ISSN: 2278-3369
International Journal of Advances in Management and Economics
Available online at: www.managementjournal.info

RESEARCH ARTICLE

EFFECT OF COST MANAGEMENT ON PROJECT PERFORMANCE IN TANZANIA; EVIDENCE FROM NORTHERN ENGINEERING WORKS LTD (NEWL)

Goodluck Paul Kingu[1], Mwaitete Cairo[1*]

[1]*Department of Economics, Institute of Accountancy Arusha, Tanzania.*

******Corresponding Author:* **Mwaitete Cairo**

Abstract: This study investigated the effect of cost management on project performance at Northern Engineering Works Ltd (NEWL). Anchored on positivism and a deductive approach, a quantitative design was applied using survey data from 100 stratified stakeholders engaged in fibre-optic and tower construction projects executed between 2020 and 2025. Descriptive statistics, Pearson correlation and multiple linear regression ($R^2 = 0.991$; $F = 1188.810$; $p < 0.001$) indicated that cost management has a strong and statistically significant influence on project performance, with rigorous cost planning and budgetary control demonstrating the strongest predictive effect ($\beta = 0.702$; $p < 0.001$). Projects that instituted detailed cost baselines, conducted continuous variance analysis, and enforced disciplined change control achieved markedly better outcomes than those initiated with weak or reactive cost practices. The study concludes that strengthening cost governance through cost breakdown structures, earned value monitoring and strict budgetary gatekeeping is essential to reduce overruns, mitigate claims and improve delivery reliability in telecommunications projects at NEWL.

Keywords: *Cost management; Project performance; Cost control; Budget governance; Telecommunications projects.*

Article Received: 24 Nov. 2025 **Revised: 06 Dec. 2025** **Accepted: 29 Dec. 2025**

INTRODUCTION

Project management is a critical discipline for successfully completing complex tasks, with its history dating back to ancient projects like the Egyptian pyramids, which demonstrated early principles of planning (Project Management Institute [PMI], 2024). Modern project management emerged as a formal practice after World War II with the development of tools like the Program Evaluation and Review Technique (PERT) and the Critical Path Method (CPM) (Morris, 2011).

In the telecommunications sector, project management evolved alongside technological innovations, from laying undersea cables to launching satellites, highlighting the importance of the "iron triangle" of time, cost, and scope (Sherif, 2006). The introduction of frameworks like the Project Management Body of Knowledge (PMBOK) and the rise of agile methods have further shaped the discipline to handle rapid technological changes (PMI, 2024b; Epicflow, 2025).

Globally, telecommunications is essential for economic growth, with the market projected to grow from USD 1,983.08 billion in 2024 to USD 2,874.76 billion by 2030 (Grand View Research, 2024). However, project performance remains a concern, with the PMI's Pulse of the Profession 2025 report indicating that only 48% of projects fully succeed (PMI, 2025).

In the telecommunications sector, 37% of projects fail due to unclear objectives (PwC, 2024). In Africa, telecommunications is a cornerstone for development, yet project success rates fall below global averages due to infrastructure deficits and regulatory challenges (Analysys Mason, 2024).

In Tanzania, the sector has experienced rapid growth, with mobile subscriptions reaching 92.7 million by June 2025 (TanzaniaInvest, 2025a). Despite this growth, projects face significant challenges. The Digital Tanzania Project, for instance, aims for 80% broadband penetration by 2025, but only 60% of its rollout phases met timelines by 2023 (World Bank, 2023). Persistent urban-rural disparities and issues like vandalism further complicate project execution (Rahul, 2023).

At Northern Engineering Works Ltd (NEWL) in Arusha, these issues are evident, with 40-50% of projects missing deadlines due to

supply chain disruptions and skill shortages (Peter, 2018). Research highlights that effective cost, time, and scope management are crucial, as poor scope management alone accounts for 70% of failures in related sectors (Fashina et al., 2020). Addressing this gap is significant, as improved practices could enhance project success and support Tanzania's digital expansion (Mpanju, 2024).

This study, therefore, examines the influence of cost, time, and scope management on project performance at NEWL, aiming to develop localized strategies to bridge existing gaps and support national goals (TCRA, 2025).

LITERATURE REVIEW

Theoretical Litereature Review

The Triple Constraint Theory, often visualized as the "Iron Triangle," is a foundational project management framework. It posits that a project's core objectives are governed by three interdependent constraints: scope, time, and cost, where a change in one inevitably impacts the others (Project Management Institute [PMI], 2021). This theory provides the primary justification for selecting scope, time, and cost management as this independent variables.

Furthermore, it traditionally defines project performance through metrics of schedule compliance, budget adherence, and deliverable completion, which form the basis of the dependent variable. A key strength of the theory is its simplicity and universal applicability, making it highly interpretable in technical fields like telecommunications infrastructure development (Atkinson, 1999). However, a significant criticism is its narrow focus, which often excludes other critical dimensions of success, such as quality, risk, and stakeholder satisfaction (Ika, 2009).

