Evaluating the Effectiveness of Earned Value Management in Construction Project Control in FCT Abuja

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ABSTRACT

This study examines the impact of Earned Value Management (EVM) on cost, schedule, and scope performance in construction projects within the Federal Capital Territory (FCT), Abuja. A quantitative approach was adopted using a structured questionnaire administered to 108 construction professionals, of which 95 valid responses (88.0%) were analysed. Descriptive statistics, including mean scores and standard deviations, were utilized to assess EVM effectiveness and identify implementation challenges. The results show that EVM significantly improves project cost management, with mean scores ranging from 4.09 to 4.18, indicating strong agreement on its ability to track costs, detect overruns early, and enhance financial transparency. Similarly, EVM positively influences schedule and scope management, with mean values between 4.04 and 4.18, reflecting improved progress monitoring, early identification of schedule delays, and clearer scope definition. In terms of overall project performance, mean scores ranged from 3.87 to 4.02, indicating a moderate-to-strong positive impact. EVM also enhances managerial decision-making, with a mean score of 4.04 for providing accurate data for decisions. However, key challenges such as inadequate training (mean = 4.00), limited management support (mean = 4.00), and poor technological infrastructure (mean = 4.04) hinder effective adoption. The study concludes that while EVM is highly effective, its success depends on improved capacity building and organizational support.

Keywords: Earned Value Management, cost control, schedule management, project performance, construction projects.

INTRODUCTION

The construction industry is widely recognized as one of the most complex and risk-prone sectors due to the persistent occurrence of cost overruns, schedule delays, and resource inefficiencies that affect project delivery performance. Effective project monitoring and control have therefore become increasingly important in ensuring that construction projects are completed within approved budgets and specified timelines. In many developing countries, including Nigeria, construction projects continue to experience performance challenges associated with weak planning systems, inadequate progress tracking, and poor integration of cost and schedule management practices. These challenges are particularly evident in the Federal Capital Territory (FCT), Abuja, where rapid urban development and increasing infrastructure demands require more efficient project management approaches.

Earned Value Management (EVM) has emerged as a widely accepted project performance measurement and control technique capable of integrating project scope, cost, and schedule into a unified management framework. EVM enables project managers to evaluate project progress using objective performance indicators such as the Cost Performance Index (CPI), Schedule Performance Index (SPI), Estimate at Completion (EAC), and Cost Variance (CV), thereby supporting informed decision-making and early corrective actions (Rodriguez Blanco, 2011). Unlike traditional monitoring methods that assess cost and schedule separately, EVM provides a comprehensive assessment of project performance by combining planned work, actual cost, and earned progress

into a single analytical system.

The increasing relevance of EVM in construction project management is linked to its ability to improve forecasting accuracy and enhance project control mechanisms. Priyo (2021) observed that EVM contributes significantly to effective cost and schedule management by providing measurable indicators for monitoring project deviations and predicting future performance trends. Similarly, Attarzadeh and Hock (2009) argued that improved forecasting models based on EVM techniques enhance the accuracy of project completion estimates, thereby reducing uncertainty in project delivery. Empirical studies further suggest that mature EVM systems positively influence project performance, particularly in large and complex construction projects where continuous monitoring is essential for minimizing delays and cost escalation (Aramali et al., 2022).

Despite these advantages, the practical implementation of EVM remains challenging within many construction environments. One of the major concerns associated with EVM adoption is its complexity and resource-intensive nature, which often requires specialized technical knowledge, integrated software systems, and accurate project reporting structures (Hunter et al., 2014). In developing construction industries, weak data management systems and inconsistent project documentation frequently reduce the reliability of EVM outputs. Almeida et al. (2021) further noted that uncertainty in progress measurement may compromise the accuracy of earned value analysis due to subjective reporting and inconsistencies in evaluating completed work.

