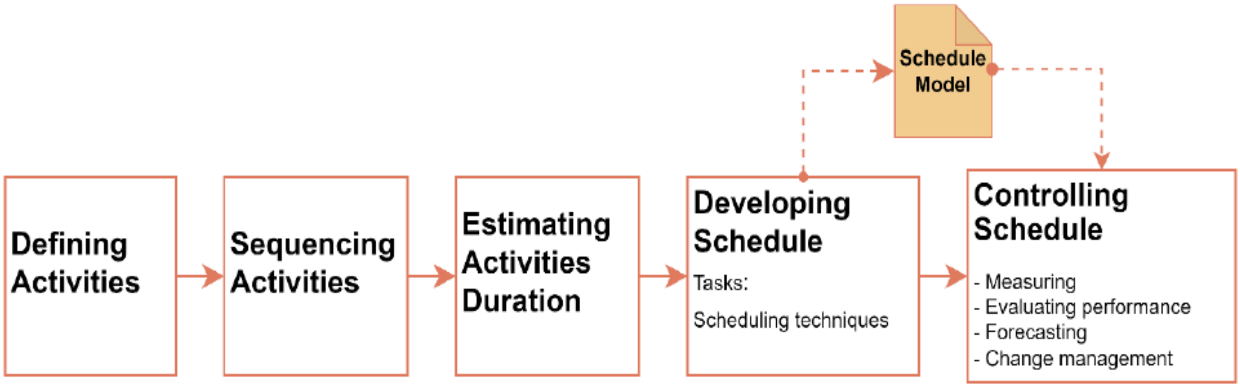

Figure 2.1: Schedule Management Processes (Project Management Institute, 2019).

Schedule Delays in Construction Projects

Delays are a prevalent obstacle in construction projects concerning project time, resulting in unsuccessful outcomes (Shahhossein et al., 2017; Park, 2021). Thus, comprehending their causes, significance to project duration, and the prevailing gap in the building business is advantageous. Meng et al. (2022) discovered that the average schedule delay in industrial megaprojects is 28%. This analysis included 318 global projects comprising oil and gas production facilities, petroleum processing and refining megastructures, mineral and metal factories, and chemical plants. A detailed analysis by Ansar et al. (2014) examined the performance of 245 significant dams constructed between 1934 and 2007 globally. The results revealed that 80% of big dams encountered delays, resulting in a 44% extension of their timelines. Ayalew et al. (2016) conducted a study in the Ethiopian construction sector, indicating timetable delays of 61% to 80%. A portion of the evidence was enumerated among numerous others. Fearnley et al. (2023) conducted a comprehensive study on these widespread delays, characterising this phenomenon as a 'paradox,' wherein timely completion continues to be a persistent challenge despite improvements in project management methodologies.

Schedule Delay Factors

Examining delays in construction projects focuses on pinpointing causes and consequences that affect the project's critical route, impacting the overall project length (Yang & Kao, 2012; Cristhian, 2024). Research on delay factors commenced with data collection methodologies, which may incorporate literature reviews and surveys or depend exclusively on literature reviews. Subsequently, they were frequently classified according to project kinds (e.g., infrastructural, industrial, residential) and project locations (generally grouped by countries or regions), among other factors (Cristhian, 2024). In data collection, academia employed a method of choosing delay factors from previous research and ranking them via surveys of industry professionals. Another method utilised extensive literature research to develop a prioritised list of delay factors. Assaf and Al-Hejji (2006) conducted a survey involving 23 contractors, 19 consultants, and 15 owners within the construction sector of Saudi Arabia. This study examined 76 large building projects, of which 45 experienced delays. This study classified the causes of delays based on Owners, Contractors, and Consultants. This investigation identified 73 delay causes, with "change orders" being the most prevalent among the three parties involved. A pertinent study was conducted by Sanni-Anibire et al. (2022), which analytically reviewed representative global studies from the preceding 15 years. Consequently, 36 factors contributing to delays were identified in the construction sector, with the top five being: “financial challenges encountered by the contractor,” “delays in approval for completed work,” “protracted material delivery,” “inefficient site organisation and coordination among stakeholders,” and “insufficient resource planning and scheduling estimation.” Furthermore, it is important to note that this study concentrated on building construction types. A comparable scope was noted in the study by Durdyev and Hosseini (2019). This research conducted a comprehensive review of global studies conducted from 1985 to 2018. Among the 149 identified causes, the ten most prevalent were: “weather/climate conditions,” “poor communication,” “lack of coordination and conflicts among stakeholders,” “ineffective or improper planning,” “material shortages,” “financial issues,” “payment delays,” “equipment/plant shortages,” “insufficient experience/qualification/competence among project stakeholders,” and “labour shortages coupled with inadequate site management.”