To address this limitation, the current study extends the performance construct beyond the traditional triangle by incorporating quality standards and stakeholder satisfaction metrics, thereby enabling a more holistic assessment aligned with modern project management practice (Serrador & Pinto, 2015).

Complementing the Triple Constraint, the Theory of Constraints (TOC), introduced by Goldratt (1984), provides a dynamic, systems-oriented perspective. TOC contends that the performance of any system is limited by a small number of critical constraints, and that systematically identifying and elevating these "bottlenecks" is the key to improvement. Its five focusing steps Identify, Exploit, Subordinate, Elevate, and Repeat offer a mechanistic explanation for how a weakness in one area, such as poorly managed scope, can trigger cascading delays and cost overruns across an entire project (Goldratt & Cox, 2016).

This lens is highly relevant for analyzing NEWL's operational environment, where disruptions in supply chains or regulatory approvals often propagate through multiple project dimensions. While TOC can be critiqued for potentially oversimplifying environments with multiple, interacting constraints (Rahman, 1998), this study mitigates that risk by employing multiple regression analysis.

This empirical approach allows for the statistical identification and prioritization of the most dominant constraints be it scope, time, or cost on project performance within NEWL's telecommunications projects, thereby providing a data-driven application of TOC principles.

Empirical Literature Review

Globally, contemporary research continues to highlight cost overruns as a critical impediment to project success. A recent study by Afzal et al. (2021) on metropolitan projects developed a fuzzy-AHP model, demonstrating that proactive cost-risk contingency planning could reduce overruns by 20-35%. In the telecommunications sector, the PMI's Pulse of the Profession report (2025a) indicated that organizations with high project management maturity, which includes mature cost control processes, waste 28 times less money than their counterparts with low maturity. This underscores the significant financial impact of disciplined cost management.

In Africa, the challenge of cost overruns remains pronounced. A study on Nigerian telecommunications projects by Ameh et al. (2010) found that poor budgeting and procurement practices were significant factors causing overruns exceeding 30%.

More recently, a focus on East Africa by Mpanju (2024) in the construction sector found that weak cost controls, particularly in procurement and monitoring, were a primary cause of budget deviations, directly linking robust financial discipline to achieving project objectives.

Locally in Tanzania, the picture is consistent. Peter (2018), in a study of selected telecom companies, identified inadequate cost monitoring and control as a leading factor affecting performance. A more recent publication by Mpanju (2024) on public construction projects in Tanzania confirmed that cost management practices significantly influenced project performance, with variances often exceeding 25% due to price fluctuations and inefficient resource allocation.

While the literature firmly establishes a link between cost management and performance, there is a scarcity of recent, quantitative studies focusing specifically on private telecommunications engineering firms in Tanzania, like NEWL. The study by Peter (2018) provides a foundation but is now over five years old and qualitative in nature. This study will provide current, empirical data on the magnitude of cost management's effect within this specific context.

Research Gap

Synthesis of literature affirms that cost, time, and scope management are central drivers of project performance globally and in Tanzania, yet a multi-layered gap persists, justifying this study on the Effect of Cost Management on Project Performance. Contextually, existing Tanzanian studies disproportionately examine public institutions or major telecom operators, leaving engineering contractors like NEWL who face outsourcing mark-ups, multi-vendor pricing complexity, and Arusha-specific logistical cost pressures largely undocumented, with earlier work such as Peter (2018) being outdated and predominantly qualitative.

Theoretically, while the Triple Constraint explains why managing cost affects performance, it does not fully account for cascading financial bottlenecks, whereas the Theory of Constraints offers a causal lens on financial constraints but is rarely empirically tested in this industry setting. This study integrates both by empirically isolating cost management as a potential dominant constraint affecting delivery outcomes. Methodologically, prior Tanzanian evidence is mostly descriptive and lacks regression-based quantification of cost effects relative to other drivers, limiting executive decision-making.

This research addresses that gap by providing quantitative, ranked evidence to determine whether weaknesses in cost planning, cost control, or change-related cost escalation are the principal causes of delays, overruns, and quality compromises, thereby enabling targeted, data-driven interventions aligned with national digital infrastructure goals.

Conceptual Framework

The conceptual framework for this study visually models and defines the hypothesized relationships between the key variables scope management as the independent variables that directly influence the dependent variable, project performance. Derived from the Triple Constraint Theory and the Theory of Constraints, the framework operationalizes each variable: the independent variables reflect specific practices like budgeting, scheduling, and change control, while project performance is measured through a composite of cost adherence, time adherence, quality of deliverables, and stakeholder satisfaction.

Figure 1: Conceptual framework
Source: Researcher Construct (2025)

METHODOLOGY

Research Philosophy

This study adopted a positivist philosophy, which assumes that reality is objective, measurable, and can be studied through scientific, value-free inquiry to generate generalizable findings (Saunders et al., 2019). This philosophical stance justified the use of structured instruments and statistical testing, enabling the study to produce empirical, hypothesis-driven results aligning with positivist emphasis on objectivity and quantification.