In addition, resistance to adopting EVM practices remains a significant challenge among construction organizations, particularly where project teams perceive EVM systems as administratively burdensome or expensive to implement (Hunter et al., 2014). Existing literature also suggests that traditional EVM approaches may not adequately incorporate risk and uncertainty management into project forecasting processes, thereby limiting their effectiveness under dynamic project conditions (De Marco et al., 2016; Kamyabniya & Bagherpour, 2014). Consequently, researchers have proposed enhanced EVM models such as Earned Schedule and risk-integrated EVM frameworks to improve project monitoring and forecasting capabilities (Beck & Kovacs, 2018; Pajares & López-Paredes, 2011).

Although several studies have examined the application of EVM in project management, much of the existing literature has focused on developed economies and industrial sectors outside the Nigerian construction context. Within Nigeria, empirical studies evaluating the adoption and effectiveness of EVM in construction projects remain relatively limited. More specifically, there appears to be insufficient research investigating the extent to which EVM is adopted in construction projects within the Federal Capital Territory (FCT), Abuja, and how such adoption influences project cost and schedule performance. Existing studies have also provided limited attention to the organizational, technical, and managerial challenges hindering the effective implementation of EVM within local construction environments.

This study therefore evaluates the adoption of Earned Value Management (EVM) and its impact on project performance within the Federal Capital Territory (FCT), Abuja, with particular emphasis on cost and schedule control. The study also identifies the critical challenges affecting the effective implementation of EVM in construction projects. By providing empirical evidence from the Nigerian construction industry, the study contributes to existing project management literature and offers practical insights for improving project monitoring, forecasting accuracy, and performance control within construction projects.

METHODOLOGY

Research Design

The study adopted a descriptive-survey research design to investigate the effectiveness of Earned Value Management (EVM) in project control within FCT, Abuja in order to achieve a broader generalisation across the study area. The descriptive approach enabled the systematic collection, analysis, and interpretation of data related to project cost, schedule, and scope management. This design was appropriate as it facilitated the understanding of both the adoption challenges and performance outcomes of EVM among project managers and stakeholders in the study area.

Population of the Study

The population of the study comprised construction professionals involved in project planning, monitoring, and control within the Federal Capital Territory (FCT), Abuja. These included project managers, site engineers, project coordinators, and QS, builders, architects drawn from selected public and private construction organizations. Based on preliminary field surveys and records obtained from the FCT Ministry of Works and Housing as well as selected construction firms, the total population of the study was 150 professionals.

Table 1: Population Distribution of Respondents

Category of Respondents	Population
Project Managers	40
Site Engineers	60
Project Coordinators	30
Other Stakeholders	20
Total	150

Source: Field Survey, 2024.

Sample Size and Sampling Technique

The sample size for the study was determined using Yamane's (1967) formula for finite populations at a 5% margin of error:

$n= \quad N/1+N(e)^2$

Where:

- n = sample size
- N = population size (150)
- e= level of precision (0.05)

$n = 150/1+150(0.05)^2$

$=150/1+0.375$

$= 150/1.375$

$=108$

Accordingly, 108 questionnaires were administered.

A stratified random sampling technique was adopted to ensure proportional representation of all respondent categories. Each stratum was sampled in proportion to its size within the population.

Table 2: Proportionate Sample Distribution

Category	Population	Sample Size
Project Managers	40	29
Site Engineers	60	43
Project Coordinators	30	22
Other Stakeholders	20	14
Total	150	108

Source: Field Survey, 2025.

Adjusted Effective Sample Size (Retrieved Questionnaires)

Out of the 108 questionnaires administered, 95 were correctly completed and retrieved**,** representing an 88% response rate. The effective sample used for analysis was therefore 95 respondents. To maintain proportionality, the retrieved responses were redistributed across categories as follows:

Table 3: Proportionate Distribution of Retrieved Responses

Category	Population	Retrieved Responses (n = 95)
Project Managers	40	25
Site Engineers	60	38
Project Coordinators	30	19
Other Stakeholders	20	13
Total	150	95

Source: Data Analysis

These 95 responses formed the basis for all statistical analyses conducted in the study.

