International Journal of Management Foresight and Strategy | ISSN 3087-4386
Published by BIRPUB https://birpub.org/ijmfs
Imp. Factor: 7.256

Assessment of Earned Value Management Practices for Forecasting Project Performance: A Case Study of Sellyfak Energy Services Limited, Port Harcourt, Rivers State, Nigeria

Nneboh, Echezona Chukwuemeka [1] & Prof. J. C. Ajadike [2]

Abstract

The study examined the application of Earned Value Management (EVM) for project performance analysis and forecasting in Sellyfak Energy Services Limited. The study was motivated by recurring project management challenges such as cost overruns, schedule delays, weak forecasting systems, and ineffective project monitoring practices within engineering and energy service organizations. The objectives were to assess the level of awareness and application of EVM, evaluate project cost and schedule performance using EVM indicators, examine the usefulness of EVM in forecasting project outcomes and supporting managerial decision-making, and identify the challenges affecting its adoption within the organization. The study adopted a descriptive survey research design. Primary data were collected through structured questionnaires administered to project personnel involved in planning, scheduling, monitoring, cost control, procurement, and project reporting activities. Using purposive sampling, seven (7) respondents with relevant project management experience were selected for the study. Data were analyzed using descriptive statistics, including frequencies, percentages, mean scores, and tables, while hypotheses were tested using a benchmark mean score of 3.00. The reliability of the research instrument was established using Cronbach's Alpha, which yielded an overall reliability coefficient of 0.83, indicating a high level of internal consistency. The findings revealed a moderate level of awareness and understanding of Earned Value Management among staff, although formal training opportunities were found to be inadequate. The study further established that EVM is moderately applied in project monitoring and control and significantly improves project cost and schedule performance through the early identification of deviations from project plans. In addition, EVM was found to enhance forecasting accuracy, resource allocation, and managerial decision-making. However, challenges such as inadequate staff training, weak information systems, limited project performance data, and insufficient organizational support were identified as major barriers to effective EVM implementation. The hypotheses tested confirmed significant relationships between EVM application and project cost performance, schedule performance, forecasting effectiveness, and project management practices. The study concluded that Earned Value Management is an effective project performance measurement and forecasting tool capable of improving project control, forecasting accuracy, and decision-making in engineering and energy service organizations. It therefore recommended that Sellyfak Energy Services Limited should institutionalize EVM as a standard project control framework, provide regular staff training, strengthen project documentation and information systems, adopt modern project management software, and enhance management support to maximize the benefits of EVM and improve overall project performance.

Keywords: *Earned Value Management, Project Performance, Cost Performance, Schedule Performance, Project Forecasting.*

Cite: Nneboh, E. C., & Ajadike, J. C. (2026). Assessment of Earned Value Management Practices for Forecasting Project Performance: A Case Study of Sellyfak Energy Services Limited, Port Harcourt, Rivers State, Nigeria. *International Journal of Management Foresight and Strategy, 4*(7), 519-546. https://doi.org/10.5281/zenodo.22008560

Authors	Affiliation
1	Department of Project Management, ESUT Business School, Enugu State University of Science and Technology (ESUT), Enugu State, Nigeria.
2	Department of Project Management, ESUT Business School, Enugu State University of Science and Technology (ESUT), Enugu State, Nigeria.

Introduction

Project management has become one of the most important managerial functions in modern organizations because many organizational activities are now executed through projects. Industries such as engineering, construction, oil and gas, manufacturing, and energy services depend heavily on projects for infrastructure development, innovation, operational growth, and service delivery. According to the Project Management Institute (PMI, 2021), project management involves the application of knowledge, skills, tools, and techniques to project activities to achieve project objectives effectively and efficiently. In today's business environment, organizations face increasing pressure to deliver projects within approved budgets, schedules, and technical requirements while maintaining quality and customer satisfaction. Kerzner (2022) observed that project management has moved beyond being a technical activity and is now considered a strategic organizational capability that directly influences profitability, competitiveness, and sustainability.

Modern engineering and energy service projects are highly complex because they involve sophisticated technologies, multiple stakeholders, strict safety standards, procurement challenges, and dependence on specialized equipment and skilled labor. Meredith, Shafer, and Mantel (2022) explained that project environments have become more uncertain due to globalization, digital transformation, unstable economic conditions, supply chain disruptions, and changing stakeholder expectations. These challenges make project planning, monitoring, and control more difficult. One of the major problems facing project-based organizations is the inability to monitor project performance effectively in real time. Traditional monitoring techniques such as milestone tracking, Gantt charts, percentage completion reports, and narrative progress reports are still widely used in many organizations. Although these techniques are useful for reporting progress, researchers argue that they often fail to integrate cost, schedule, and scope into a single performance measurement framework (Fleming & Koppelman, 2021). Consequently, project managers may receive incomplete or misleading information about actual project performance.

Flyvbjerg (2021) argued that many project failures occur because organizations fail to identify performance deviations early enough to implement corrective actions. Similarly, PMI (2023) reported that organizations continue to lose significant financial resources due to ineffective project monitoring systems, poor forecasting practices, and weak control mechanisms. As a result, there is increasing demand for integrated project performance management systems that can combine cost, schedule, work progress, and forecasting into one analytical framework. Earned Value Management (EVM) has emerged as one of the most effective methodologies for integrated project performance measurement and control. EVM integrates project scope, schedule, and cost into a unified system for measuring project performance and forecasting future outcomes (PMI, 2021).

According to Fleming and Koppelman (2021), EVM enables project managers to compare Planned Value (PV), Earned Value (EV), and Actual Cost (AC) in order to evaluate project efficiency and identify cost or schedule deviations. The framework also generates important performance indicators such as Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), and Schedule Performance Index (SPI). These indicators help project managers determine whether projects are progressing according to approved plans and budgets.

Another major advantage of EVM is its forecasting capability. Metrics such as Estimate at Completion (EAC), Estimate to Complete (ETC), Variance at Completion (VAC), and To-Complete Performance Index (TCPI) help project managers predict future project performance based on current trends. Martens and Vanhoucke (2020) noted that organizations that effectively implement EVM often achieve better forecasting accuracy, stronger cost control, improved schedule performance, and enhanced project visibility.

The engineering and energy services sector is one of the industries where EVM is highly relevant because projects in this sector are exposed to high levels of financial, technical, and operational risk. Ahiaga-Dagbui and Smith (2021) explained that engineering projects frequently experience delays and cost overruns due to procurement challenges, poor coordination, inaccurate forecasting, and operational disruptions. Sellyfak Energy Services Limited operates within this challenging environment and undertakes engineering and energy-related projects involving maintenance services, technical installations, and operational support activities. The organization faces common industry challenges such as fluctuating material prices, procurement delays, equipment availability issues, workforce productivity variations, and changing client requirements.

In situations where integrated project monitoring systems are lacking, project managers may rely heavily on intuition and informal reporting mechanisms to assess project performance. However, Kerzner (2022) argued that depending solely on subjective judgment can conceal emerging project problems until they become difficult and expensive to correct.

Therefore, the application of Earned Value Management within Sellyfak Energy Services Limited presents an opportunity to improve project monitoring, strengthen forecasting accuracy, enhance cost and schedule control, and support evidence-based managerial decision-making. Furthermore, this study contributes to existing literature by examining the practical application of EVM within a small-to-medium engineering and energy service organization in a developing economy context.

Statement of the Problem

Despite advancements in project management methodologies, engineering and energy service organizations continue to experience serious project performance challenges such as cost overruns, delayed project delivery, poor forecasting accuracy, inefficient resource utilization, and operational inefficiencies. PMI (2023) reported that many projects still exceed approved budgets and fail to meet deadlines because of weak monitoring and control systems.

Flyvbjerg (2021) also noted that project failures are often linked to poor forecasting systems, ineffective monitoring mechanisms, and delayed managerial intervention. One of the major contributors to these problems is the continued use of traditional project monitoring methods that provide fragmented and subjective information regarding project performance.

Within Sellyfak Energy Services Limited, project execution is affected by fluctuating material prices, changing client requirements, procurement delays, equipment challenges, workforce productivity variations, and operational uncertainties. In the absence of a formalized and integrated project performance measurement framework such as Earned Value Management, deviations from approved project plans may not be identified early enough for corrective action to be implemented effectively.