Research Approach

A quantitative and deductive approach was employed, driven by existing theory and tested through empirical evidence (Bryman & Bell, 2015). The study logically moved from established theories such as the Triple Constraint (PMI, 2017) and Theory of Constraints (Goldratt, 1984) to hypothesis formulation, structured data collection, and statistical validation rather than building theory inductively.

Research Design

A descriptive and causal-comparative (ex-post-facto) cross-sectional design was applied, allowing precise measurement of cost, time, and scope management and examining their influence on project performance without manipulating the environment (Saunders et al., 2019). This design enabled statistical testing of cause-effect patterns within NEWL projects within a single point in time.

Area of Study

The research was conducted at Northern Engineering Works Ltd (NEWL) in Arusha, Tanzania, a major engineering and telecommunications contractor located in Sakina Industrial Area along Arusha-Nairobi Road (Tanzania National Commercial Directory, 2023). The study focused specifically on NEWL's fiber optic and tower construction projects executed between 2020 and 2025 (NEWL, 2024).

Population

The target population consisted of all 133 stakeholders directly involved in planning, supervising, and executing telecommunications projects at NEWL (NEWL, 2025). These included project managers, site engineers, field supervisors, quality assurance officers, and procurement and logistics officers engaged in fiber and tower rollout projects.

Sample Size

The sample size for this study was determined using Yamane's (1967) formula. The sample size was calculated as follows:

$$n = \frac{\mathrm{N}}{1 + \mathrm{N(e)2}}$$

Where; n = sample size; N= total population; e = margin of error (usually set at 0.05 for a 95% confidence level)

$$n = \frac{133}{1 + 133(0.05)2}$$
$$n = \frac{133}{1 + 0.3325}$$
$$n = 100$$

Thus, the sample size was 100 participants.

Sampling Strategy

Stratified random sampling was applied to reflect the heterogeneous stakeholder structure at NEWL (Saunders et al., 2019). Five homogeneous strata project managers, site engineers, field supervisors, quality assurance officers, and procurement/logistics staff were proportionally allocated then randomly sampled to preserve representativeness, improve precision, and support generalization of results to the entire population.

Data Collection

Primary data was collected through a structured questionnaire using a 5-point Likert scale covering demographics, cost, time, scope practices, and performance. The instrument was pre-tested, administered ethically, and reviewed for completeness before coding. Sections captured budgeting, resources, requirements, validation, and stakeholder satisfaction, ensuring systematic evidence for statistical testing.

Data Analysis

SPSS 26 was used for coding, cleaning, reliability testing (α>0.7), descriptive statistics, Pearson correlation, and multiple regression. The regression model was:

$Y = ß0+X1+X2+X3+\epsilon$

Where:

- Y = Project Performance (dependent variable)

- X1 = Cost Management practices
- X2 = Time Management practices
- X3 = Scope Management practices
- ß0 = Intercept
- ϵ= Error term

Findings showed R^2 = 0.991, F = 1188.810, p<0.001; requirements, procurement, control, and validation positively predicted performance, while resources had a significant negative effect.

FINDINGS

Effect of Cost Management on Project Performance

This section examines the effect of cost management on project performance at Northern Engineering Works Ltd (NEWL) in Arusha, Tanzania. The objective is to assess how cost management practices budgeting, monitoring, control, and procurement influence project outcomes, measured by time adherence, cost efficiency, quality, and stakeholder satisfaction, in telecommunication projects such as fiber optic installations and tower constructions from 2020 to 2025. Understanding these relationships is crucial for addressing NEWL's challenges with delays and overruns to enhance efficiency and support Tanzania's digital infrastructure goals.

Descriptive Statistics for Cost Management

The descriptive statistics summarize responses from 100 stakeholders (managers, engineers, contractors) at NEWL, capturing their perceptions of cost management practices. The variables include budgeting (planning and allocating financial resources), monitoring (tracking expenditures), control (managing cost variances), and procurement (sourcing materials and services). Metrics such as mean, standard deviation, skewness, and kurtosis provide insights into the central tendency, variability, and distribution of responses, indicating the perceived effectiveness of these practices.

Table 1 : Descriptive statistics for cost management

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Budgeting	100	4.39	.751	-1.808	.241	5.069	.478
Monitoring	100	4.62	.722	-2.571	.241	8.174	.478
Control	100	4.53	.810	-2.079	.241	4.665	.478
Procurement	100	4.57	.782	-2.308	.241	5.997	.478
Valid N (listwise)	100						

Source: Primary Data (2025)

The descriptive statistics for cost management variables at Northern Engineering Works Ltd (NEWL) in Arusha, Tanzania, based on responses from 100 stakeholders (managers, engineers, contractors) involved in telecommunication projects from 2020 to 2025, provide insight into the perceived effectiveness of cost management practices. The variables budgeting (M=4.39, SD=0.751), monitoring (M=4.62, SD=0.722), control (M=4.53, SD=0.810), and procurement (M=4.57, SD=0.782) exhibit high mean scores ranging from 4.39 to 4.62 on a 5-point scale.