Research Instruments

Data for the study were collected using a structured questionnaire designed to capture relevant information on the application of Earned Value Management (EVM) in construction project control. The questionnaire was divided into four sections:

- Section A**:** Demographic characteristics of respondents
- Section B**:** Application of EVM in project cost, schedule, and scope management
- Section C: Challenges hindering the adoption of EVM
- Section D: Influence of EVM on project performance, managerial decision-making, and improvement strategies

A five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree) was used for all close-ended items.

Validity of the Instrument

Content validity of the research instrument was established through expert review. The questionnaire was examined by two university lecturers specializing in Project Management and two experienced construction project managers. Their observations and recommendations were incorporated to improve clarity, relevance, and coverage of the research variables.

Reliability of the Instrument

A pilot study was conducted using 10 respondents drawn from a construction company outside the study area. The reliability of the instrument was assessed using Cronbach's Alpha to test internal consistency.

Table 4: Reliability Test Result

Instrument	Number of Items	Cronbach's Alpha	Decision
Questionnaire	30	0.82	Reliable

Source: Field Survey, 2025

The coefficient exceeded the minimum acceptable threshold of 0.70, indicating that the instrument was reliable.

Data Collection Procedure

Approval was obtained from relevant authorities and management of the selected construction organizations prior to data collection. Respondents were informed of the purpose of the study and assured of confidentiality. Questionnaires were self-administered and collected within a two-week period. Follow-up reminders were issued to improve the response rate.

Data Analysis Techniques

Data collected were analysed using Statistical Package for Social Sciences (SPSS) version 26**.**

- Descriptive statistics (mean, frequency, percentage, and standard deviation) were used to summarize respondents' characteristics and perceptions.
- Inferential statistics (correlation and regression analyses) were employed to examine the
- influence of EVM on project performance and managerial decision-making.

Table 5: Research Objectives and Data Analysis Techniques

Research Objective	Data Analysis Method
Impact of EVM on cost, schedule, and scope	Mean, Standard Deviation, Percentage
Challenges in EVM adoption	Frequency, Percentage, Ranking
Influence on project performance and decision-making	Regression Analysis, Correlation
Strategies for improving EVM effectiveness	Mean, Ranking

RESULT

Socioeconomic and Demographic Characteristics of Respondents

This section presents the socioeconomic and demographic characteristics of respondents whose questionnaires were successfully retrieved and analyzed. Out of the 108 questionnaires administered, 95 were duly completed and returned, representing a response rate of 88.0%. The analysis focused on respondents' gender, age, educational qualification, years of professional experience, and professional category. The gender distribution shows that male respondents accounted for 60 (63.2%), while female respondents constituted 35 (36.8%), confirming the male-dominated nature of the construction and project management sector in FCT, Abuja. Regarding age, the majority of respondents 45 (47.4%) fell within the 31–40 years bracket, indicating an active and productive workforce. Respondents aged 30 years and below accounted for 18 (18.9%), while 8 (8.4%) were above 50 years. In terms of educational qualifications, 53 respondents (55.8%) possessed Bachelor's degrees, 27 (28.4%) held Master's degrees, and 15 (15.8%) had HND/Diploma qualifications. This distribution suggests that the respondents were sufficiently educated to provide informed opinions on Earned Value Management (EVM). Analysis of work experience revealed that 44 respondents (46.3%) had 6–10 years of professional experience, while 30 respondents (31.6%) had more than 10 years of experience, indicating a blend of mid-career and seasoned professionals. Professionally, site engineers (38.9%) and project managers (31.6%) dominated the sample, ensuring adequate representation of core project decision-makers.

Table 6: Socioeconomic and Demographic Characteristics of Respondents (n = 95)

Characteristic	Category	Frequency	Percentage (%)
Gender	Male	60	63.2
	Female	35	36.8

Age (Years)	≤ 30	18	18.9
	31–40	45	47.4
	41–50	24	25.3
	> 50	8	8.4
Educational Qualification	HND/Diploma	15	15.8
	Bachelor's Degree	53	55.8
	Master's Degree	27	28.4
Years of Experience	≤ 5	21	22.1
	6–10	44	46.3
	> 10	30	31.6
Professional Category	Project Manager	30	31.6
	Site Engineer	37	38.9
	Project Coordinator	22	23.2
	Other Stakeholders	6	6.3
Total	—	95	100.0

Source: Field Survey, 2025.