Sepasgozar et al. (2019) selected 94 research publications from 29 countries globally, identifying the causes and effects of delays in the construction sector. Consequently, 30 pivotal factors among the most pertinent include scheduling (improper resource allocation, inaccurate budgeting, procurement, unrealistic timelines), payment delays to labourers or contractors, design and scope alterations, unqualified personnel (workers, technical staff), and financing and cash flow challenges (insufficient contingency provisions, penalties, or loan acquisition difficulties). This research also encompassed residential, commercial, industrial, and infrastructure construction types. In contrast to prior studies, Selcuk et al. (2024) evaluated 70 journal papers produced in 33 poor nations. This study identified the 30 most prevalent causes of delays, including material procurement, change orders, project scope uncertainty, labour and technical staff supply issues, delayed contractor payments by owners, unforeseen weather conditions, inadequate or incomplete design documents and specifications, insufficient contractor management skills, equipment procurement challenges, poor communication among parties, and inadequate budgeting and planning by the contractor. Similarly, the predominant category of construction examined was building and infrastructure projects; in contrast, only one industrial project was studied in this study. Kermanshachi and Pamidimukkala (2023) encompassed the principal phases of the project lifecycle, including design, procurement, and construction. This research includes 44 case studies from a literature assessment on heavy industrial projects, categorising them into three primary classifications: general project elements, specialised project characteristics, and optimal building approaches. This study, based on a survey of over 140 construction professionals, identifies the following delay factors in the design phase: project team size, agreement on penalty clauses for delays, early provision of engineering components, number of budgeting stages, effective financing procedures, collaboration among designers, engineers, and contractors, the number of vendors and subcontractors, regulatory compliance, sufficient project team interactions, appropriate employee ratios, skilled labour availability, alignment between project objectives and physical deliverables, efficient change management processes, external inspections, clarity of owner requirements, effective resource management, conflict resolution strategies, and the influence of best practice methodologies.

The procurement phase exhibits the following indicators: project engineering schedule performance, design and technology complexity, collaboration among project stakeholders, number of implementation sites for procurement activities, quality of resources (labour and bulk materials), and timing impact of change orders. During the construction phase, key factors identified included cost overruns from the engineering phases, the actual duration of the engineering phase, the project team's involvement in procurement, the close relationship with technologies by organisations, the level of completion of the engineering/design project, challenges in procuring machinery due to project location, and the time lag associated with required changes. Despite the several variables contributing to timetable delays identified by Academia, the absence of a standard categorisation is paramount. A unified classification would facilitate the implementation of measures to mitigate the effects of such delays (Selcuk et al., 2024). A classification is offered based on the responsibility of delays: compensable, excusable, non-excusable, and concurrent. Compensable pertains to delays instigated by the owner, but excusable denotes unforeseen circumstances. Non-excusable delays are attributable to third parties, such as contractors or subcontractors, whereas concurrent delays result from a combination of different types (Mayo-Alvarez et al., 2022). Chhotelal et al. (2023) suggest classifying delay factors into critical and non-critical categories, determined by their influence on the project's critical path. Despite several attempts, no consensus has been established thus far.