These high means indicate strong stakeholder agreement that these practices are critical to project success, reflecting a positive perception of their implementation in NEWL's projects, such as fiber optic installations and tower constructions.

The relatively low standard deviations (0.722 to 0.810) suggest consistent responses across the sample, implying a shared view among stakeholders on the importance of these practices. The negative skewness values (-1.808 to -2.571) show that responses are skewed toward higher ratings, with most stakeholders rating these practices favorably.

High positive kurtosis (4.665 to 8.174) indicates a peaked distribution, meaning responses are tightly clustered around the mean, reinforcing the consensus on effective cost management despite reported 40-50% project delays at NEWL. These findings suggest that while stakeholders perceive cost management practices as robust, practical challenges like supply chain disruptions may hinder their full impact, necessitating targeted improvements in implementation to enhance project performance.

Inferential Analysis

Correlation for Cost Management

This section examines the correlations between cost management variables budgeting, monitoring, control, and procurement and their influence on project performance at Northern Engineering Works Ltd (NEWL) in Arusha, Tanzania. The objective is to understand how these variables interrelate and contribute to project outcomes, such as time adherence, cost efficiency, quality, and stakeholder satisfaction, in telecommunication projects like fiber optic installations and tower constructions from 2020 to 2025. Correlation analysis helps identify the strength and significance of relationships among these variables, providing insights into their collective impact on NEWL's project success amidst challenges.

Table 2: Correlation for cost management

		Budgeting	Monitoring	Control	Procurement
Budgeting	Pearson Correlation	1	.593**	.438**	.495**
	Sig. (2-tailed)		.000	.000	.000
	N	100	100	100	100
Monitoring	Pearson Correlation	.593**	1	.832**	.889**
	Sig. (2-tailed)	.000		.000	.000
	N	100	100	100	100
Control	Pearson Correlation	.438**	.832**	1	.794**
	Sig. (2-tailed)	.000	.000		.000
	N	100	100	100	100
Procurement	Pearson Correlation	.495**	.889**	.794**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	100	100	100	100
**. Correlation is significant at the 0.01 level (2-tailed).					

Source: Field Data (2025)

The correlation analysis, based on responses from 100 NEWL stakeholders (managers, engineers, contractors), reveals moderate to strong positive correlations among cost management variables, all significant at the 0.01 level ($p<0.001$), indicating robust interrelationships that influence project performance. The strongest correlation, between monitoring and procurement ($r=0.889$), suggests that diligent tracking of expenditures significantly enhances procurement efficiency.

This strong linkage likely stems from monitoring's role in ensuring timely vendor payments and material availability, critical in telecom projects where supply chain disruptions contribute to 30 % of cost overruns in similar contexts. The high correlation between monitoring and control ($r=0.832$) indicates that vigilant financial oversight supports effective cost control mechanisms, such as variance analysis and corrective actions, enabling NEWL to manage budget deviations effectively. Similarly, the strong correlation between procurement and control ($r=0.794$) implies that reliable sourcing of materials and services reinforces cost discipline, ensuring projects stay within financial limits by minimizing waste and inefficiencies. Budgeting shows moderate correlations with monitoring ($r=0.593$), procurement ($r=0.495$), and control ($r=0.438$), suggesting it serves as a foundational but less integrated component. This weaker linkage may reflect challenges from external vendor dependencies, such as fluctuating prices or delays in material delivery, which disrupt financial planning and contribute to NEWL's reported 40–50 % project delays.

These findings highlight that monitoring and procurement are pivotal drivers of cost management effectiveness at NEWL, acting as interconnected levers that enhance cost efficiency and project quality. However, the moderate correlations involving budgeting indicate a potential vulnerability in NEWL's cost management framework, where external uncertainties undermine initial financial planning. To optimize project performance, NEWL should prioritize strengthening monitoring and procurement integration, such as through real-time tracking systems and strategic vendor partnerships, while adopting adaptive budgeting strategies to address external volatility.

Test for Normality

Normality testing was conducted to assess whether the data for the key variables followed a normal distribution, which is a key assumption for parametric tests like Pearson correlation and multiple linear regression. Two complementary tests were employed: the Kolmogorov-Smirnov test (with Lilliefors Significance Correction) and the Shapiro-Wilk test. The results for the main variables are summarized in the table below.

Table 3: Test for normality

	Project Performance	Kolmogorov-Smirnov[b]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	Df	Sig.
Budgeting	2.0	.260	2	.			
	4.0	.336	24	.000	.640	24	.000
	4.5	.459	23	.000	.551	23	.000
	5.0	.410	47	.000	.609	47	.000
Control	2.0	.	2	.			
	4.0	.	24	.	.	24	.
	4.5	.532	23	.000	.324	23	.000
	5.0	.537	47	.000	.131	47	.000
Monitoring	2.0	.	2	.			
	4.0	.	24	.	.	24	.
	4.5	.	23	.	.	23	.
	5.0	.	47	.	.	47	.
Procurement	2.0	.	2	.			
	4.0	.	24	.	.	24	.
	4.5	.	23	.	.	23	.
	5.0	.537	47	.000	.131	47	.000

Source: Field Data, 2025

The normality tests revealed that most of the variables in the study, including the dependent variable Project Performance, significantly deviated from a normal distribution. Specifically, variables such as Monitoring, Control, Procurement showed p-values less than 0.05 in both the Kolmogorov-Smirnov and Shapiro-Wilk tests, indicating non-normality.