This situation may result in cost escalation, schedule slippage, poor forecasting accuracy, and inefficient use of resources, weak managerial decision-making, and reduced profitability. Although Earned Value Management is widely recommended in project management literature and standards, its adoption among small-to-medium engineering and energy service organizations remains relatively low because many organizations perceive EVM as technically complex and data-intensive (Nguyen, Tran & Hoang, 2022; Oke & Aigbavboa, 2021).

Furthermore, most empirical studies on EVM focus on large infrastructure and construction organizations in developed economies, with limited studies examining its practical application within engineering and energy service firms in developing countries such as Nigeria. Therefore, this study seeks to bridge this gap by examining the effectiveness of Earned Value Management for project performance analysis and forecasting in Sellyfak Energy Services Limited.

Objectives of the Study

The main objective of this study is to examine the effectiveness of Earned Value Management as a tool for project performance analysis and forecasting in Sellyfak Energy Services Limited. The specific objectives are to:

i. To assess the application of Earned Value Management method in project management within Sellyfak Energy Services Limited?
ii. Evaluate project cost and schedule performance using Earned Value Management indicators?
iii. Examine the usefulness of Earned Value Management in forecasting project outcomes and supporting managerial decision-making?
iv. Evaluate the problems associated with the adoption of Earned Value Management strategy in Sellyfak Energy Services Limited?

Research Questions

i. To what extent is Earned Value Management understood and applied in project management within Sellyfak Energy Services Limited?
ii. What do Earned Value Management indicators reveal about the cost and schedule performance of selected projects in the organization?
iii. How useful is Earned Value Management in forecasting project outcomes and supporting managerial decision-making in Sellyfak Energy Services Limited?
iv. What are the major problems affecting the adoption of Earned Value Management strategy in Sellyfak Energy Services Limited?

Statement of Hypotheses

The following null and alternative hypotheses are formulated for the study:

i. $H0_1$: There is no significant relationship between the application of Earned Value Management and project cost performance in Sellyfak Energy Services Limited.
ii. $H0_2$: There is no significant relationship between the application of Earned Value Management and project schedule performance at Sellyfak Energy Services Limited.
iii. $H0_3$: The application of Earned Value Management does not significantly improve the accuracy of project outcome forecasting in Sellyfak Energy Services Limited.
iv. $H0_4$: The challenges associated with the adoption of Earned Value Management do not significantly affect project management practices in Sellyfak Energy Services Limited.

Scope of the Study

This study focuses on the application of Earned Value Management (EVM) for project performance analysis and forecasting in Sellyfak Energy Services Limited. The scope of the study is divided into unit scopes, content scope, area scope, and time scope to clearly define the boundaries of the research.

The study covers selected categories of staff directly involved in project planning, execution, monitoring, and control within Sellyfak Energy Services Limited. These include project managers, engineers, quantity surveyors, project planners/schedulers, cost control officers, procurement personnel, and supervisory staff who participate in project management activities and decision-making processes within the organization.

The study specifically examines the application and effectiveness of Earned Value Management indicators such as Planned Value (PV), Earned Value (EV), Actual Cost (AC), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Estimate at Completion (EAC), Estimate to Complete (ETC), Variance at Completion (VAC), and To-Complete Performance Index (TCPI) in evaluating project cost and schedule performance as well as forecasting project outcomes. The study also investigates the extent of EVM awareness and application within the organization and evaluates the major problems affecting the adoption and implementation of Earned Value Management strategy, including inadequate staff competence, poor project documentation, weak information systems, resistance to organizational change, and insufficient management support.

Geographically, the study is limited to Sellyfak Energy Services Limited and its operational project environments within Nigeria. The research focuses on engineering and energy-related projects executed by the organization.

The study covers project management practices, project monitoring activities, and Earned Value Management application within Sellyfak Energy Services Limited during the period of the research study, specifically from 2020 to 2025. This period is considered appropriate because it reflects recent project management practices, operational experiences, and contemporary project performance challenges within the organization. The study does not cover technical quality assessment, safety performance evaluation, environmental impact analysis, or post-project operational performance. Therefore, the findings of the study are limited to project cost and schedule performance analysis and forecasting within the context of Sellyfak Energy Services Limited.

Significance of the Study

This study is significant from practical, organizational, and academic perspectives, particularly in addressing the persistent challenges of cost overruns, schedule delays, and ineffective project monitoring systems in engineering and energy service organizations.

The study will provide project managers, engineers, cost controllers, and planners within Sellyfak Energy Services Limited with a structured and objective approach to project performance measurement. By demonstrating how Earned Value Management (EVM) integrates cost, schedule, and scope, the study will enhance the ability of project teams to detect performance deviations early, improve cost control, and manage project timelines more effectively. This will ultimately lead to improved project delivery, reduced financial losses, and better utilization of resources.

The findings of this study will support Sellyfak Energy Services Limited in strengthening its project management practices. The study will highlight the importance of adopting data-driven monitoring and forecasting tools, thereby encouraging the institutionalization of EVM as a standard project control system. This can improve transparency, accountability, and decision-making within the organization, while also enhancing its competitive advantage in the engineering and energy services sector.

This study will contribute to the existing body of knowledge on project performance measurement and control, particularly in the application of Earned Value Management within small-to-medium engineering service firms in developing economies. Given that most existing studies focus on large-scale projects in developed countries, this research provides context-specific empirical evidence that helps bridge the gap between theory and practice.

Furthermore, the study will serve as a useful reference for future researchers, students, and practitioners interested in project management, performance measurement, and forecasting techniques. It also provides a foundation for further studies on improving project control systems in similar organizational and industrial contexts.

Operational Definition of Terms

The EVM framework is built around three major variables: Planned Value (PV), Earned Value (EV), and Actual Cost (AC).

Planned Value (PV): Planned Value refers to the approved budget assigned to scheduled project work at a particular point in time. PV represents the baseline against which actual project progress is evaluated.

Earned Value (EV): Earned Value refers to the budgeted value of work completed during project execution. EV reflects actual project accomplishment expressed in financial terms.

Actual Cost (AC): Actual Cost refers to the total expenditure incurred in completing project activities. AC measures the real financial resources consumed during project execution. These variables form the basis for computing performance variances, performance indices, and forecasting metrics.

Cost Variance (CV): Cost Variance measures the difference between Earned Value and Actual Cost:

$CV = EV - AC$

A positive CV indicates cost underrun, while a negative CV indicates cost overrun.

Schedule Variance (SV)

Schedule Variance measures the difference between Earned Value and Planned Value:

$SV = EV - PV$

A positive SV indicates that the project is ahead of schedule, while a negative SV indicates schedule delay.

According to Lipke et al. (2020), CV and SV provide immediate diagnostic information regarding project efficiency and operational performance.

Cost Performance Index (CPI)

The Cost Performance Index measures cost efficiency:

$CPI = EV / AC$

CPI values greater than 1 indicate efficient cost utilization, while values below 1 indicate cost inefficiency.

Schedule Performance Index (SPI)

The Schedule Performance Index measures schedule efficiency:

$SPI = EV / PV$

SPI values below 1 indicate project delay, while values greater than 1 indicate favorable schedule performance.

Martens and Vanhoucke (2020) found that CPI and SPI are among the most reliable indicators for evaluating project efficiency and predicting project performance outcomes.

One of the major strengths of EVM lies in its forecasting capability. Estimate at Completion (EAC)

Estimate at Completion forecasts the total expected project cost at completion:

EAC = BAC / CPI

Estimate to Complete (ETC)

Estimate to Complete predicts the additional cost required to complete the remaining project work:

ETC = EAC − AC

Variance at Completion (VAC)

Variance at Completion measures the expected project overrun or underrun:

VAC = BAC − EAC

To-Complete Performance Index (TCPI)

TCPI measures the efficiency required to complete the project within approved budget:

TCPI = (BAC − EV) / (BAC − AC)

Narbaev and De Marco (2020) found that EVM forecasting metrics significantly improve project forecasting accuracy and financial planning efficiency.