Empirical Review of Related Studies

Adigwe et al. (2023) investigated the mitigation strategies for cost overruns in road infrastructure projects executed by local enterprises in Nigeria. The study employed a descriptive survey design. The research employed a structured questionnaire to gather data. The study population comprised 18 local road-building enterprises in Nigeria, overseeing 116 active projects in the Southeast region. A sample of 90 respondents was selected from a population of 116 management personnel in road-building enterprises in Southeast Nigeria. The empirical findings indicate that site visitation mitigation measures have a positive and significant impact on cost overruns in road infrastructure projects executed by local firms in Nigeria (t-statistics (4.09) > P-value (0.000)); interim valuation mitigation measures also demonstrate a positive and significant effect on cost overruns in these projects (t-statistics (3.759) > P-value (0.000)); and site meeting mitigation measures likewise exhibit a positive and significant influence on cost overruns in road infrastructure projects undertaken by local firms in Nigeria (t-statistics (4.374) > P-value (0.000)). The study advises that the contractor hire an adequate number of professional labourers, such as technicians, to ensure satisfactory development, prevent substandard craftsmanship, and assist in supervising unskilled labourers on site.

Kermanshachi and Pamidimukkala (2023) ascertain the total project cost and schedule overrun indicators and assess their reliability for large-scale heavy industrial projects. To achieve the study's objectives, a structured survey was created and distributed to construction industry professionals to gather their insights on the most significant cost overrun indicators (COIs) and schedule overrun indicators (SOIs). The gathered data were examined using multiple statistical tests, and a compilation of the significant COIs and SOIs was created using exhaustive regression analysis. The extreme bound analysis (EBA) method was employed to assess the robustness of the discovered indicators. The findings indicated that the nine critical organisational indicators (COIs) are: design phase contract type, change management strategy, the extent of internal stakeholder alignment, delays in the delivery of long-term facility machinery, percentage of locally sourced artisanal labour, the proportion of design completion prior to project budget approval, preparations for startup deployment, agreements incorporating delayed completion penalties, and the number of design organisations; two of these were identified as fragile indicators. The findings revealed nine significant indicators contributing to total schedule overrun: the execution of front-end planning, effectiveness of the change management process, project population density, average number of project management team members during the procurement phase, previous collaboration between designers and contractors, delays in the delivery of long-term facility machinery, average size of the project management team during the design phase, effectiveness of designer group interactions, and the number of subcontracting firms; six of these indicators exhibited a strong correlation with the model.

Yap et al. (2022) elucidates the importance of project knowledge and expertise for successfully executing construction projects. After conducting a comprehensive literature study, a quantitative positivist methodology utilising a questionnaire survey of industry specialists is implemented to evaluate the 30 predominant causes of time-cost overruns based on frequency, effectiveness, and importance indices. The data are subsequently analysed using Spearman's rank correlation tests and exploratory factor analysis. The importance index (IMP.I), which integrates both frequency and effectiveness indices, underscores the essential role of knowledge and experience in addressing the contractor's inadequate planning and scheduling, construction errors, substandard work, site management and supervision, protracted decision-making, incomplete drawings and design documents, and change or variation orders. Spearman's rank correlation tests demonstrate a strong agreement in perceptions among the principal stakeholders. Exploratory factor analysis reveals six fundamental knowledge-based factors influencing construction performance: inaccurate resource estimates, design alterations, resource deficiencies, insufficient experience, incompetence, and errors and defects.

Mbugua et al. (2021) select and prioritise the key performance indicators based on their significance to enhance construction performance. A comprehensive literature review was performed, resulting in the identification of 10 key performance metrics. A questionnaire survey and interviews were employed to gather data, which was subsequently analysed utilising the analytical hierarchical approach and pairwise comparison. The foremost priority of critical performance measures was safety, which was succeeded by time efficiency and client pleasure. Environmental performance was the least ranked key performance indicator. The findings of this paper may provide a framework for enhancing building construction projects.

Weldegebreal (2020) examined and contrasted the project cost and time performance disparities between local and foreign contractors in Ethiopia's construction sector. The study primarily utilised primary data from primary sources to gain information pertinent to reaching the research objective using a questionnaire survey. The descriptive statistical analysis technique is employed to examine and summarise quantitative data. The investigation revealed that both local and international contractors employ construction cost and time management techniques, with the disparity resting in the efficacy of their application in projects, which correlates with the implementation of the methods. Consequently, the data indicate a cost and time performance disparity between local and foreign real estate developers operating in Addis Ababa. It is advisable to enhance local contractors' project cost and time management performance through training to develop their knowledge and practical capabilities, thereby significantly improving the contractors' capacity to deliver projects successfully.