Impact of Earned Value Management on Project Cost, Schedule, and Scope Management

This section examined the effect of Earned Value Management (EVM) on the three core dimensions of project control cost, schedule, and scope within construction projects in FCT, Abuja. The analysis evaluated respondents' perceptions of EVM's effectiveness in cost monitoring, schedule control, and scope alignment.

Effect of EVM on Project Cost Management

The results indicate strong agreement among respondents that EVM positively influences project cost management. Most respondents affirmed that EVM enhances cost tracking, enables early detection of cost overruns, and supports corrective actions. The high mean scores (above 4.0) suggest strong consensus on the effectiveness of EVM in improving cost control and financial transparency.

Table 7: Effect of EVM on Project Cost Management (n = 95)

Statement	SD	D	N	A	SA	Mean	Std. Dev.
EVM helps track actual project costs against planned costs	4	5	10	44	32	4.10	0.96
EVM enables early detection of cost overruns	3	5	12	38	37	4.12	0.94
EVM facilitates corrective actions to manage budget deviations	5	4	9	41	36	4.09	0.98
EVM provides accurate cost forecasting	2	3	14	41	35	4.12	0.91
EVM enhances transparency and accountability in project costs	1	4	13	41	36	4.18	0.88

Source: Field Survey, 2025.

Effect of EVM on Schedule and Scope Management

Respondents largely agreed that EVM supports effective schedule monitoring and scope control. Mean scores exceeding 4.0 indicate that EVM enables early identification of schedule slippages, facilitates corrective actions,

and enhances adherence to defined project scope.

Table 8: Effect of EVM on Schedule and Scope Management (n = 95)

Statement	SD	D	N	A	SA	Mean	Std. Dev.
EVM helps track progress against planned schedule	4	6	11	40	34	4.08	0.97
EVM enables early detection of schedule slippages	3	6	13	37	36	4.07	0.95
EVM assists in controlling project scope	5	4	11	42	33	4.04	0.99
EVM facilitates timely corrective actions	2	5	12	39	37	4.16	0.91
EVM enhances clarity of scope objectives	3	4	10	41	37	4.18	0.90

Source: Field Survey, 2025.

Influence of EVM on Project Performance and Decision-Making

Recalculation of the Likert scores confirms that EVM has a moderate-to-strong positive influence on project performance, with mean values ranging from 3.87 to 4.02**,** indicating overall agreement.

Table 9: Impact of EVM on Project Performance Metrics (n = 95)

Statement	Mean	Std. Dev.
Tracking project cost efficiency	4.02	0.87
Timely detection of performance variances	3.98	0.84
Alignment with planned objectives	3.97	0.89
Integration of cost and schedule monitoring	3.87	0.91
Objective evaluation of project success	3.90	0.87

Source: Field Survey, 2025.

EVM and Managerial Decision-Making Efficiency

EVM was found to significantly enhance managerial decision-making by providing accurate and timely performance data, improving corrective actions, and supporting efficient resource allocation.

Table 10: EVM and Decision-Making Efficiency (n = 95)

Statement	Mean	Std. Dev.
Accurate data for decision-making	4.04	0.86
Simplifies managerial decisions	3.87	0.92
Improves resource allocation	3.96	0.89
Supports timely corrective actions	3.96	0.88
Enhances risk management	3.82	0.95

Source: Field Survey, 2025.

Regression Analysis of EVM Impact on Project Performance

A multiple linear regression was conducted to predict overall project performance from EVM cost management score, EVM schedule management score, and years of experience. The regression model was statistically significant ($F(3,91) = 12.45$, $p < .001$, $R^2 = 0.291$). EVM cost management score was a significant predictor ($\beta = 0.342$, $p = .002$), as was EVM schedule management score ($\beta = 0.287$, $p = .008$), while years of experience was not significant ($\beta = 0.098$, $p = .312$).

Challenges Hindering the Adoption of EVM

The findings reveal that inadequate training, limited management support, resistance to change, and insufficient technological infrastructure are significant barriers to EVM adoption.