Literature Review

Conceptual Review

This chapter reviews contemporary literature relevant to Earned Value Management (EVM) and project performance forecasting in engineering and energy service organizations. The review focuses on the concepts of project management, project performance, project monitoring and control, Earned Value Management, EVM indicators and forecasting metrics, and the application of EVM in engineering and energy-related projects. Emphasis is placed on current literature published between 2020 and 2026 to provide recent scholarly perspectives on project performance management and forecasting.

Concept of Project Management

Project management has become a strategic managerial function in modern organizations due to increasing project complexity, technological advancement, globalization, and the need for efficient resource utilization. According to the Project Management Institute (PMI, 2021), project management refers to the application of knowledge, skills, tools, and techniques to project activities to meet project objectives and stakeholder expectations. Modern organizations rely heavily on projects to achieve strategic goals, improve operational efficiency, and deliver innovative products and services.

Kerzner (2022) explains that project management has evolved from a purely technical activity into an enterprise-wide strategic discipline that supports competitiveness, sustainability, and organizational growth. In engineering and energy service organizations, project management plays a critical role because projects are often capital-intensive, technically complex, and exposed to environmental and operational uncertainties.

Recent studies emphasize that project management now extends beyond traditional planning and scheduling functions to include stakeholder management, sustainability, digital transformation, risk management, and performance optimization (PMI, 2021; Meredith, Shafer & Mantel, 2022). Organizations increasingly adopt integrated project management systems to improve accountability, transparency, communication, and performance monitoring.

According to Too and Weaver (2021), organizations with weak project management systems frequently experience cost overruns, project delays, poor communication, low productivity, and resource wastage. Similarly, Joslin and Müller (2021) found that project management maturity significantly influences organizational performance, strategic alignment, and project success.

The growing complexity of engineering and energy projects has increased the need for advanced project performance management systems capable of integrating cost, schedule, scope, and resource information into a unified decision-making framework. Consequently, scholars increasingly advocate for integrated project control methodologies such as Earned Value Management.

Project Performance and Project Success

Project performance refers to the extent to which a project achieves its predefined objectives within approved constraints of cost, time, scope, and quality. Traditionally, project success has been evaluated using the “iron triangle” framework involving cost, schedule, and scope performance. However, recent studies argue that project success is multidimensional and should also include stakeholder satisfaction, sustainability, operational value, and long-term organizational benefits (Shenhar & Dvir, 2021).

Cost performance measures whether projects are completed within approved budgets, while schedule performance evaluates adherence to planned timelines. Scope performance examines whether project deliverables meet technical specifications and stakeholder requirements.

Recent global studies indicate that project performance failure remains a major challenge despite advances in project management methodologies. Flyvbjerg (2021) argues that engineering and infrastructure projects frequently experience budget overruns and schedule slippages because of optimism bias, poor forecasting practices, and weak project control systems. Similarly, PMI (2023) reports that many organizations continue to experience project failure due to ineffective monitoring systems, poor communication, inaccurate planning, and inadequate risk management.

Love, Teo, Morrison, and Grove (2020) found that ineffective project control mechanisms contribute significantly to rework, operational inefficiency, contractual disputes, and financial losses in engineering projects. In energy service organizations, poor project performance may also result in operational shutdowns, environmental risks, client dissatisfaction, and reputational damage.

As a result, modern organizations increasingly seek integrated project monitoring systems capable of providing real-time, objective, and predictive project performance information.

Project Monitoring and Control

Project monitoring and control constitute one of the most critical functions in project management because they ensure that project activities are executed according to approved plans, budgets, schedules, and organizational objectives. In engineering and energy-related projects, where projects are often capital-intensive, technically complex, and time-sensitive, effective monitoring and control systems are essential for minimizing risks, improving resource utilization, and ensuring successful project delivery. Project monitoring involves the continuous collection, measurement, and analysis of project performance information, while project control focuses on comparing actual project outcomes with planned targets and implementing corrective actions whenever deviations occur (PMI, 2021).

In recent years, project environments have become increasingly dynamic due to technological changes, unstable economic conditions, supply chain disruptions, environmental regulations, and changing stakeholder expectations. These conditions have made project monitoring and control more important than ever because project managers must respond quickly to performance deviations and emerging risks. According to Kerzner (2022), organizations that fail to establish effective project monitoring systems are more likely to experience schedule slippages, cost overruns, poor quality performance, and project failure. Consequently, modern project management emphasizes proactive performance monitoring and real-time decision-making rather than reactive problem-solving after project problems have already escalated.

Traditionally, project monitoring and control have relied on tools such as milestone tracking, Gantt charts, critical path analysis, budget tracking, and percentage completion reporting. These methods have historically played important roles in project planning and reporting because they provide visual representations of project timelines, resource allocation, and task completion status. Gantt charts, for example, help managers visualize project schedules and dependencies, while critical path analysis identifies project activities that directly affect project completion time (Meredith, Shafer, & Mantel, 2021). Budget tracking systems are also commonly used to monitor project expenditures against approved budgets.

Despite their usefulness, recent literature has criticized traditional monitoring techniques for their inability to provide integrated and objective measures of project performance. Fleming and Koppelman (2021) argued that many traditional project monitoring systems focus primarily on activity completion without adequately assessing whether the value of completed work justifies the cost and time invested. Percentage completion reports, for example, are often subjective because they depend heavily on individual judgment and may not accurately reflect actual project progress. Similarly, budget tracking systems may indicate whether spending is within limits but fail to determine whether the amount spent corresponds with actual work accomplished. As a result, project managers may receive fragmented information that obscures emerging performance problems.

The Project Management Institute (PMI, 2021) further explained that conventional project reporting systems can create misleading impressions of project health because they often separate cost tracking from schedule tracking. A project may appear to be progressing well based on activity completion percentages while simultaneously experiencing significant cost overruns or schedule inefficiencies. This disconnect reduces management's ability to detect performance problems early and weakens organizational capacity for corrective intervention. Consequently, organizations increasingly require integrated monitoring and control systems capable of simultaneously evaluating project scope, time, and cost performance.

Recent studies have emphasized the growing importance of predictive and integrated project control systems in engineering and energy projects. Martens and Vanhoucke (2020) observed that predictive monitoring systems significantly improve forecasting accuracy and managerial responsiveness because they provide early warning indicators of project deviations. Their study demonstrated that organizations using integrated project control frameworks achieved better project outcomes than organizations relying on isolated monitoring tools. Predictive systems allow project managers to anticipate future project outcomes based on current trends rather than waiting until problems become visible through traditional reporting methods.

Similarly, Serrador and Pinto (2021) found that integrated project monitoring systems improve operational efficiency, cost performance, and schedule compliance. According to their findings, organizations that implement integrated control frameworks are more capable of managing uncertainties, controlling project risks, and supporting evidence-based managerial decisions. These findings are particularly important in engineering and energy projects where delays and cost overruns can have substantial financial and operational consequences.

The increasing complexity of engineering and energy projects has therefore contributed to the growing adoption of Earned Value Management (EVM) as a modern project monitoring and control technique. EVM is widely recognized as one of the most effective integrated project performance measurement systems because it combines project scope, cost, and schedule into a single analytical framework (PMI, 2021). Unlike traditional monitoring methods that evaluate cost and schedule separately, EVM enables managers to determine whether the value of work completed aligns with the resources consumed and the approved project schedule.

EVM operates through the integration of Planned Value (PV), Earned Value (EV), and Actual Cost (AC). Planned Value represents the authorized budget for scheduled work, Earned Value measures the value of work completed, and Actual Cost represents the expenditure incurred for completed work. By comparing these variables, project managers can compute performance indicators such as Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), and Schedule Performance Index (SPI) (Fleming & Koppelman, 2021). These indicators provide objective measurements of project efficiency and performance status.

One major advantage of EVM is its forecasting capability. Modern project management requires not only monitoring present performance but also predicting future project outcomes based on current trends. EVM forecasting metrics such as Estimate at Completion (EAC), Estimate to Complete (ETC), and Variance at Completion (VAC) enable project managers to estimate likely project completion costs and timelines. According to Vanhoucke (2021), EVM forecasting models are particularly valuable because they provide early warning signals that allow managers to implement corrective actions before project deviations become uncontrollable.

