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COST CONTROL MEASURES AND PERFORMANCE OF DAM PROJECTS IN KIRINYAGA COUNTY, KENYA

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Abstract
This research study aimed at investigating the effects of project cost control techniques on performance of dam projects in Kirinyaga County, Kenya. The specific objectives that were focused on are cost forecasting and cost tracking. These variables were grounded on the theory of project management and transaction cost theory. Through a comprehensive review of existing literature, this research study sought to provide valuable insights into the correlation between effective cost control strategies and the overall success of dam projects. The quantitative component of this study involved meticulous data collection from ongoing and completed dam projects in the region. Concurrently, the qualitative aspect of the research involved issuance of questionnaires to dam projects stakeholders e.g., site engineers, contactors and community representatives to glean insights into the subjective dimensions of project success. The target population for this study included all stakeholders involved in dam projects within Kirinyaga County, with the unit of analysis being the dam projects and the unit of observation comprising project managers, contractors, site engineers, and government officials. Using Yamane's formula, a sample of 125 stakeholders was selected for the study. A descriptive survey research design was employed, and data was collected using a structured questionnaire. This data was analyzed using the descriptive and inferential statistics. The study revealed that the two variables significantly positively impacted project performance, with coefficients of 0.316 ($p = 0.001$) for cost forecasting and 0.351 ($p = 0.000$) for cost tracking. The findings conclude that effective cost control practices enhance project outcomes by improving financial planning, resource allocation, monitoring, and optimization. Recommendations include the adoption of advanced forecasting tools and integrated tracking systems to further enhance project performance.
Keywords: *Cost Forecasting, Cost Tracking, Performance, Dam Projects*

INTRODUCTION

A project is a temporary endeavor undertaken to create a unique product, service, or result. Projects are undertaken to fulfill objectives by producing deliverables. An objective is defined as an outcome towards which work is to be directed, a strategic position to be attained, a purpose to be achieved, a result to be obtained, a product to be produced, or a service to be performed. Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements (PMI, 2017). Project performance can be measured by successful execution of the project objectives such as social goal, economic goal and

environmental goal. These objectives can be determined by triple constraint. Triple constraint is a triangle of time, cost and scope that bounds the project environment (Rugenyi, 2016).

Project costs can be experienced during the project implementation that the project team simply did not consider or ignored as part of direct project activity costs. Most of the project costs directly related to specific project work activity and forms are part of the project cost estimates; yet, added costs occurs throughout the project implementation (Wilson, 2016). Project cost management can be defined as application of tools, techniques and knowledge in planning, estimating and controlling project costs as well as analyzing the possibility of risks that may potentially lead to cost overruns (Ronald & Agung, 2018).

Project costs management is a process essential for project performance within budget. Therefore, project managers must describe the project scope well, estimate project time and costs in a most realistic way. For effective project cost management, project managers must undertake cost management planning, cost estimation, budgeting and cost control (Dusan & Jugoslav, 2019). Global entities such as the United Nations, the World Bank and the World Trade Organization have progressively recognized the essentials for more effective project cost management and control. This offers a promising global setting for the project cost management to advance cognizance amongst these major project donors on the significance and value of engaging expert cost managers rather than have the role carried out by other experts as a subset of their general roles (Smith, 2015).

Several studies underscore the importance of project cost control in the success of dam projects. The World Bank, in its comprehensive analysis of dam construction projects, highlights the correlation between effective cost management and overall project success (WB, 2019). The report emphasizes the need for continuous monitoring and adjustment of project costs to mitigate risks and ensure financial sustainability. Based on the research of Lu (2019) on China's Three Gorges Dam, the effectiveness of projects hinges on various facets of project management, such as overseeing scope, time, resources, procurement, and stakeholder involvement. It also involves effective communication, resource allocation, and cost management, along with measures for cost control. Every project involves expenses and requires diverse resources to fulfill the envisioned service or product. Additionally, project managers are particularly concerned about cost overruns.