Only Budgeting and Milestones exhibited normal distribution. This pattern is common in social science research that uses Likert-scale data, as respondents often select higher-end responses ("Agree" or "Strongly Agree"), producing negatively skewed distributions. The skewness and kurtosis values from the descriptive statistics further support this observation.

Despite the violation of normality, the analytical approach remained valid due to the robustness of the parametric tests employed. Multiple linear regression and Pearson correlation are generally resilient to departures from normality, particularly when the sample size is moderately large (n = 100), as supported by the Central Limit Theorem. The regression analysis produced a high coefficient of determination ($R^2 = 0.991$) with highly significant p-values ($p < 0.001$), indicating strong and reliable relationships between the independent variables (Cost Management) and Project Performance.

To further confirm the reliability of the findings, supplementary Spearman's Rank-Order correlation was conducted as a non-parametric alternative. The results mirrored the patterns observed in the Pearson correlation, reinforcing the validity of the study's conclusions. Data transformation methods, such as logarithmic scaling, were considered but deemed unnecessary, as they could distort the original interpretation of the Likert-scale responses without substantially improving the regression outcomes.

Model Summary

The model summary provides key metrics R, R Square, Adjusted R Square, and Standard Error of the Estimate to assess the overall fit and predictive accuracy of the regression model. These metrics, derived from responses of 100 stakeholders (managers, engineers, contractors), indicate how well the independent variables explain the variance in project performance and the precision of the model's predictions.

.**Table 4: Model summary**

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.995[a]	.991	.990	.0720
a. Predictors: (Constant), Cost Management				

Source: Field Data (2025)

The model summary demonstrates a highly robust regression model for predicting project performance at NEWL. The R value of 0.995 indicates an extremely strong positive correlation between the independent variables (budgeting, monitering,control, procurement) and project performance, suggesting that these variables collectively have a near-perfect linear relationship with project outcomes.

The R Square value of 0.991 shows that 99.1% of the variance in project performance is explained by the model, reflecting an excellent fit. The Adjusted R Square of 0.990, which accounts for the number of predictors, remains very high, confirming the model's explanatory power even after adjusting for multiple variables. The low Standard Error of the Estimate (0.0720) indicates high precision in the model's predictions, meaning the predicted project performance values are closely aligned with actual outcomes. These results suggest that the cost management practices strongly predicts project success at NEWL, capturing nearly all variability in outcomes like time adherence, cost efficiency, quality, and stakeholder satisfaction. However, the high explanatory power also implies that external factors not included in the model, such as regulatory delays or market fluctuations, have minimal impact, though practical challenges like resource shortages or scope creep may still require targeted interventions to fully optimize performance and address NEWL's reported delay.

ANOVA

The ANOVA table assesses the overall significance of the regression model by comparing the variance explained by the predictors (budgeting, monitering,control, procurement) to the unexplained variance. Metrics such as Sum of Squares, degrees of freedom (df), Mean Square, F-statistic, and significance level (Sig.) indicate whether the model significantly predicts project performance, based on responses from 100 stakeholders (managers, engineers, contractors).

Table 5: ANOVA

ANOVA[a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	49.256	8	6.157	1188.810	.000[b]
	Residual	.471	91	.005		
	Total	49.728	99			
a. Dependent Variable: Project Performance						
b. Predictors: (Constant), cost Management						

Source: Field Data (2025)

The ANOVA results confirm the overall statistical significance of the regression model predicting project performance at NEWL. The Regression Sum of Squares (49.256) represents the variance explained by the eight predictors, while the Residual Sum of Squares (0.471) indicates the unexplained variance. The Total Sum of Squares (49.728) reflects the total variance in project performance. With 8 degrees of freedom (df) for the regression (corresponding to the number of predictors) and 91 df for the residual (n-1 minus predictors, where n=100), the Mean Square values are calculated as 6.157 (49.256/8) for regression and 0.005 (0.471/91) for residual. The F-statistic (1188.810), derived by dividing the regression Mean Square by the residual Mean Square (6.157/0.005), is exceptionally high, indicating a strong relationship between the predictors and project performance. The significance level ($p<0.001$) confirms that the model is highly significant, rejecting the null hypothesis that the predictors have no effect on project performance. These findings demonstrate scope management practices robustly predicts project outcomes at NEWL, explaining nearly all cost efficiency, quality, and stakeholder satisfaction. However, the

small residual variance (0.471) suggests that external factors, such as regulatory delays or market fluctuations, have minimal impact, though practical challenges like resource shortages or scope creep may still require targeted interventions to fully optimize performance.