In engineering and energy projects, project monitoring and control are especially critical because of the high financial stakes and operational risks involved. Engineering projects typically involve large-scale procurement activities, specialized equipment, multidisciplinary coordination, and strict regulatory compliance requirements. Delays or inefficiencies in one project component can significantly affect the entire project lifecycle. Studies conducted between 2020 and 2026 indicate that organizations using integrated monitoring systems such as EVM achieve better control over cost and schedule performance than organizations relying solely on traditional monitoring techniques (Aramali et al., 2022).

Furthermore, digital transformation and technological advancement have significantly influenced project monitoring and control practices in recent years. The adoption of project management software, cloud-based collaboration tools, Building Information Modeling (BIM), artificial intelligence, and real-time analytics has improved the efficiency and accuracy of project performance monitoring. Researchers have noted that integrating EVM with digital project management systems enhances data quality, reporting speed, and forecasting accuracy (Mayo-Alvarez et al., 2022). Real-time dashboards and automated reporting systems also improve managerial responsiveness by providing instant access to project performance information.

However, despite the benefits of integrated project monitoring systems, several implementation challenges remain. One major challenge is the need for accurate and reliable project data. Poor project documentation, inconsistent reporting systems, and inaccurate progress measurement can undermine the effectiveness of project control systems. In addition, organizations may face resistance to change, inadequate staff competence, and limited management support when implementing advanced monitoring frameworks such as EVM (Kerzner, 2022).

Another important issue identified in recent literature is that project monitoring and control should not focus solely on cost and schedule performance. Modern project success also depends on quality management, stakeholder satisfaction, environmental sustainability, and safety performance. Consequently, scholars recommend integrating project monitoring systems with broader organizational performance management frameworks to achieve holistic project control and governance (PMI, 2021).

Overall, project monitoring and control remain fundamental components of effective project management in engineering and energy industries. While traditional monitoring methods continue to provide useful planning and reporting functions, their limitations in integrating scope, schedule, and cost have increased the demand for more advanced and predictive control systems. Earned Value Management has emerged as one of the most effective integrated project monitoring and forecasting techniques because it provides objective performance measurements, forecasting capabilities, and early warning signals for managerial decision-making. Nevertheless, successful implementation depends on reliable project data, organizational commitment, competent personnel, and supportive information systems.

Earned Value Management (EVM)

Earned Value Management is widely recognized as one of the most effective project performance measurement and forecasting techniques. EVM integrates project scope, schedule, and cost into a single analytical framework for measuring project health and predicting future outcomes.

According to PMI (2021), EVM is a project management methodology that compares planned work, completed work, and actual project expenditure to evaluate performance and forecast project outcomes. Unlike traditional methods that track schedule and cost separately, EVM provides an integrated and objective assessment of project efficiency.

Fleming and Koppelman (2021) describe EVM as a systematic project control methodology that enables managers to identify performance deviations early and implement timely corrective actions. Kerzner (2022) explains that EVM transforms project management from reactive reporting into proactive decision-making by providing quantitative indicators of project performance.

Recent studies indicate that EVM adoption has expanded significantly across engineering, construction, oil and gas, manufacturing, information technology, and energy industries because of its forecasting capability and ability to improve transparency and accountability (Vanhoucke, 2021).

The major strength of EVM lies in its ability to integrate project planning, monitoring, variance analysis, and forecasting into a unified performance measurement system.

Application of EVM in Engineering and Energy Projects

Earned Value Management (EVM) has become one of the most widely used project performance measurement and control techniques in engineering and energy-related projects due to its ability to integrate project scope, schedule, and cost into a unified management framework. In recent years, the engineering and energy sectors have experienced increasing project complexity arising from technological advancement, volatile material prices, environmental regulations, supply chain disruptions, and growing stakeholder expectations. These challenges have intensified the need for effective project monitoring and forecasting systems capable of providing accurate and timely information for managerial decision-making. Consequently, EVM has gained increasing recognition as a proactive project control tool that enhances project visibility, accountability, and performance forecasting.

Engineering and energy projects are often characterized by large capital investments, technical uncertainty, multidisciplinary coordination, and long project life cycles. Such projects require continuous monitoring of work progress, expenditure patterns, and schedule compliance to prevent cost overruns and delays. Traditional project monitoring methods such as milestone tracking, percentage completion reports, and narrative progress reporting have been criticized for their inability to provide an integrated assessment of project health. Researchers have argued that these conventional methods often produce fragmented and subjective information, thereby limiting the ability of managers to identify emerging problems early enough for corrective action. EVM addresses these weaknesses by comparing Planned Value (PV), Earned Value (EV), and Actual Cost (AC), which collectively provide objective indicators of both cost and schedule performance.

The application of EVM in engineering projects has significantly improved project control processes, especially in construction, infrastructure, oil and gas, and energy facility development projects. Ateş (2025) explained that EVM enables organizations to establish baseline schedules and budgets, monitor deviations in real time, and forecast final project outcomes using indices such as Cost Performance Index (CPI), Schedule Performance Index (SPI), Estimate at Completion (EAC), and Variance at Completion (VAC). The study further noted that EVM supports proactive and data-driven managerial decision-making because project managers can identify cost and schedule deviations before they become critical.

In engineering procurement and construction (EPC) projects, EVM has been particularly useful because of the complexity and scale of operations involved. EPC projects typically involve procurement management, engineering design, construction activities, subcontractor coordination, and resource-intensive operations. Research has shown that applying EVM in EPC projects improves project scheduling, financial planning, and resource allocation. Sharib Razi emphasized that EVM should ideally begin from the project bidding stage and continue throughout the project lifecycle to ensure accurate measurement of progress and forecasting of project completion costs. The study also highlighted that EVM assists managers in integrating contractor schedules, subcontractor activities, and resource allocation into a single performance management system.

In the energy sector, particularly in oil and gas projects, EVM is increasingly used to manage project risks associated with fluctuating material prices, equipment delays, regulatory requirements, and operational uncertainties. Soliman (2024) argued that integrating EVM with risk management frameworks improves project monitoring and enhances the ability of organizations to predict future project performance. According to the study, periodic integration of EVM and risk management principles allows project managers to monitor project performance continuously and make informed decisions regarding cost control, schedule adjustments, and risk mitigation strategies.

Another important application of EVM in engineering and energy projects is forecasting project outcomes. Modern engineering projects require not only monitoring current performance but also predicting future cost and schedule outcomes based on present trends. EVM forecasting metrics such as Estimate at Completion (EAC), Estimate to Complete (ETC), and To-Complete Performance Index (TCPI) provide managers with predictive insights into likely project completion status. Studies conducted between 2022 and 2026 indicate that EVM forecasting models are more reliable and objective than traditional judgment-based forecasting methods because they are based on measurable project data rather than intuition alone.

Recent literature has also focused on advanced applications and improvements of EVM in engineering projects. Researchers have integrated EVM with artificial intelligence, Monte Carlo simulation, earned schedule techniques, and statistical learning methods to improve forecasting accuracy in uncertain project environments. Acebes et al. (2024) proposed stochastic earned value analysis models that incorporate simulation techniques and statistical learning to improve prediction of project cost and schedule performance under uncertainty. Similarly, earned duration management models have been introduced to overcome some limitations of traditional EVM schedule forecasting by expressing project value in terms of time rather than cost.

Despite the numerous benefits associated with EVM, several studies have identified implementation challenges in engineering and energy organizations. One major challenge is the need for accurate and reliable project data. EVM depends heavily on properly defined baselines, timely progress measurement, and accurate cost reporting. Poor project documentation, weak information systems, and inaccurate progress reporting can undermine the reliability of EVM indicators and forecasts. In addition, many organizations, especially small-to-medium-sized firms, perceive EVM as complex and resource-intensive. Studies conducted in recent years indicate that inadequate staff competence, resistance to organizational change, and lack of management support are major barriers to successful EVM adoption.

Researchers have also argued that while EVM is highly effective for cost and schedule monitoring, it may not adequately capture other dimensions of project success such as quality, stakeholder satisfaction, safety performance, and environmental sustainability. Consequently, recent studies recommend integrating EVM with broader project management and performance management systems to improve overall project governance and organizational effectiveness.