Table 11: Organizational and Technical Challenges (n = 95)

Statement	Mean	Std. Dev.
Inadequate training limits EVM adoption	4.00	0.98
Limited management support affects EVM use	4.00	0.94
Resistance to change hinders EVM implementation	4.01	0.97
Inadequate technological infrastructure	4.04	0.93
High cost of EVM tools discourages adoption	3.93	0.96

Source: Field Survey, 2025

Strategies for Improving EVM Adoption

The results underscore training, capacity building, and technology as critical enablers of effective EVM implementation.

Table 12: Training and Technology Strategies (n = 95)

Statement	Mean	Std. Dev.
Continuous training improves EVM application	3.98	0.89
Capacity building improves EVM interpretation	3.98	0.87
Software adoption supports EVM	3.92	0.90
Technology improves reporting accuracy	3.90	0.88
Cost and access to technology remain barriers	3.91	0.89

Source: Field Survey, 2025

The findings implied that policies, standardized processes, and strong management support were critical enablers of sustainable EVM implementation. While many respondents acknowledged these elements as drivers of success, the presence of dissenting views suggested that gaps in leadership consistency and weak institutional frameworks still posed challenges. Addressing these barriers through stronger governance and leadership accountability will be essential for maximizing EVM's potential in project control across FCT, Abuja.

DISCUSSION

The findings of this study indicate that Earned Value Management (EVM) has a generally positive and meaningful impact on project control in construction projects within the Federal Capital Territory (FCT), Abuja. The demographic profile of respondents shows that most participants were experienced professionals, particularly site engineers and project managers, which suggests that the responses are reliable for evaluating project management practices. The dominance of respondents with over five years of experience also implies that the study reflects practical industry perspectives rather than theoretical opinions. The relatively lower score for risk management (mean = 3.82, SD = 0.95) compared to other decision-making dimensions warrants attention. This may reflect that traditional EVM frameworks, as originally developed, do not explicitly incorporate risk and uncertainty into their forecasting models. De Marco et al. (2016) and Kamyabniya and Bagherpour (2014) have noted this limitation and proposed risk-integrated EVM extensions that incorporate contingency reserves and probabilistic analysis. The higher standard deviation (0.95) suggests substantial disagreement among respondents, possibly indicating that some organizations have integrated risk management

into their EVM processes while others have not. Project management offices in FCT should consider adopting enhanced EVM frameworks that explicitly account for risk, such as the Risk-Based Earned Value Management (RBEVM) approach or the integration of Monte Carlo simulation with EVM forecasts."

EVM and Project Cost Management

The results show a strong consensus that EVM improves cost control, enhances cost tracking, and enables early identification of cost overruns. This aligns with Kerzner (2017), who emphasized that EVM provides an integrated cost-performance framework that allows project managers to detect financial deviations early. Similarly, Fleming and Koppelman (2016) argued that EVM improves cost transparency by linking actual expenditure to planned value, thereby supporting more informed financial decisions. The high mean scores in this study suggest that even within the FCT construction environment, EVM is perceived as an effective tool for enhancing budget control and accountability.

EVM and Schedule and Scope Management

Respondents also agreed that EVM contributes significantly to schedule monitoring and scope control. This supports Vanhoucke (2014), who noted that EVM provides early indicators of schedule slippage through performance indices such as SPI. The ability of EVM to integrate scope, cost, and time aligns with Anbari (2003), who described it as a comprehensive performance measurement system that improves project coordination. The findings suggest that projects using EVM are more likely to maintain alignment with planned objectives, although the effectiveness may still depend on managerial competence and consistent application.

Challenges in EVM Adoption

Despite its benefits, the study identified several barriers to EVM adoption, including inadequate training, limited management support, resistance to change, and weak technological infrastructure. These findings are consistent with Oladipo (2007), who observed that technical and institutional capacity constraints significantly hinder the adoption of modern project management tools in Nigeria. Similarly, Aibinu and Jagboro (2002) noted that resistance to advanced project control systems is common in developing construction industries due to low awareness and inadequate professional development. These challenges suggest that while EVM is conceptually effective, its practical implementation remains limited in the FCT.