Samiullah et al. (2020) investigated the causes of cost overruns and their corresponding mitigation strategies within the Pakistani construction sector. A literature analysis identified 34 characteristics that contribute to cost overruns in the construction business. These characteristics served as the primary basis for the questionnaire design. Respondents were instructed to evaluate these criteria using a 4-point Likert scale on their frequency of occurrence. A survey was conducted with 130 stakeholders in the construction business to identify the primary causes contributing to cost overruns. Data was collected and statistically analysed using the average index method, revealing the ten most prevalent factors contributing to cost overruns in the Pakistani construction industry: financial crises faced by clients, errors in accurate estimation, deficiencies in drawings, delays in client approvals, inadequate planning by clients; contractor incompetence; insufficient supervision by consultants; payment delays to contractors; communication gaps between parties; and natural disasters. These factors were elucidated along with their mitigation measures. The results of this study can assist the Pakistani construction community in managing cost overruns for their projects.

Jaffari et al. (2019) investigated the determinants influencing performance and timelines in constructing Multi-Unit Residential Buildings (MURBs) in Dar-es-Salaam, Tanzania. This study aimed to gather perspectives from MURB project stakeholders concerning their perceptions of factors influencing MURB projects. Purposive sampling was employed, and 50 questionnaires were disseminated to Quantity Surveyors, Architects, and Engineers, of which 46 were returned. Data were gathered via a structured questionnaire and literature study and analysed using Microsoft Excel with tabular presentation. The study identifies 12 factors influencing performance and timelines in MURBs construction projects in Dar-Es-Salaam, Tanzania, with late payment, underestimation, insufficient planning and communication, absence of a competent project manager, scope alterations, design modifications, and adherence to specifications being the most significant factors impacting MURBs performance. Moreover, it was discovered that delays in completion and payments affect cost overruns, leading to disputes, claims, and occasionally arbitration. Furthermore, some mitigating strategies, such as meticulous work planning, transparent communication channels, the employment of experienced labour, and dedicated leadership and management, were identified as significantly beneficial in enhancing the construction performance of MURBs, provided they are effectively executed. The report advocates for the management structure of MURB building projects to emulate that of Australia, thereby benefiting the Tanzanian construction industry, particularly the MURB stakeholders.

3.0 METHODOLOGY

3.1 Research Design

The distinction between a researcher's understanding of reality and their interpretation of academic work and conclusions is sometimes unclear (Sileyew, 2019; Brunjes, 2020). This study will utilise a survey questionnaire to collect data from relevant personnel of the chosen agency. The data will be evaluated using both descriptive and inferential statistical methods. Descriptive statistics involve calculating percentages, frequencies, and mean scores, while inferential statistics includes using multiple linear regression (MLR) analysis. Thus, the methodology applied in this research employs random sampling techniques. The sample size will be calculated using Yamane's (1973) formula, which is noted for its precision in estimating population size. The research method refers to the strategy utilised by the researcher to execute a specific study (Field, 2024). This research will utilise a qualitative methodology, specifically a questionnaire survey. The research will utilise descriptive and inferential statistics to analyse the collected data.

3.2 Target Population

The population of a study is typically defined as the total number of units or individuals that a researcher aims to examine (Kothari, 2004). This research will encompass individuals employed by construction organisations. The populations consist of managers and CEOs within the construction sector, encompassing heads of strategy and planning, general managers, marketing managers, sales managers, and finance managers. Using a stratified sampling approach, the researcher selected 20 companies that accurately represented the whole target population (Lewi et al., 2015). The population distribution across managerial levels in the Department is as follows:

Table 1: Selected Construction Companies in North Central, Nigeria

Names of construction companies	STATE	Managers/ CEOs
AG Vison Construction Nig. Ltd	Kogi	12
Dantata & Sawoe Construction Company Nig. Ltd	Kwara	10
Ceezali Nig. Ltd	Niger	16
Dumez Nig. Ltd.	Benue	11
Kadeyprime Group Ltd.	Plateau	12
Kingfem Nig. Ltd	Nasarawa	19
Kouris Construction Nig. Ltd.	Abuja	22
Total		**102**