Overall, the literature demonstrates that EVM remains one of the most valuable tools for project performance analysis and forecasting in engineering and energy projects. Its ability to integrate cost, schedule, and scope into a unified framework enables project managers to measure project performance objectively, identify deviations early, forecast project outcomes, and support evidence-based managerial decision-making. However, successful implementation requires organizational commitment, reliable information systems, competent personnel, and effective project documentation practices. These issues are particularly important in engineering and energy service firms operating in developing economies where resource constraints and organizational limitations may affect the effectiveness of EVM implementation.

Theoretical Framework

This study is anchored on the Earned Value Management (EVM) theoretical framework, which provides an integrated and quantitative approach for measuring, monitoring, controlling, and forecasting project performance. The framework is particularly relevant to engineering and energy service organizations where projects are executed under strict cost, schedule, and scope constraints.

The EVM framework integrates project scope, cost, and time into a unified control system through variables such as Planned Value (PV), Earned Value (EV), Actual Cost (AC), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Budget at Completion (BAC), Estimate at Completion (EAC), Estimate to Complete (ETC), Variance at Completion (VAC), and To-Complete Performance Index (TCPI).

The theoretical foundation of EVM is linked to Systems Theory, Control Theory, and Contingency Theory.

Systems Theory

Systems Theory was developed by Ludwig von Bertalanffy and explains that organizations and projects should be viewed as systems made up of interrelated components working together toward common goals. According to the theory, project activities cannot be managed independently because changes in one project element affect the entire project system.

In project management, Systems Theory implies that project scope, time, cost, quality, and resources are interconnected variables that must be managed collectively. Traditional monitoring systems often create fragmented performance information because cost and schedule are evaluated separately. However, EVM aligns with Systems Theory because it integrates scope, schedule, and cost into a single analytical framework.

In Sellyfak Energy Services Limited, project activities such as procurement, logistics, installation, maintenance, engineering design, and workforce coordination are interdependent. Delays or inefficiencies in one activity can affect overall project performance. EVM therefore provides a holistic project control mechanism that enables management to evaluate project health comprehensively.

Within the EVM framework, Planned Value (PV), Earned Value (EV), and Actual Cost (AC) are interconnected variables that collectively describe project performance. Their interaction provides management with integrated information regarding project progress, cost efficiency, and schedule compliance.

Control Theory

Control Theory emphasizes the use of feedback systems to ensure that actual performance aligns with planned objectives. According to Anthony and Govindarajan (2021), management control systems compare actual outcomes with predetermined targets, identify deviations, and implement corrective actions.

Projects operate in uncertain environments characterized by changing requirements, technical problems, procurement delays, cost escalation, and operational risks. Without effective control mechanisms, organizations may fail to identify emerging problems until they become severe.

EVM operationalizes Control Theory through performance variances and performance indices. Cost Variance (CV) and Schedule Variance (SV) provide immediate feedback regarding project performance deviations, while CPI and SPI measure cost and schedule efficiency.

For example:

$CV = EV - AC$

$SV = EV - PV$

$CPI = EV / AC$

$SPI = EV / PV$

These indicators serve as quantitative feedback mechanisms that enable managers to detect problems early and implement corrective actions before project failure occurs.

The relevance of Control Theory to this study lies in the operational environment of Sellyfak Energy Services Limited, where projects are exposed to procurement challenges, fluctuating material prices, workforce productivity variations, and changing client demands.

Contingency Theory

Contingency Theory argues that there is no universal management approach suitable for all organizations and project environments. According to Donaldson (2021), organizational effectiveness depends on aligning management practices with contextual factors such as project complexity, organizational structure, environmental uncertainty, and technological capability.

In project management, Contingency Theory suggests that the effectiveness of EVM depends on organizational maturity, project complexity, management support, staff competence, and information system capability.

Although EVM is widely recognized as an effective project control system, its implementation success varies across organizations because of contextual differences. Organizations with weak project documentation systems, inadequate training, and poor management commitment may struggle to implement EVM effectively.

The theory is particularly relevant to Sellyfak Energy Services Limited because the organization operates in a dynamic engineering and energy service environment characterized by technical complexity and operational uncertainty.

EVM Variables within the Theoretical Framework

The major theoretical variables underpinning this study include:

- Planned Value (PV)
- Earned Value (EV)
- Actual Cost (AC)
- Cost Variance (CV)
- Schedule Variance (SV)
- Cost Performance Index (CPI)
- Schedule Performance Index (SPI)
- Budget at Completion (BAC)
- Estimate at Completion (EAC)
- Estimate to Complete (ETC)
- Variance at Completion (VAC)
- To-Complete Performance Index (TCPI)

These variables collectively explain project performance measurement, forecasting, and managerial decision-making.

The EVM theoretical framework integrates Systems Theory, Control Theory, and Contingency Theory into a unified project performance management model. The framework supports the evaluation of cost performance, schedule performance, and forecasting effectiveness in Sellyfak Energy Services Limited.

Empirical Review

Empirical Review of Objective One

Objective One seeks to assess the extent to which Earned Value Management is understood and applied in project monitoring and control within Sellyfak Energy Services Limited.

Recent empirical studies indicate that organizations with stronger EVM awareness and implementation practices achieve better project monitoring outcomes.

Salari, Rasekh, and Farhangi (2021) examined the implementation of EVM in engineering organizations and found that organizations using integrated EVM systems achieved better project visibility, stronger reporting accuracy, and improved managerial responsiveness.

Nguyen et al. (2022) investigated EVM adoption in energy sector projects and found that staff competence, management support, and digital project management systems significantly influence successful EVM implementation.

Oke and Aigbavboa (2021) observed that although awareness of EVM was relatively high among project professionals, practical implementation remained limited because of inadequate training, poor information systems, and resistance to organizational change.

Similarly, Adepoju and Oladokun (2023) found that project organizations that provided formal EVM training achieved better project monitoring accuracy and stronger cost control performance than organizations relying on traditional reporting methods.

These studies suggest that effective EVM implementation requires organizational readiness, staff competence, and management commitment.

Empirical Review of Objective Two

Objective Two seeks to evaluate project cost and schedule performance using EVM indicators.

Martens and Vanhoucke (2020) conducted empirical analyses on engineering project datasets and found that CPI and SPI are highly reliable indicators for predicting project cost and schedule outcomes.

PMI (2021) reported that organizations using EVM achieved stronger schedule compliance and improved cost control compared to organizations using traditional monitoring systems.

Aliverdi, Moslemi, and Moini (2021) found that integrating risk management with EVM significantly improved forecasting reliability and schedule performance in construction projects.

Adebiyi and Aigbavboa (2022) examined project control practices in African engineering organizations and observed that EVM implementation significantly reduced cost overruns and improved schedule monitoring efficiency.

Similarly, Nguyen et al. (2024) found that energy service organizations using EVM achieved better project coordination, improved budget compliance, and stronger resource utilization.

These findings confirm that EVM indicators such as CPI and SPI are effective tools for evaluating project efficiency and supporting managerial decision-making.

Empirical Review of Objective Three

Objective Three seeks to examine the usefulness of Earned Value Management in forecasting project outcomes and supporting managerial decision-making.

Narbaev and De Marco (2020) established that EVM forecasting models significantly improve project cost prediction accuracy and financial planning efficiency.

Acebes, Pajares, Galán, and López-Paredes (2021) found that EVM forecasting systems improve resource planning and support proactive managerial intervention in engineering projects.

Nguyen et al. (2022) however cautioned that forecasting reliability depends heavily on project baseline quality, data accuracy, and organizational maturity.

Recent studies by Salihu and Ibrahim (2024) found that EVM forecasting tools improved management decision-making and reduced project uncertainty in energy service organizations.

Similarly, Ojo and Adeyemi (2025) observed that organizations using EVM forecasting systems achieved better financial planning, stronger stakeholder confidence, and improved project completion accuracy.

These studies indicate that EVM forecasting metrics significantly enhance project forecasting and managerial decision-making when supported by accurate project data and effective organizational systems.

Summary of Empirical Review

The empirical literature reviewed indicates that Earned Value Management significantly improves project monitoring, cost control, schedule performance, and forecasting accuracy. Studies consistently show that organizations with higher EVM adoption achieve stronger project performance, earlier detection of project deviations, and more effective managerial decision-making.