Dam projects in Africa represent ambitious endeavors aimed at addressing various developmental needs, including electricity generation, irrigation, and flood control. These projects are often characterized by significant investments and have far-reaching socio-economic, environmental, and geopolitical implications. For instance, Mekonnen and Köhlin (2008) found that the Gilgel Gibe dam in Ethiopia contributed to rural electrification and economic growth, while Mulatu et al. (2016) highlighted the socio-economic benefits of the Akosombo dam in Ghana, albeit with disparities in benefit distribution.

In Kenya, there are many failed construction projects. In addition, performance measurement systems are not effective or efficient to overcome this problem. Construction projects performance problem appears in many aspects in the Kirinyaga County (Weil, 2017). There are many construction projects failing in time, cost and others fail in financial performance factors. In 2019 there were many projects which finished with poor performance because of many evidential reasons such as: obstacles by client, availability of materials, road closure, amendment of the design and drawing, additional works, waiting the decision, handing over, variation order, amendments in Bill of Quantity (B.O.Q) and delay of receiving drawings (Strenman, 2020).

In Kenya, dam projects are pivotal for water resource management and agricultural development. The government of Kenya has been undertaking the construction of several dams. The construction of numerous dams by the Kenyan Government has faced challenges, including delays, cost overruns, and substandard quality (Olima & K'akumu, 2019). While the majority of these dams are designed for a single purpose, there is a noticeable increase in the development of multipurpose dams (Olima & K'akumu, 2019). Notably, ongoing and completed projects have predominantly focused on irrigation (48%), hydropower (17%), water supply (13%), flood control (10%), recreation (5%), with less than 1% allocated for navigation and fish farming (Olima & K'akumu, 2019). It is noteworthy that numerous dam projects in Kenya have experienced extended timelines for completion, with some even coming to a standstill.

Kirinyaga county is among the few counties in Kenya that boasts of numerous dams. The major reason for this being that agriculture is a key source of livelihoods here. Kirinyaga county actually produces about 80% of rice in Kenya. The rice canals are irrigated by water from dams throughout the year regardless of availability of rainfall. Water supply to residents of the county is also largely dependent on the dams. This is under the mandate of Kirinyaga Water and Sanitation Company Limited (KIRIWASCO).

Statement of the Problem

Dam projects are complex undertakings that require significant financial resources, technical expertise, and time to complete. These projects are critical for achieving various objectives, including socioeconomic development and the provision of essential services like water supply and electricity generation. However, many dam projects face challenges such as delays, budget overruns, and failure to meet quality standards, which undermine their intended goals and result in severe social and economic consequences. In developing countries like Kenya, these issues are particularly prevalent, with numerous dam projects being abandoned, left incomplete, experiencing cost overruns, or delivering substandard quality. According to the Kenya National Bureau of Statistics (KNBS, 2020), about 35% of infrastructure projects in Kenya, including dams, experience delays or exceed their initial budgets, resulting in an average cost overrun of 20%. These setbacks prevent communities from accessing the benefits of improved infrastructure and better living conditions.

The problem is especially critical in projects that aim to provide essential resources, such as water, in regions with limited natural water sources. In Kenya, only 55% of the population has access to safe drinking water, and sewerage services reach just 16%, far below the government's Vision 2030 target of 80% (Water Services Regulatory Board, 2021). This deficit is worsened by climate change, which has altered rainfall patterns and increased water scarcity, making dam projects increasingly vital for supplying water for domestic, agricultural, and industrial use.

In Kirinyaga County, the situation is dire, as residents frequently face water supply interruptions due to stalled or incomplete dam projects. For example, the Mariera Dam project remains unfinished, and the Kahero Dam project has been significantly delayed, leaving local communities without reliable water sources. The Thiba Dam project, expected to benefit over 300,000 people with irrigation and domestic water supply, was temporarily halted in October 2019 due to funding shortages (African Development Bank, 2020). Additionally, some completed projects, like the Kwa Waweru Dam, have been plagued with quality issues, such as cracks and leaks, shortly after completion. Cases of mismanagement and misuse of public funds, as observed in the Kakuzi and Chinga Dam projects, further highlight the need for improved oversight and accountability. These challenges not only deprive local communities of the socio-

economic benefits of well-functioning dam projects but also exacerbate problems like agricultural decline, food insecurity, and poverty.