Source: Researchers Computation, (2024)

3.3 Sampling Technique and Size

Sampling is a technique researchers employ to intentionally select respondents or data while excluding persons or sources deemed to have insufficient knowledge or experience about the subject of inquiry (Bhatta, 2018). The census sampling method is utilised due to the small population size and the constant accessibility of the

MDs/CEOs.The aggregate population of general managers, marketing managers, sales managers, and finance managers at Dantata & Sawoe Construction Company Nig. Ltd, AG Vison Construction Nig. Ltd, Ceezali Nig. Ltd, Dumez Nig. Ltd, Kingfem Nig. Ltd, Kouris Construction Nig. Ltd, and Kadeyprime Group Ltd in the construction sector are fewer than four hundred; consequently, the study will not utilise any formula to diminish the population size. A questionnaire will be distributed to all 102 MDs/CEOs. This methodology corresponds with the techniques utilised by Sila and Gakobo (2021) in their research in Kenya and Yusuf (2021) in their study in Nigeria.

3.5 Instruments for Data Collection

Data-collecting instruments are tools for obtaining necessary data (Yin, 2018; Thysen et al., 2021). The study will utilise archival data collection as the primary approach for information gathering. The survey tool was a closed-ended questionnaire structured into demographic sections. In the preliminary stage, participants were requested to furnish a comprehensive profile including various information such as their organisational affiliation, geographical location, professional title, educational qualifications, experience level, and project nature. Participants will be requested to provide their responses on a five-point Likert scale (1 = Extremely Unimportant, 2 = Unimportant, 3 = Neutral) 4 indicates Important, while 5 represents Highly Important. The instrument will be designed and examined with specialists to comprehensively analyse its different facets, particularly the significance of attributes related to the performance of public sector organisations. Before collecting data on a substantial sample size, a survey will be administered to assess the project's feasibility. Vaske (2019) defines pilot research as an informal method that engages a small sample of participants to assess the effectiveness of subsequent investigations. The prediction of instrument dependability and research approaches has enhanced the understanding of advanced research.

The questionnaire would entail the following;
Section A: Background Information of the Respondents
Section B: Multiple Response Questions
Part One: Time Performance of Construction Companies (TPCC).
Part Two: Cost Performance of Construction Companies (CPCC).
Part Three: Cost Variance Analysis (CVA)
Part Four: Schedule Management Analysis (SMA)

3.6 Method of Analysis

The accurate and appropriate interpretation of study results is essential for maintaining data integrity (Vaske, 2019). Before assessing the responses, the completed questionnaires will be meticulously reviewed to ensure their completeness and consistency. The gathered data will be subjected to a coding process to categorise responses into several groups. The impact of procurement procedures on the performance of public sector firms in Nigeria will be analysed through qualitative data utilising descriptive analytic approaches with the assistance of SPSS. The findings are displayed graphically, encompassing tables and charts. The average score and standard deviation will be evaluated on a Likert scale. The data will be presented using statistical metrics like percentages, tabulations, means, and other measures of central tendency. This study will employ multiple regression analysis to assess the influence of procurement procedures on the performance of public sector enterprises in Nigeria. Regression analysis will be employed to forecast the value of the dependent variable based on the independent factors. According to Kothari (2014), this refers to identifying a statistical relationship among two or more variables. In simple regression, there are two variables: one independent variable that influences the behaviour of another variable, referred to as the dependent variable.

$TPCC = f(CVA, SMA)$
$CPCC = f(CVA, SMA)$

The model for the regression analysis is as follows:

$TPCC = \beta_0 + \beta_1 CVA + \beta_2 SMA + \varepsilon$
$CPCC = \beta_0 + \beta_1 CVA + \beta_2 SMA + \varepsilon$

Whereby;
TPCC= Time Performance of Construction Companies
CPCC = Cost Performance of Construction Companies
CVA = Cost Variance Analysis
SMA = Schedule Management Analysis
β_0 = Constant
β_{1-3} = Coefficient of the Independent Variables
ε = Error Term

3.7 Cronbach's Alpha Reliability Statistics

According to Vesna et al. (2017), Cronbach's Alpha reliability coefficient must have a minimum value of .70 to demonstrate the content validity and reliability of the instrument used in this research. The instrument will undergo a reliability test, with an estimated minimum score of .70.