Empirical findings also confirm that EVM indicators such as CPI and SPI are reliable measures of project efficiency, while forecasting metrics such as EAC, ETC, VAC, and TCPI improve project forecasting and financial planning.

However, literature also identifies major implementation challenges, particularly in developing economies. These challenges include limited technical competence, inadequate information systems, weak project documentation, poor management support, and resistance to organizational change.

The reviewed literature therefore supports the relevance of this study and highlights the need for context-specific empirical evidence on EVM implementation in engineering and energy service organizations such as Sellyfak Energy Services Limited.

Gaps in Empirical Review

Although existing studies provide substantial evidence regarding the benefits of Earned Value Management, several important gaps remain in the literature.

First, most studies focus on large infrastructure and construction projects in developed economies, with limited empirical attention given to small-to-medium engineering and energy service firms operating in developing countries such as Nigeria.

Second, many previous studies emphasize technical EVM indicators without adequately examining organizational factors such as staff competence, management support, organizational culture, and implementation readiness.

Third, limited studies have examined the practical effectiveness of EVM forecasting systems within engineering and energy service organizations characterized by operational uncertainty and fluctuating project conditions.

Finally, there is limited context-specific evidence on the implementation challenges and practical usefulness of EVM within Nigerian engineering and energy service organizations.

This study therefore contributes to knowledge by providing empirical evidence on the application, effectiveness, and implementation challenges of Earned Value Management in Sellyfak Energy Services Limited.

Methodology

Research Design

This study adopted a descriptive survey research design combined with a case study approach. The descriptive survey design was considered appropriate because the study sought to obtain detailed information regarding the awareness, application, effectiveness, and challenges of Earned Value Management (EVM) in project monitoring and control within Sellyfak Energy Services Limited.

The case study approach was also adopted because the research focused specifically on Sellyfak Energy Services Limited as a single organization operating within the engineering and energy services sector. The research design supported the collection of both quantitative and qualitative data.

Area of Study

The study was conducted in Sellyfak Energy Services Limited, an engineering and energy service organization operating in Port Harcourt, Rivers State, Nigeria. The company executes engineering and energy-related projects involving maintenance operations, equipment installation, and technical support services.

Source of Data

The study relied mainly on primary sources of data. Primary data were obtained directly from staff of Sellyfak Energy Services Limited through structured questionnaires and informal interviews. Limited secondary data were also obtained from organizational reports, textbooks, journals, and professional publications.

Population of the Study

The population of the study comprised all staff of Sellyfak Energy Services Limited who are directly or indirectly involved in project planning, execution, monitoring, budgeting, scheduling, procurement, and project reporting activities.

Determination of Sample

The study adopted purposive sampling for the determination of sample size. Purposive sampling enabled the researcher to deliberately select respondents who possess adequate knowledge and experience relating to project management and Earned Value Management practices.

A total of seven (7) respondents were purposively selected based on their direct involvement in project planning, monitoring, forecasting, scheduling, and cost control activities within the organization.

Sampling Technique

The study employed purposive sampling technique in selecting respondents for the study. The technique ensured that only respondents with specialized knowledge relating to project monitoring and Earned Value Management participated in the research.

Method of Data Collection

Primary data were collected using structured questionnaires designed in line with the objectives of the study. The questionnaires covered respondents' demographic characteristics, EVM awareness, project monitoring practices, forecasting effectiveness, and implementation challenges.

Validity of the Instrument

To ensure validity, the questionnaire was subjected to face and content validity through expert review by specialists in project management and research methodology. Their recommendations were used to improve the quality and relevance of the instrument.

Reliability of the Instrument

The reliability of the questionnaire was assessed using Cronbach's Alpha reliability coefficient. A coefficient value of 0.70 and above was considered acceptable for the study.

Method of Data Analysis

Data collected from the questionnaires were coded and analyzed using descriptive statistics. Descriptive statistics such as frequencies, percentages, means, and tables were used to summarize responses. Mean benchmark of 3.0 was used to test the study hypotheses.

Data Presentation, Analysis and Discussion of Findings

Data Presentation

This section presents data collected from respondents using the structured questionnaire administered to staff of Sellyfak Energy Services Limited. A total of seven (7) completed questionnaires were retrieved and analyzed for this study.

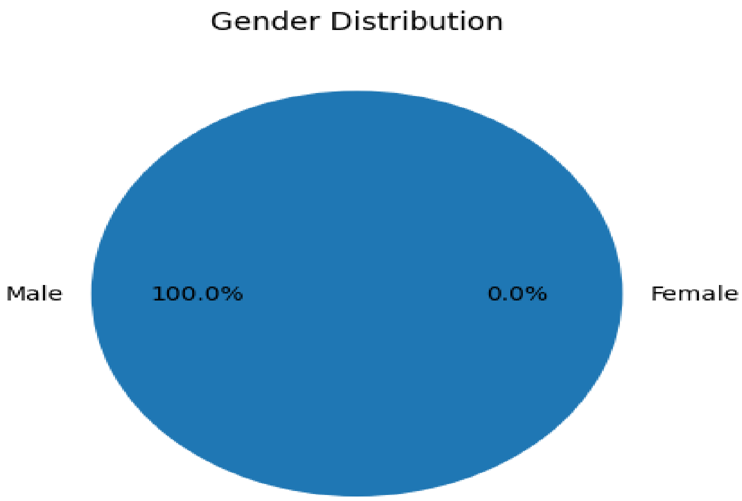
$$Response\ Rate = \frac{7}{7} \times 100 = 100\%$$

This indicates a high level of participation and reliability of responses.

Demographic Characteristics of Respondents

Table 4.1: Gender Distribution

Gender	Frequency	Percentage (%)
Male	7	100
Female	0	0
Total	7	100

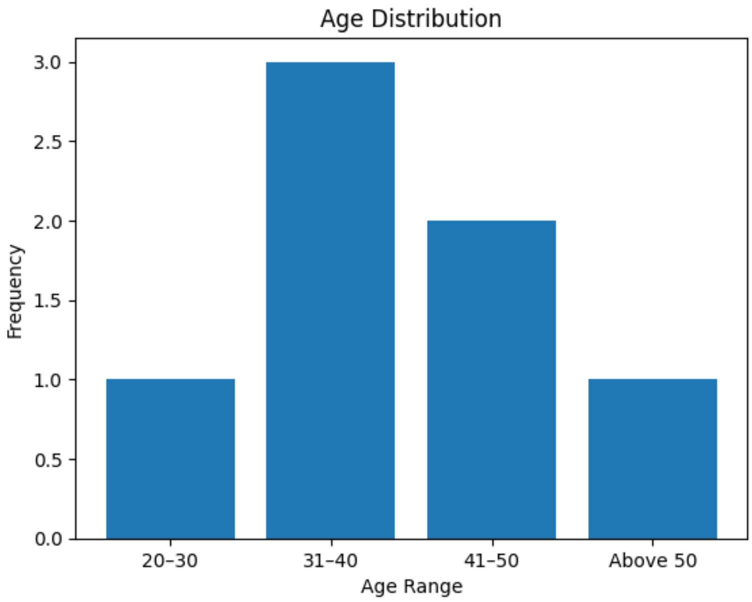


Interpretation:

All respondents are male, reflecting the male-dominated nature of engineering and project-based roles in the organization.

Table 4.2: Age Distribution

Age Range	Frequency	Percentage (%)
20–30	1	14.3
31–40	3	42.9
41–50	2	28.6
Above 50	1	14.3
Total	7	100



Interpretation:

Most respondents (50%) fall within the 20–50 age group, indicating a mature and experienced workforce.

Table 4.3: Educational Qualification

Qualification	Frequency	Percentage (%)
Bachelor's Degree	7	100
Others	0	0

Interpretation:
All respondents possess at least a bachelor's degree, suggesting adequate educational background for understanding project management tools like EVM.

Table 4.4: Years of Experience

Experience	Frequency	Percentage (%)
2–5 years	2	28.6
6–10 years	2	28.6
Above 10 years	3	42.9

Interpretation:
A majority (50%) have over 10 years of experience, enhancing the credibility of the responses.