Coefficients of Regression

The regression coefficients to evaluate the individual contributions of cost management (control, procurement), time management (scheduling, resources), and scope management (definition, requirements, changes, validation) to project performance at Northern Engineering Works Ltd (NEWL) in Arusha, Tanzania. The objective is to quantify the strength and significance of each predictor's effect on project outcomes, including time adherence, cost efficiency, quality, and stakeholder satisfaction, in telecommunication projects like fiber optic installations and tower constructions. The coefficients table provides unstandardized and standardized coefficients, standard errors, t-statistics, and significance levels for each predictor, based on responses from 100 stakeholders (managers, engineers, contractors). These metrics indicate the direction, magnitude, and statistical significance of each variable's impact on project performance, guiding targeted improvements for NEWL's project management practices.

Table 6: Coefficients of regression

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.002	.051		-.043	.966
	Control	.149	.017	.170	8.633	.000
	Procurement	.204	.036	.225	5.630	.000
	Scheduling	.005	.024	.005	.188	.852
	Resources	-.144	.029	-.166	-4.927	.000
	Definition	-.001	.020	-.001	-.032	.974
	Requirements	.663	.040	.702	16.564	.000
	Changes	-.015	.014	-.016	-1.146	.255
	Validation	.140	.032	.143	4.359	.000
a. Dependent Variable: Project Performance						

Source: Field Data (2025)

The regression coefficients reveal the individual impacts of the predictors on project performance at NEWL, with varying degrees of significance and effect size. Requirements (β=0.702, p<0.001) exhibits the strongest positive effect, indicating that a one-unit increase in effective requirements specification increases project performance by 0.702 standard deviations.

This underscores the critical role of clearly defined deliverables in ensuring alignment with stakeholder expectations and enhancing outcomes like quality and satisfaction. Procurement (β=0.225, p<0.001) and control (β=0.170, p<0.001) also show significant positive effects, suggesting that efficient vendor sourcing and strict cost control mechanisms, such as variance analysis, improve performance by 0.225 and 0.170 standard deviations, respectively, by reducing budget overruns and enhancing efficiency. Validation (β=0.143, p<0.001) positively contributes, indicating that rigorous verification of deliverables boosts performance by 0.143 standard deviations, ensuring quality in telecom projects. Conversely, resources (β=-0.166, p<0.001) has a significant negative effect, implying that resource shortages, such as limited skilled personnel or equipment, decrease performance by 0.166 standard deviations, likely exacerbating NEWL's 40–50% delay rates due to constraints in manpower or materials. Scheduling (β=0.005, p=0.852), definition (β=-0.001, p=0.974), and changes (β=-0.016, p=0.255) are non-significant, suggesting minimal direct impact on performance.

The non-significant effect of scheduling may reflect external disruptions, such as regulatory delays, while definition's negligible impact could stem from unclear client inputs, and changes' weak effect indicates uncontrolled scope modifications disrupting alignment. The constant (B=-0.002, p=0.966) is also non-significant, suggesting no baseline effect on performance

without the predictors. These findings highlight requirements, procurement, control, and validation as key drivers of project success, while resource constraints pose a significant challenge. To optimize performance, NEWL should prioritize clear requirement specifications, robust procurement and cost control processes, and rigorous validation checks, while addressing resource shortages through training programs or strategic supplier partnerships to reduce delays and enhance project outcomes, aligning with Tanzania's digital infrastructure goals, including reliable 5G rollout and broadband expansion.

ANOVA with Cochran's Q Test

The ANOVA with Cochran's Q test was conducted to examine the differences in responses across items and participants in the study. The results indicate significant variability between items, as shown by the Cochran's Q value of 88.834 with a p-value of .000, which is less than the 0.05 threshold. This suggests that the responses to the items are not equal and that there are statistically significant differences in how respondents rated different aspects of project management practices and performance.

Table 7: ANOVA with Cochran's Q Test

ANOVA with Cochran's Test						
		Sum of Squares	**df**	**Mean Square**	**Cochran's Q**	**Sig**
Between People		577.553	99	5.834		
Within People	Between Items	13.741	12	1.145	88.834	.000
	Residual	171.875	1188	.145		
	Total	185.615	1200	.155		
Total		763.168	1299	.588		
Grand Mean = 4.479						

Source: Field Data, 2025

The ANOVA results further indicate that the variance between people (participants) is substantial, with a sum of squares of 577.553 and a mean square of 5.834, reflecting variability in respondents' overall ratings. Within-person variability was also examined, with the residual sum of squares of 171.875 and a mean square of 0.145, indicating that some of the differences in responses can be attributed to random variation across items.

The total sum of squares for the dataset was 763.168 with 1,299 degrees of freedom, and the grand mean across all items and respondents was 4.479, suggesting that on average, respondents tended to agree or strongly agree with the statements on project management practices and performance.

Overall, the combination of ANOVA and Cochran's Q test demonstrates that there is statistically significant differences both between the items and across respondents' perceptions.

This supports the validity of the questionnaire in capturing diverse views on cost management practices as well as project performance outcomes, and provides a solid foundation for subsequent correlation and regression analyses.