Table 3.2: The Cronbach's Alpha Test for the Factors

Individual Construct	Short Form	Cronbach's Alpha
Time Performance of Construction Companies	TPCC	.811
Cost Performance of Construction Companies	CPCC	.797
Cost Variance Analysis	CVA	.801
Schedule Management Analysis	SMA	

Source: Author's Field Survey, (2024)

4.0 ANALYSIS AND RESULT

Descriptive Statistics

Background Information of Respondents

In line with the outcome of Table 4.1, which shows the profile of the respondents, the gender of the respondents entails 83 males and 19 females, delineating a response rate of 81 and 19 per cent, respectively. This means that the male gender dominates the Nigerian construction sector, which is not unconnected to the muscular and strenuous nature of the construction jobs (Muhammed et al., 2022). The age of the respondents encompasses 25 – 35 years (15), 26 – 45 years (50), 46 – 55 years (30), and 56 and above years (7), depicting a response rate of 15, 49, 29 and 7 per cent correspondingly. Also, academic qualification includes BSc/HND (10), MSc/MBA (72) and DBA/PhD (20) representing a response rate of 9, 71, and 20 percent congruently. Furthermore, the participating construction companies include AG Vision Construction Nig. Ltd (12), Dantata & Sawoe Construction Company Nig. Ltd (10), Ceezali Nig. Ltd (16), Dumez Nig. Ltd. (11), Kadeyprime Group Ltd. (12), Kingfem Nig. Ltd (19) and Kouris Construction Nig. Ltd (22) consistently represents a response rate of 12, 10, 16, 11, 12, 18 and 21.

Table 4.1: Profile of the Respondents

Variables	Frequency	Percentage
Gender of the Respondents		
Male	83	81
Female	19	19
Total	102	100
Age of the Respondents		
25-35 years	15	15
36-45 years	50	49
46-55 years	30	29
56 & above	7	7
Total	102	100
Academic Qualification		
BSc/HND	10	9
MSc/MBA	72	71
DBA/PhD	20	20
Total	102	100
Participating Construction Companies		
AG Vision Construction Nig. Ltd	12	12
Dantata & Sawoe Construction Company Nig. Ltd	10	10
Ceezali Nig. Ltd	16	16
Dumez Nig. Ltd.	11	11
Kadeyprime Group Ltd.	12	12
Kingfem Nig. Ltd	19	18
Kouris Construction Nig. Ltd.	22	21
Total	102	100

Source: Survey Questionnaire, (2024)

Test for Data Normality

Table 4.2 tests the normality of the data used in this study. The population mean of TPCC is 4.28, CPCC is 3.99, CVA is 3.82, and SMA is 3.63. The standard deviation of the three variables has revealed that the data are centred on the population mean, indicating 2.863 for time performance, 2.348 for cost performance, 2.513 cost variance and 1.937 for schedule management analysis. Hence, the low standard error of the mean shows that the population means of each of the four variables represent the population used in the study (Saunders et al., 2023). However, to ascertain the data's true normality, Kolmogorov-Smirnov and Shapiro-Wilk tests were performed, taking 0.05 as the significance level. These tests aim to determine if the data are statistically significantly different from the normal distribution, and a higher than 0.05 means it is not statistically different from the normal distribution (Saunders et al., 2023). Hence, in the normality table, the Kolmogorov-Smirnov test has revealed that TPCC is .101, CPCC is .211, CVA is .262, and SMA is .374. Furthermore, the Shapiro-Wilk test revealed that TPCC is .231, CPCC is .410, CVA is .164, and SMA is .275. Since all these values are higher than 0.05, we conclude that the data are normally distributed because they are not statistically different from the normal distribution.