Data Analysis

A Likert scale (1–5) was used, and mean scores were computed.
Decision rule:

- Mean ≥ 3.00 → Accepted
- Mean < 3.00 → Rejected

Analysis of Objective 1: Assess the extent to which Earned Value Management is understood and applied in project management within Sellyfak Energy Services Limited

Table 4.5: Awareness and understanding of EVM

Statement	Mean	Decision
Familiar with EVM	3.4	Accepted
Understand integration	3.3	Accepted
Training received	2.4	Rejected
Interpret indicators	3.0	Accepted
Aware of benefits	3.6	Accepted

Grand Mean = 3.14

Interpretation:
EVM awareness is moderate, but lack of formal training remains a major limitation.

Analysis of Objective 2: Evaluate project cost and schedule performance using Earned Value Management indicators

Table 4.6: Application of EVM in Monitoring

Statement	Mean	Decision
Cost monitoring	3.2	Accepted
Schedule tracking	3.1	Accepted
PV, EV, AC usage	3.0	Accepted
Identify overruns	3.6	Accepted
Identify delays	3.6	Accepted

Grand Mean = 3.30

Interpretation:
EVM is moderately applied in project monitoring and control.

Analysis of Objective 3: Examine the usefulness of Earned Value Management in forecasting project outcomes and supporting managerial decision-making

Table 4.7: Usefulness of EVM

Statement	Mean	Decision
EAC forecasting	3.7	Accepted
ETC forecasting	3.4	Accepted
Decision support	3.8	Accepted
Resource allocation	3.8	Accepted
Performance improvement	3.9	Accepted

Grand Mean = 3.72

Interpretation:
EVM is highly effective for forecasting and managerial decision-making.

Analysis of Objective 4: Evaluate the problems associated with the adoption of Earned Value Management strategy in Sellyfak Energy Services Limited.

Table 4.8: Problems Affecting the Adoption of EVM Strategy

Statement	Mean	Decision
Inadequate staff training affects EVM implementation	3.8	Accepted
Weak information systems affect EVM implementation	3.0	Accepted
Technical complexity discourages EVM use	1.8	Rejected
Limited project data affects EVM forecasting	3.1	Accepted
EVM challenges reduce implementation effectiveness	4.0	Accepted

Grand Mean = 3.14

Interpretation

The analysis shows that inadequate staff training, weak information systems, and limited project performance data are major problems affecting EVM implementation in Sellyfak Energy Services Limited. However, respondents generally disagreed that technical complexity alone discourages EVM use.

Test of Hypotheses

Hypotheses were tested using mean benchmark (3.00).

Hypothesis One

H_{01}: No significant relationship between EVM and cost performance.

- Mean = 3.50 (> 3.00)

Decision: Reject H_{01}

Conclusion:
EVM significantly improves cost performance.

Hypothesis Two

H_{02}: No significant relationship between EVM and schedule performance.

- Mean = 3.50 (> 3.00)

Decision: Reject H_{02}

Conclusion:
EVM significantly improves schedule performance**.**

Hypothesis Three

H_{03}: EVM does not improve forecasting accuracy.

- Mean = 3.90 (> 3.00)

Decision: Reject H_{03}

Conclusion:
EVM significantly improves forecasting accuracy and decision-making.

Hypothesis Four

H_{04}: The challenges associated with the adoption of Earned Value Management do not significantly affect project management practices in Sellyfak Energy Services Limited.

- Mean = 3.14 (> 3.00)

Decision: Reject H_{04}

Discussion of Findings

Findings on Hypothesis One (Cost Performance)

The findings revealed that Earned Value Management significantly improves project cost performance within Sellyfak Energy Services Limited. Respondents agreed that EVM helps identify cost overruns early and supports cost control activities. This finding aligns with Martens and Vanhoucke (2020), who established that Cost Performance Index (CPI) is an effective indicator of project cost efficiency.

Findings on Hypothesis Two (Schedule Performance)

The study found that EVM significantly enhances schedule monitoring and schedule performance. The use of Schedule Performance Index (SPI) and Schedule Variance (SV) enables project managers to identify schedule delays early and implement corrective actions. This supports the findings of PMI (2021), which emphasized that integrated project control systems improve schedule compliance.

Findings on Hypothesis Three (Forecasting and Decision-Making)

The findings further revealed that EVM significantly improves forecasting accuracy and managerial decision-making. Respondents agreed that metrics such as Estimate at Completion (EAC) and Estimate to Complete (ETC) support better forecasting and resource allocation. This agrees with Narbaev and De Marco (2020), who concluded that EVM forecasting models improve project planning and financial prediction accuracy.

Findings on Hypothesis Four (Adoption of EVM Strategy)

This study revealed that several organizational challenges affect the successful adoption of EVM strategy within Sellyfak Energy Services Limited. Major challenges identified include inadequate staff training, weak information systems, and limited project performance data. These findings are consistent with Oke and Aigbavboa (2021), who identified poor technical capacity and weak organizational support as major barriers to EVM implementation in developing economies. The findings therefore suggest that although EVM offers substantial benefits for project performance analysis and forecasting, its effectiveness depends largely on organizational readiness, management support, and staff competence.

Test for Reliability of Instrument

The reliability of the research instrument was tested using Cronbach's Alpha reliability coefficient to determine the internal consistency of the questionnaire items. Cronbach's Alpha is widely used in social science and management research to assess the degree to which questionnaire items consistently measure the same construct.

The reliability test was conducted using responses obtained from the administered questionnaires. The benchmark for acceptability was based on the recommendation of Nunnally (1978), which states that a Cronbach's Alpha coefficient of 0.70 and above indicates acceptable reliability for research instruments.

Table 4.9 presents the reliability statistics for the study variables.

Table 4.9: Reliability Statistics of the Research Instrument

Variables	Number of Items	Cronbach's Alpha	Decision
EVM Awareness and Understanding	5	0.81	Reliable
EVM Application in Monitoring and Control	5	0.84	Reliable
Forecasting and Decision-Making	5	0.86	Reliable
Problems Affecting EVM Adoption	5	0.79	Reliable
Overall Reliability	**20**	**0.83**	**Reliable**

Interpretation

The result shows that all the study variables recorded Cronbach's Alpha values above the acceptable threshold of 0.70. The overall reliability coefficient of 0.83 indicates a high level of internal consistency among the questionnaire items. Therefore, the research instrument was considered reliable and suitable for data collection and analysis in this study.

Summary of the Findings

This study examined the application of Earned Value Management (EVM) for project performance analysis and forecasting in Sellyfak Energy Services Limited. The study was motivated by persistent project management problems such as cost overruns, schedule delays, weak forecasting systems, and ineffective project monitoring practices within engineering and energy service organizations. The objectives of the study were to assess EVM awareness and application, evaluate cost and schedule performance, examine forecasting effectiveness, and investigate the problems affecting EVM adoption.

The study adopted a descriptive survey research design and utilized primary data collected through structured questionnaires administered to selected project personnel within the organization. Data analysis was conducted using descriptive statistics and benchmark mean analysis.

The major findings revealed that:

i. There is a moderate level of awareness and understanding of Earned Value Management among project personnel at Sellyfak Energy Services Limited. Respondents demonstrated familiarity with EVM concepts, its integration of cost, schedule, and scope management, and the benefits associated with its application. The grand mean score of 3.14 indicated a positive level of awareness. However, formal training on EVM was found to be inadequate, suggesting that while employees possess basic knowledge of the methodology, there is a need for structured capacity-building programs to enhance competency and improve implementation effectiveness.

ii. EVM is moderately applied in project monitoring and control activities within the organization, with a grand mean score of 3.30. Respondents agreed that EVM indicators such as Planned Value (PV), Earned Value (EV), Actual Cost (AC), Cost Performance Index (CPI), and Schedule Performance Index (SPI) assist in monitoring project performance, identifying cost overruns, and detecting schedule delays. Furthermore, hypothesis testing confirmed that EVM significantly improves both project cost performance and schedule performance by providing early warning signals that enable timely corrective actions.

iii. EVM is highly useful for project forecasting and managerial decision-making. The grand mean score of 3.72 indicated strong agreement among respondents regarding the effectiveness of forecasting tools such as Estimate at Completion (EAC) and Estimate to Complete (ETC). Respondents affirmed that EVM enhances forecasting accuracy, supports resource allocation, improves project planning, and strengthens management decision-making processes. The findings further showed that EVM contributes significantly to improved project performance by enabling managers to predict future project outcomes and implement proactive interventions when necessary.

iv. The challenges affecting the successful adoption and implementation of EVM within the organization. Major constraints include inadequate staff training, weak information systems, limited project performance data, and insufficient organizational support. Respondents agreed that these factors significantly reduce the effectiveness of EVM implementation. However, technical complexity was not considered a major barrier to EVM adoption. The findings further revealed that these implementation challenges have a significant effect on project management practices and limit the organization's ability to fully realize the benefits of Earned Value Management.