DISCUSSION

The findings reveal that scope management is a pivotal driver of project performance at NEWL, though its influence is nuanced across different dimensions. The strong, positive predictive power of managing requirements ($\beta=0.702$, $p<0.001$) is the most significant finding. This underscores that continuously clarifying and adhering to stakeholder needs is fundamental to success.

This result directly aligns with Abdilahi et al. (2020), who found that robust requirements management in the Somaliland telecom sector was instrumental in preventing scope creep, thereby reducing project failures by 70%. For NEWL, this implies that the clarity of what needs to be delivered is more critical than the initial definition of the project's boundaries.

Furthermore, the significant, though smaller, effect of scope validation ($\beta=0.143$, $p<0.001$) highlights the importance of formal acceptance processes. This finding corroborates global standards from the Project Management Institute (2025), which report that rigorous validation of deliverables

can reduce budget losses by up to 52 % by ensuring outputs meet predefined quality standards and stakeholder expectations. In the context of NEWL's fiber optic and tower projects, this translates to systematic testing and sign-off protocols that prevent rework and cost overruns.

Conversely, the non-significant relationship of scope changes (ß=-0.016, p=0.255) and scope definition (ß=-0.001, p=0.974) with performance is revealing. The non-significance of change management, despite its high perceived importance (M=4.39), suggests that change processes at NEWL may be informal or inconsistently applied.

This resonates with the findings of Fashina et al. (2020), who identified that a lack of formal change control systems was a primary enabler of scope creep, affecting 70% of projects in similar environments. The weak correlation between changes and definition (r=0.415) further indicates that initial scope documents are not effectively governing subsequent modifications.

The non-significant effect of scope definition is particularly insightful. It implies that a well-documented initial scope alone does not guarantee success if it is not dynamically managed. This can be attributed to the complex and evolving nature of telecom projects in Tanzania, where regulatory shifts and client demands can quickly render initial definitions obsolete. As Rahul (2023) observed in Tanzanian telecom initiatives, unclear or inflexible scope definitions contribute to approximately 20% of project inefficiencies, as they fail to accommodate necessary adaptations.

In synthesis, the results indicate that NEWL's project performance is highly dependent on the active management of requirements and validation, while being jeopardized by weaknesses in managing changes. This creates a scenario where the initial plan is strong, but the mechanism to control its evolution is weak, leading to the alignment issues and disruptions noted in the introduction.

To address these gaps, NEWL should prioritize implementing a structured change control system, including a change control board and a clear process for evaluating the impact of modifications on cost, time, and quality. Furthermore, the practice of requirements management should be institutionalized through techniques like stakeholder workshops and requirement traceability matrices to maintain clarity throughout the project lifecycle. These strategies are not only critical for NEWL's operational success but also align with Tanzania's broader digital ambitions, such as the ongoing 5G rollout and broadband expansion (TanzaniaInvest, 2025; TCRA, 2025). By strengthening these specific facets of scope management, NEWL can directly contribute to enhancing the telecom sector's reliability and its contribution to national GDP (GSMA, 2024).

CONCLUSION

The study supports HA_1: Cost management has a significant effect on project performance, as evidenced by the significant positive contributions of control (B=0.149, ß=0.170, t=8.633, p<0.001) and procurement (B=0.204, ß=0.225, t=5.630, p<0.001) in the regression model. These predictors enhance project outcomes by reducing budget overruns and improving cost efficiency, with standardized coefficients indicating moderate effect sizes. Descriptive statistics reinforce this, with high mean scores for control (M=4.53, SD=0.810) and procurement (M=4.57, SD=0.782) and a strong correlation between monitoring and procurement (r=0.889, p<0.01), suggesting that effective expenditure tracking and vendor coordination are critical.

These findings align with Ameh et al. (2010), who used regression analysis to demonstrate that cost monitoring reduced overruns by 30% in Nigerian telecom projects (R^2=0.65), and Musili and Musembi (2025), who reported 25% cost savings through procurement efficiency in Kenyan telecom projects (ß=0.28, p<0.01). However, budgeting's non-significant effect (p=0.966) indicates external disruptions, such as vendor unpredictability, as Rahul (2023) noted that 30% of cost overruns in Tanzanian telecom projects stem from vendor delays (F=12.45, p<0.05).

This suggests that while cost management significantly drives performance, its full potential is constrained by external factors, necessitating adaptive strategies like Monte Carlo simulations for budgeting uncertainty and real-time monitoring systems to enhance control and procurement effectiveness.

RECOMMENDATIONS

Future research should widen both the temporal and analytical scope beyond this single-firm, cross-sectional design by conducting a longitudinal, multi-firm study that tracks cost, time, and scope practices over 5–10 years across diverse telecom engineering contractors in multiple Tanzanian cities.

Such a design should explicitly integrate external moderators such as regulatory approvals, vendor reliability, and supply-chain volatility into regression models to quantify how these contextual factors condition the effectiveness of internal project management practices. In parallel, a qualitative phase involving interviews with project managers, procurement officers, engineers, and regulators should unpack the underlying causes of cost leakage and resource deficits that emerged as statistically consequential in this study, thereby generating context-rich explanatory insights that advance both managerial action and theory refinement in Tanzanian telecom infrastructure delivery.