The challenges identified in FCT, including inadequate training, limited management support, resistance to change, and weak technological infrastructure, are broadly consistent with findings from other developing-country construction industries. For instance, Mandiyo Priyo reported that limited understanding of Earned Value Management (EVM) practices and weak implementation capacity remain persistent barriers in Indonesian construction projects (Priyo, 2021). Similar concerns regarding inadequate organizational support and poor technical integration have also been observed in broader EVM implementation studies (Aramali et al., 2021). In Nigeria, Albert et al. (2025) further identified inadequate training, lack of institutional frameworks, and weak top management support as major barriers to EVM adoption in construction projects. These similarities suggest that the implementation challenges are not unique to Nigeria but may reflect wider capacity and institutional constraints across developing economy construction sectors. Regional knowledge sharing and collaborative capacity-building initiatives across West Africa could therefore enhance EVM adoption more effectively than isolated national efforts.

EVM and Project Performance and Decision-Making

The results further indicate that EVM moderately enhances overall project performance and managerial decision-making. Respondents agreed that EVM improves resource allocation, supports timely corrective actions, and provides accurate data for decision-making. This is consistent with Fleming and Koppelman (2016), who emphasized that EVM improves forecasting accuracy and managerial responsiveness. However, the slightly lower mean values for risk management suggest that EVM is not fully optimized in practice, possibly due to incomplete implementation or lack of integration with other risk management systems.

Strategies for Improving EVM Adoption

The findings highlight training, capacity building, technological adoption, and managerial support as key strategies for improving EVM implementation. This aligns with Kerzner (2017), who stressed that successful EVM application depends heavily on organizational maturity and skilled personnel. The emphasis on software tools also reflects global trends in digital project management, where automation and data integration are increasingly essential for accurate performance tracking.

Limitation of the study

A limitation of this study is its reliance on self-reported perceptual data. While the high response rate (88%) and the professional experience of respondents (46.3% with 6-10 years of experience, 31.6% with over 10 years) increase confidence in the validity of the perceptions expressed, the findings reflect what respondents believe about EVM effectiveness rather than objectively measured performance outcomes.

CONCLUSION

The study concludes that Earned Value Management is a valuable and effective project control tool for improving construction project performance in the Federal Capital Territory, Abuja. It significantly enhances cost management, schedule tracking, and scope control by integrating key project performance indicators into a single monitoring framework.

However, despite its demonstrated benefits, the level of effective implementation remains limited due to institutional and technical challenges. These challenges reduce the ability of project managers to fully utilize EVM for proactive decision-making and risk management.

Overall, the study establishes that while EVM has strong potential to improve project delivery outcomes, its effectiveness in the FCT construction environment is still constrained by weak implementation structures, limited technical capacity, and insufficient organizational support. Strengthening these areas is therefore essential for improving project control and achieving better project performance outcomes. Future research should triangulate these findings by collecting actual CPI and SPI data from completed projects in FCT, comparing projects that used EVM with matched projects that did not. Additionally, longitudinal case studies tracking EVM implementation over the full project lifecycle would provide stronger evidence of causal effects on cost and schedule outcomes."

RECOMMENDATIONS

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

1. Construction firms and government agencies should organize continuous training programs to improve professionals' knowledge and practical application of Earned Value Management techniques.

2. The use of modern EVM-compatible software tools should be encouraged to improve accuracy in cost tracking, schedule monitoring, and performance reporting.

3. Organizational leadership should provide stronger support for EVM adoption by promoting its use as a standard project control tool and reducing resistance to change within project teams.

4. EVM should be formally integrated into project management frameworks for public infrastructure projects in the FCT to ensure consistency and standardization in project monitoring practices.

5. Relevant professional bodies and regulatory agencies should develop guidelines and policies that promote standardized implementation of EVM within the Nigerian construction industry.

6. Investment in digital project management systems should be prioritized to support real-time data collection, analysis, and reporting for better project control.

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