The effectiveness of cost control measures is critical in addressing these issues by minimizing unnecessary expenditures, preventing wastage, and enhancing project performance (Muema & Ngugi, 2021). Although previous studies have examined the relationship between cost control and project performance, such as Waithira and Onjure's (2020) work on fish farming projects in Kiambu County and Joseph et al.'s (2020) study in the Nigerian construction industry, there remains a gap in understanding the specific cost control challenges faced by dam projects in Kirinyaga County. Therefore, this study sought to fill these gaps by investigating the impact of cost control techniques on the performance of dam projects in Kirinyaga County, Kenya, and offering actionable recommendations to improve their management and sustainability.

Objectives of the Study

The main objective of the study is to determine the influence of cost control measures on the performance of dam projects in Kirinyaga County.

Specific Objectives

i. To establish the influence of cost forecasting on the performance of dam projects in Kirinyaga County.
ii. To find out the influence of cost tracking on the performance of dam projects in Kirinyaga County.

LITERATURE REVIEW

Theoretical Literature Review

Theory of Project Management

Koskela and Howell (2002) laid the groundwork for the theory, which centers on diverse facets of project management, encompassing project initiation, planning, execution, monitoring and controlling, and project closure. The leadership framework governs project management, utilizing planning as a strategic tool to achieve overarching goals and objectives. Significantly, the theory aligns itself with the principles outlined in the PM-BOK (Project Management Body of Knowledge) and PMI (Project Management Institute), resulting in a dual categorization as the theory of project and the theory of management (Morris, 2002). The theory of project revolves around the transformation of project operations, wherein the project is compartmentalized into functional areas responsible for converting inputs into outputs. This involves breaking down overall project tasks into smaller, independently deliverable assignments to teams.

On the other hand, the theory of management is underpinned by three core elements. Firstly, it views management as a planning tool, actively involved in formulating and executing plans crucial for the project's success. Causal connections play a pivotal role in achieving anticipated project outcomes. The second element introduces the dispatching model, conceptualized by the allocation of project tasks to different workstations and team members. The final element employs the thermostat model, guided by the principle of assessing variances between standards and values and subsequently implementing corrective measures to control project outcomes (Hanisch & Wald, 2018). This theory offers a comprehensive framework for cost forecasting within the project lifecycle. By emphasizing strategic planning as a tool to achieve project goals, the theory underscores the importance of accurate initial cost estimates during project initiation.

Transaction Cost Theory

Established by Williamson in 1979, this theory revolves around optimizing the organizational structure to achieve economic efficiency and minimize exchange costs (Williamson, 1979). According to the theory, every transaction in market exchanges involves associated costs, which

are outlined in the contractual agreements made between the parties involved (Williamson, 1979). These contracts act as safeguards against opportunistic behavior and specify which party bears the incurred costs. Alaghehband, Rivard, Wu, and Goyette (2011) explain that the theory focuses on reducing transaction costs by employing various methods such as forming partnerships, monitoring and evaluating transaction processes, and leveraging digital systems and technology.

In the context of project management, the theory aims to mitigate high operational costs, particularly in megaprojects, where significant expenses are incurred in acquiring raw materials, tools, equipment, and labor (Alaghehband et al., 2011). Transaction costs in large projects can be substantial, necessitating measures to minimize them. Project managers can establish dedicated teams to monitor costs, design systems to cut down operational expenses, and ensure an efficient tendering process to secure quality products at the lowest bid quotes or implement supply chain strategies like bulk purchasing for economies of scale. Rindfleisch (2020) emphasizes that project profitability may suffer if transaction costs are excessively high, especially for small projects with low profit margins. Elevated transaction costs could lead project managers to compromise on material quality, impacting the final project quality and its service. Therefore, effective management of transaction costs requires managers to estimate, budget, closely monitor, and implement measures to control costs for the success of projects (Rindfleisch, 2020). This theory is highly relevant to cost tracking in project management. It emphasizes understanding the hidden costs associated with various transactions, optimizing organizational structures to minimize costs, and leveraging contractual agreements to clarify cost responsibilities.