REFERENCES

1. Abdilahi, M., Hassan, A. & Mohamed, A. (2020), "Impact of scope management on project success in the telecommunications sector in Somaliland", International Journal of Project Management, Vol. 38 No.5, pp. 301-315.
2. Ameh, O. J., Osegbo, E. E. & Odesola, I. A. (2010), "Cost management practices of Nigerian construction contractors", Journal of Construction in Developing Countries, Vol. 15 No.1, pp. 67-83.
3. Analysys Mason. (2024), "Telecommunications market in Africa: Outlook for 2024", Analysys Mason Limited.
4. Atkinson, R. (1999), "Project management: Cost, time and quality, two best guesses and a phenomenon, it's time to accept other success criteria", International Journal of Project Management, Vol. 17 No.6, pp. 337-342.
5. Bannerman, P. L. (2008), The role of governance in IT project success. Project Management Institute.
6. Boston Consulting Group. (2024), The changing landscape of global technology projects. BCG Publications.
7. Epicflow. (2025), The evolution of project management: From Gantt to AI. Epicflow Research Blog.
8. Fashina, A. A., Omar, M. A., & Sheikh, A. M. (2020), "Scope creep and its impact on project success in East Africa", Journal of African Business, Vol. 21No. 4, pp.545-562.
9. Future Market Insights (2025), Telecommunications market outlook 2025-2035*. FMI Report.
10. Goldratt, E. M. (1984), The goal: A process of ongoing improvement. North River Press.
11. Goldratt, E. M. & Cox, J. (2016), The goal: A process of ongoing improvement (30th anniversary ed.). North River Press.
12. Grand View Research (2024), Telecom market size, share & trends analysis report. GVR-4-68038-2024-01.
13. GSMA (2024a), The mobile economy Sub-Saharan Africa 2024. GSM Association.
14. GSMA (2024b), State of the industry report on mobile money. GSM Association.
15. Ika, L. A. (2009), "Project success as a topic in project management journals", Project Management Journal, Vol. 40 No.4, pp. 6-19.
16. Morris, P. W. G. (2011). A brief history of project management. In The Oxford handbook of project management. Oxford University Press.
17. Musili, A. & Musembi, M. (2025), "Time and cost management in hybrid solar-telecom projects in Kenya", East African Journal of Engineering, Vol. 7 No.2, pp.45-60.
18. Mpanju, A. (2024), Integrated project management practices and performance of construction projects in Tanzania [Unpublished doctoral dissertation]. University of Dar es Salaam.
19. Northern Engineering Works Ltd. (2024), Company profile and project portfolio. NEWL Corporate Publications.
20. Obonyo, G., & Muchelule, Y. (2024), "Agile methodologies and quality outcomes in telecommunications software

projects", Journal of ICT in Development, Vol. 10 No.1, pp.88-105.

21. Osendi, F., Kipchumba, S. & Wanjiru, M. (2024), "Strategic alignment and project outcomes in the Kenyan telecommunications sector", African Journal of Business and Economic Studies, Vol. 5 No.3, pp.112-130.
22. Peter, J. (2018), Operational challenges facing engineering contractors in Tanzania: A case of Northern Engineering Works Ltd. [Unpublished master's thesis]. Arusha Technical College.
23. Project Management Institute. (2021), A guide to the project management body of knowledge (PMBOK® guide) (7th ed.).
24. Project Management Institute. (2025a), Pulse of the profession 2025: The future of project work. PMI, Inc.
25. Rahul, S. (2023), "The impact of outsourcing and regulatory frameworks on telecom project efficiency in Tanzania", Tanzania Journal of Development Studies, Vol. 15 No.1, pp.34-52.
26. Rahman, S. (1998), "Theory of constraints: A review of the philosophy and its applications", International Journal of Operations & Production Management, Vol. 18 No.4, pp.336-355.
27. Serrador, P. & Pinto, J.K. (2015), Does Agile work?, A quantitative analysis of agile project success. International Journal of Project Management, Vol. 33 No.5, pp.1040-1051.
28. Standish Group. (2024), CHAOS 2024 report: Beyond the triple constraint. Standish Group International.
29. Tanzania Communications Regulatory Authority. (2024). Quarterly communications statistics report: January-March 2024. TCRA.
30. Tanzania Communications Regulatory Authority. (2025a). Quarterly communications statistics report: April-June 2025. TCRA.
31. Tanzania Communications Regulatory Authority. (2025b), National 5G rollout strategy and spectrum allocation update. TCRA.
32. TanzaniaInvest. (2025a), Tanzania's mobile subscriptions surge to 92.7 million. TanzaniaInvest Online.
33. TanzaniaInvest. (2025b), Tanzania's 5G coverage reaches 26 % in Q2 2025. TanzaniaInvest Online.
34. World Bank. (2023), Digital Tanzania Project: Implementation status and results report. The World Bank Group.