Table 4.2: Test for Data Normality

Factors	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	**Df**	**Sig.**	**Statistic**	**Df**	**Sig.**
TPCC	.319	102	.101	.679	102	.231
CPCC	.321	102	.211	.637	102	.410
CVA	.284	102	.262	.684	102	.164
SMA	.420	102	.374	.573	102	.275

Source: Survey Questionnaire, (2024)

Table 4.3 outlines the factors considered in the objectives of this study, which indicates that the topmost factors for the TPCC entail 'use of time monitoring and control (M = 4.61)', 'project completed at an estimated time (M = 4.56)', 'regular schedule updates (M = 4.13)' and 'the schedule is minimised (M = 3.82)' ranked 1st, 2nd, third and fourth respectively. The factors of CPCC include 'use of cost monitoring during the design (M = 4.15)', 'project completed within budget (M = 4.13)', 'financial transparency (M = 4.02)' and 'appropriate procurement system (M = 3.68)' ranked 1st, 2nd, third and fourth respectively (Yusuf et al., 2022). The CVA factors encompass 'the difference between budgeted cost and the actual cost of projects is assessed in your company (M = 4.34)', 'cost engineers always investigate the causes of cost variation in your company (M = 3.99)', 'cost engineers always take corrective actions in case of cost variation in your company (M = 3.04)' ranked 1st, second and third correspondingly. For the SMA factors, they include 'managers prepare time-table for each project in your organisation (M = 4.08)', 'your company always fail to deliver projects to clients within the contractual agreement (M = 3.75)', 'your company always incur additional cost for delayed project development (M = 3.06)' ranked 1st, second and third correspondingly.

Table 4.3: Factors

Factors	Mean	SD	Rank
Time Performance of Construction Companies (TPCC)			
Use of time monitoring and control	4.61	0.489	1
The project was completed at an estimated time	4.56	0.498	2
Regular schedule updates	4.13	0.334	3
The schedule is minimised	3.82	0.827	4
Cost Performance of Construction Companies (CPCC)			
Use of cost monitoring during the design	4.15	0.876	1
The project was completed within budget	4.13	0.334	2
Financial transparency	4.02	0.811	2
Appropriate procurement system	3.68	0.948	2
Cost Variance Analysis (CVA)			
The difference between the budgeted cost and the actual cost of projects is assessed in your company	4.34	0.474	1
Cost Engineers always investigate the causes of cost variation in your company	3.99	0.827	2
Cost Engineers always take corrective actions in case of cost variation in your company	3.04	1.433	3
Schedule Management Analysis (SMA)			
Managers prepare a time-table for each project in your organisation	4.08	0.410	1
Your company always fail to deliver projects to clients within the contractual agreement	3.75	0.797	2
Your company always incur additional costs for delayed project development	3.06	0.661	3

Source: Survey Questionnaire, (2024)

Inferential Statistics

Study Hypotheses

H_{01}: There is no significant statistical impact of cost variance and schedule management on the on-time performance of construction companies

H_{02}: There is no significant statistical impact of cost variance and schedule management on the cost performance of construction companies

Regression Analysis

Table 4.4 illustrates the model summary, and it indicates an R Square of .855 and .791, which represent about 86% and 79% of the variables' impact on TPCC and CPCC, respectively. The rest covers the factors that are not considered by the model.

Table 4.4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1 TPCC	.801[a]	.855	.831	.10589	.597
2 CPCC	.781[a]	.791	.751	.01699	.786

a. Predictors: (Constant), CVA, SMA

b. Dependent Variables: TPCC, CPCC

Source: Author's Field Survey, (2023).

Table 4.5, which indicates the coefficients of this study, indicates a Sig (<0.05), signifying the rejection of all the hypotheses, such as the H_{01} and H_{02} of this study. In contrast, the regression line for the first TPCC model indicates TPCC = -.012 + 0.605(CVA) + 0.746(SMA), the second CPCC model denotes CPCC = .213 - 0.871(CVA) - .025(SMA). This indicates that for both models, both CVA and SMA are positive predictors of TPCC, and they are both negative predictors of CPCC, as indicated in both models, which is in line with the outcome of this study.