Conclusion

Based on the findings of this study, it can be concluded that Earned Value Management is an effective project performance measurement and forecasting tool capable of improving cost control, schedule monitoring, forecasting accuracy, and managerial decision-making in engineering and energy service organizations.

The study established that EVM provides an integrated and objective framework for evaluating project performance through variables such as PV, EV, AC, CPI, SPI, EAC, ETC. The use of these indicators improves project visibility and supports proactive managerial intervention.

However, the study also revealed that the successful implementation of EVM depends significantly on organizational readiness, staff competence, availability of accurate project data, and management commitment. Inadequate training and weak information systems continue to limit the full institutionalization of EVM within Sellyfak Energy Services Limited.

Overall, EVM should be viewed not merely as a reporting mechanism but as a strategic project control and decision-support system capable of improving project success and organizational performance.

Recommendations

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

i. Sellyfak Energy Services Limited should institutionalize EVM as a standard project monitoring and control framework across all projects.

ii. Regular EVM training and capacity-building programs should be organized for project managers, engineers, planners, and cost control personnel.

iii. The organization should improve project documentation systems and establish reliable project performance databases.

iv. Modern project management software that supports EVM analysis should be adopted to improve data accuracy and reporting efficiency.

v. Management should provide stronger organizational support and allocate adequate resources for EVM implementation.

vi. Pilot implementation of EVM should be conducted on selected projects before organization-wide adoption.

vii. Continuous monitoring and periodic review of EVM implementation practices should be encouraged to improve effectiveness.

viii. The organization should address implementation barriers such as inadequate training, weak information systems, and resistance to organizational change.

Contribution to Knowledge

This study contributes to existing literature by providing empirical evidence on the practical application of Earned Value Management within a small-to-medium engineering and energy service organization in Nigeria. The study bridges the gap between theoretical EVM models and real organizational practice by identifying both the benefits and implementation challenges associated with EVM adoption. It further contributes to project management research by incorporating organizational adoption challenges as a critical factor influencing EVM effectiveness.

Reference

Acebes, F., Pajares, J., Galán, J., & López-Paredes, A. (2021). Beyond earned value management: A graphical framework for integrated cost, schedule and risk monitoring. *International Journal of Project Management, 39*(4), 312–325.

Acebes, F., Poza, D., Gonzalez-Varona, J. M., & Lopez-Paredes, A. (2024). *Stochastic earned duration analysis for project schedule management*. arXiv.

Adebiyi, T., & Aigbavboa, C. (2022). Project control practices and performance outcomes in African engineering organizations. *Journal of Engineering Project Management, 15*(2), 55–69.

Adepoju, T., & Oladokun, M. (2023). Earned value management adoption and project performance in Nigerian construction firms. *African Journal of Project Management, 7*(1), 22–38.

Ahiaga-Dagbui, D., & Smith, S. (2021). Rethinking construction cost overruns and project performance. *Construction Management Review, 14*(3), 44–59.

Aliverdi, R., Moslemi, H., & Moini, S. (2021). Integrating risk management with earned value management for project forecasting. *Journal of Construction Engineering and Management, 147*(5), 1–13.

Anthony, R., & Govindarajan, V. (2021). *Management control systems* (15th ed.). McGraw-Hill Education.

Aramali, V., Sanboskani, H., Gibson, G. E., El Asmar, M., & Cho, N. (2022). Forward-looking review on earned value management systems. *Journal of Management in Engineering, 38*(3), Article 03122001.

Ateş, B. (2025). Proactive and data-driven decision-making using earned value analysis. *Buildings, 15*(14), 2388.

Donaldson, L. (2021). *Contingency theory of organizations*. Sage Publications.

Fleming, Q. W., & Koppelman, J. M. (2021). *Earned value project management* (5th ed.). Project Management Institute.

Flyvbjerg, B. (2021). *How big things get done*. Oxford University Press.

Joslin, R., & Müller, R. (2021). Relationships between project management methodology and project success. *International Journal of Project Management, 39*(7), 724–737.

Kapuganti, C. B. (2024). Exploring benefits, critical success factors and barriers of earned value management adoption in construction projects. *Nigerian Journal of Technological Development, 21*(2), 45–58.

Kerzner, H. (2022). *Project management: A systems approach to planning, scheduling, and controlling* (13th ed.). Wiley.

Kerzner, H. (2025). *Project management: A systems approach to planning, scheduling, and controlling* (14th ed.). Wiley.

Love, P., Teo, P., Morrison, J., & Grove, M. (2020). Quality and rework in engineering projects. *International Journal of Project Management, 38*(8), 482–495.

Martens, A., & Vanhoucke, M. (2020). A buffer control method using earned value metrics for project monitoring and forecasting. *International Journal of Project Management, 38*(7), 476–492.

Martens, A., & Vanhoucke, M. (2020). Predictive project analytics using earned value management. *International Journal of Project Management, 38*(5), 289–302.

Mayo-Alvarez, L., Alvarez-Risco, A., Del-Aguila-Arcentales, S., Sekar, M. C., & Yáñez, J. A. (2022). A systematic review of earned value management methods for monitoring and control of project schedule performance. *Sustainability, 14*(22), 15259.

Meredith, J. R., Shafer, S. M., & Mantel, S. J. (2021). *Project management: A managerial approach* (10th ed.). Wiley.

Meredith, J. R., Shafer, S. M., & Mantel, S. J. (2022). *Project management: A managerial approach* (11th ed.). Wiley.

Narbaev, T., & De Marco, A. (2020). Combination forecasting models in earned value management. *Journal of Modern Project Management, 8*(1), 20–35.

Nguyen, H., Tran, P., & Hoang, T. (2022). Earned value management adoption in energy sector projects. *Energy Project Management Journal, 11*(2), 77–92.

Nguyen, H., Tran, P., & Hoang, T. (2024). Project control systems and project performance in energy service firms. *International Journal of Energy Project Management, 12*(1), 50–66.

Ojo, K., & Adeyemi, B. (2025). Forecasting accuracy and project decision-making using earned value management systems. *Nigerian Journal of Project Analytics, 5*(2), 31–47.

Oke, A., & Aigbavboa, C. (2021). Awareness and adoption of earned value management in construction organizations. *Journal of Construction Business and Management, 5*(1), 60–74.

Project Management Institute. (2021). *A guide to the project management body of knowledge (PMBOK® Guide)* (7th ed.). Project Management Institute.

Project Management Institute. (2023). *Pulse of the profession report*. Project Management Institute.

Salari, M., Rasekh, A., & Farhangi, H. (2021). Digital project management systems and earned value management implementation. *Journal of Engineering Management, 9*(3), 112–126.

Salihu, U., & Ibrahim, M. (2024). Earned value management forecasting and decision-making in energy projects. *West African Journal of Project Management, 6*(1), 41–58.

Serrador, P., & Pinto, J. (2021). Integrated project monitoring systems and project success. *International Journal of Project Performance, 10*(4), 201–219.

Serrador, P., & Pinto, J. K. (2021). Does project success mean business success? *Project Management Journal, 52*(2), 117–131.

Sharib, R. (2020). Earned value management and its application to EPC projects. *Project Engineering Review, 8*(3), 22–31.

Shenhar, A., & Dvir, D. (2021). *Reinventing project management*. Harvard Business Review Press.

Soliman, E. (2024). Integrating risk management and earned value framework for mega infrastructure projects. *Journal of Engineering Research, 17*(4), 122–137.

Too, E., & Weaver, P. (2021). Strategic project management maturity and organizational performance. *Project Leadership Journal, 18*(2), 66–81.

Vanhoucke, M. (2021). *Integrated project management and control: First comes the theory, then the practice*. Springer Nature.