Conceptual Framework

A conceptual framework forms a simplified structure, which is meant to help gain insight into a phenomenon that one needs to explain (Orodho, 2009). It depicts the relationship between a dependent variable and an independent variable. The framework for this study is based on the relationships of the independent variables (cost forecasting and cost tracking) and the dependent variable which is the performance of dam projects in Kenya.

The conceptual framework in figure 1 below hypothesizes the relationship between project cost control and the performance of dam projects.

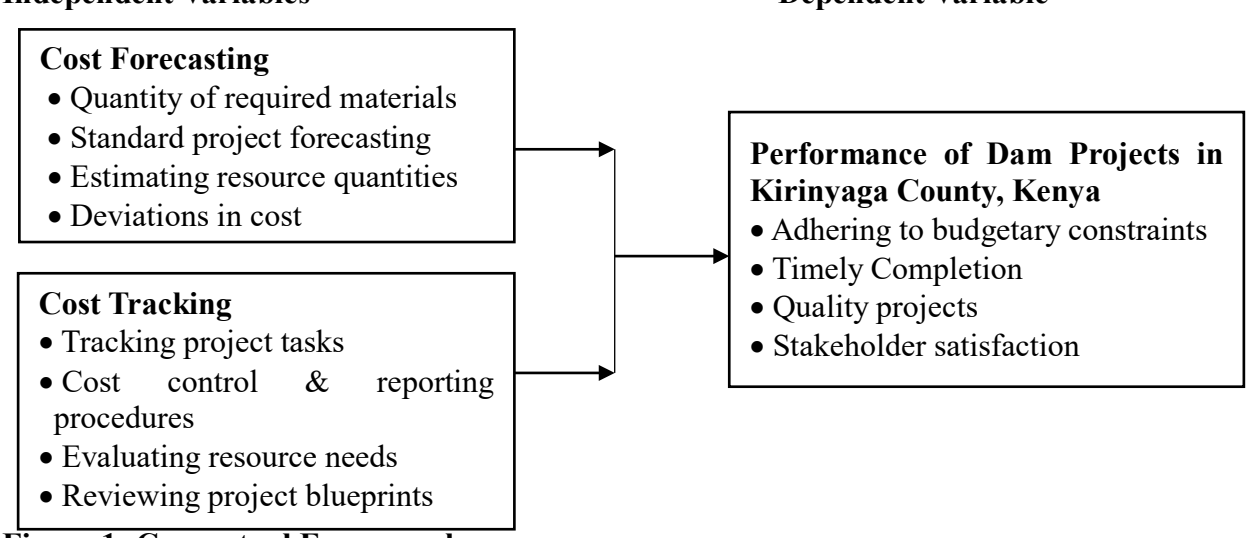

Figure 1: Conceptual Framework

Cost Forecasting

Cost forecasting is a critical aspect of project management, particularly in infrastructure projects like dam construction. cost forecasting plays a pivotal role in ensuring project success (Mertens & Wilson, 2018). Accurately estimating the quantity of materials required for dam construction is essential for effective cost forecasting. This involves detailed assessments of the project's design, including the type and volume of materials such as concrete, steel, aggregates, and geological considerations specific to dam construction. Utilizing historical data from similar projects and engaging with subject matter experts can enhance the accuracy of these estimates. Factors like the dam's size, design complexity, and environmental considerations must be taken into account.

Standard project forecasting involves predicting the future costs of the project based on historical data, current market conditions, and anticipated project activities. It provides a baseline against which actual project costs can be compared. Techniques such as time series analysis, regression analysis, and probabilistic modeling can be employed to forecast costs (Shihemi, 2016). These methods help project managers anticipate potential cost overruns or savings and adjust their strategies accordingly.