Table 4.5: Regression Coefficients

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
TPCC	(Constant)	-.012	.148		-.079	.007
	CVA	0.605	.029	1.592	55.899	.001
	SMA	0.746	.056	.665	23.867	.002
CPCC	(Constant)	.213	.311		-.180	.011
	CVA	-0.871	.055	-1.379	35.838	.011
	SMA	-.025	.084	-.025	-.301	.004

a. Dependent Variables: TPCC, CPCC

Source: Author's Field Survey, (2023).

Discussion

Weldegebreal (2021) asserts that effective cost management is an essential component of project management, entailing the regulation of project expenses to guarantee completion within the sanctioned budget and timeline. This indicates that precise cost assessment is essential for efficient cost and schedule management, as demonstrated by their considerable influence in this study (Mbugua et al., 2021). Project managers must estimate all project expenses, encompassing direct and indirect costs, and ensure their inclusion in the project budget (Sanni-Anibire et al., 2021). Project Managers must be knowledgeable and proficient in various estimate methodologies, such as Analogous and Parametric estimation. In high-risk environments, 3-point estimations (optimistic, most likely, and pessimistic assessments) yield the most precise estimates (Kermanshachi & Pamidimukkala, 2023). Budgeting through several strategies entails organising funds throughout the cost-estimating phase (Cleary et al., 2022). The Project Management Institute has recommended several tools, including Expert Judgment, Reserve Analysis, and Historical Information Review, which collectively establish the Cost Baseline for the monitoring and managing of the overall project budget (PMBOK 6th edition). Consistent budget oversight enables project managers to track project expenditures systematically, ensuring adherence to budgetary constraints and timelines. This entails comparing actual expenditures with the project budget, discovering discrepancies, and implementing corrective measures as necessary, utilizing methods such as variance analysis and S curves to maintain project alignment (Adigwe et al., 2023). Furthermore, for efficient cost management, it is imperative to identify and mitigate project risks that may result in cost overruns (Mayo-Alvarez et al., 2022). Project managers must recognise potential risks, evaluate their effects on the project budget, and formulate ways to mitigate them (Zidane & Andersen, 2018). Effective cost management entails optimising project resources, such as labour, equipment, and materials, to guarantee efficient and effective utilisation (Yap et al., 2022). Furthermore, continuous improvement signifies an ongoing process, necessitating project managers to consistently evaluate and enhance cost management processes and procedures to ensure their efficacy. Nnaemeka and Chijindu (2023) assert that proficient management of project expenses enables project managers to finish projects within budget, on schedule, and to the requisite quality standards, minimising waste, enhancing efficiency, and augmenting profitability.

5.0 CONCLUSION AND RECOMMENDATION

This study that investigated the impact of cost variance and schedule management on the time and cost performance of the construction companies within the Nigerian North-Central region concludes that there is a significant impact of cost variance and schedule management on the time performance of the selected construction companies as outlined by their R-Square of .855. It equally concludes that there is a high impact of cost variance and schedule management on the cost performance of construction companies as outlined by their R-Square of .791. Furthermore, the outcome concluded that both CVA and SMA are positive predictors of TPCC and they are both negative predictors of CPCC. The following recommendations are inherent in this study's conclusion:

1. The factors influencing building costs and time performance must be rigorously evaluated, and local contractors should accurately quantify their effects on projects. This facilitates enhanced construction performance on their projects.
2. It is advisable for construction companies to strategize in advance for responses to unforeseen cost and time performance impediments. The solution may involve establishing a prudent time and cost contingency, incorporating a variation provision in purchase agreements concerning these elements, or assigning the risks to clients. The efficacy and efficiency of various alternatives must be assessed initially, allowing developers to implement the most advantageous time and cost framework.
3. Construction companies should anticipate and manage technical risks, including internal causes, to mitigate their potential occurrence. Such aspects are the obligations that construction organisations are required to manage. This will impact their timetable and result in expenses. Consequently, construction organisations should mitigate the likelihood and effects of these factors.
4. Identifying potential changes and assessing their impact are crucial for managing a project in an unpredictable environment. The study's findings indicate that these processes enhance the assurance of potential events that may adversely impact project performance.

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