Estimating the quantities of resources required for dam construction involves assessing labor, equipment, and other resources needed to execute the project. This estimation is closely tied to cost forecasting as it directly influences project budgets and schedules. Resource quantity estimation should consider factors such as labor productivity, equipment availability, and site-specific conditions (Aneesha & Haridharan, 2017). Advanced software tools like Building Information Modeling (BIM) and project management software can aid in this process by simulating resource allocation scenarios and optimizing resource utilization.

Despite careful planning and forecasting, deviations in project costs are inevitable due to various factors such as changes in market prices, unforeseen site conditions, or design modifications. Monitoring and controlling these deviations are essential for effective cost management. Implementing robust change management processes allows project teams to assess the impact of changes on project costs and schedule (Tengan & Aigbavboa,2017). Techniques such as Earned Value Management (EVM) help in tracking project performance against the planned budget and schedule, enabling early identification of cost deviations.

Cost Tracking

Cost tracking is integral to ensuring that dam projects stay within budget and are executed efficiently. Tracking project tasks involves monitoring the progress of various activities within the dam construction project. This includes tasks related to site preparation, excavation, concrete pouring, structural assembly, and landscaping, among others. Project managers often use project management software or spreadsheets to create detailed task lists, allocate resources, assign responsibilities, and track progress against scheduled timelines. By regularly updating task statuses and identifying any delays or bottlenecks, project managers can take timely corrective actions to mitigate risks and keep the project on track (Walliman, 2011).

Cost control procedures encompass methodologies and protocols aimed at managing project expenditures and preventing cost overruns. This involves establishing budgetary controls, implementing change management processes, and monitoring spending against the approved budget. Regular cost reporting is essential for providing stakeholders with visibility into project finances. Reports may include budget variances, expenditure breakdowns, forecasted costs, and explanations for significant deviations. Automated cost tracking systems can streamline the

reporting process by aggregating data from various sources and generating standardized reports at predefined intervals.

Continuous evaluation of resource needs is vital for ensuring that the project has adequate manpower, equipment, materials, and subcontractors to support its objectives. Resource requirements may evolve throughout the project lifecycle due to changes in scope, unexpected delays, or external factors. Regular assessments help project managers anticipate resource demands and make informed procurement and staffing decisions (Lekunze,2017). Utilizing resource management tools and techniques, such as resource histograms and resource leveling algorithms, enables project managers to optimize resource utilization and prevent resource shortages or overages.

Project blueprints, or engineering drawings, serve as the primary reference for construction activities and provide detailed specifications for dam design and construction. Regular review of project blueprints ensures that construction activities align with the approved designs and specifications (Eskerold, et al,2017). Any discrepancies or deviations identified during the review process can be addressed promptly to prevent rework and associated cost implications. Collaboration between project managers, engineers, architects, and construction teams is essential to validate the accuracy and completeness of project blueprints and facilitate effective communication of design changes or clarifications.

Project Performance

Assessing the project performance of dam projects in Kirinyaga County, Kenya, involves evaluating various key aspects, including adherence to budgetary constraints, timely completion, quality of projects, and stakeholder satisfaction. One crucial aspect of project performance is the extent to which dam projects adhere to budgetary constraints. This involves comparing actual expenditures with the approved budget and assessing variances. Projects that stay within or closely align with budgetary constraints demonstrate effective financial management and resource allocation. Conversely, significant budget overruns can indicate poor cost control and may impact the overall financial viability of the project. Adhering to budgetary constraints not only ensures the efficient use of resources but also enhances transparency and accountability in project management.

Timely completion is another critical factor in assessing project performance. Dam projects that meet or exceed their scheduled completion dates demonstrate effective project planning, execution, and coordination. Delays in project completion can have various adverse consequences, including increased costs, disruption to communities and ecosystems, and potential socio-economic impacts. Timely completion minimizes these risks and ensures that the intended benefits of the dam project are realized within the expected timeframe.

The quality of dam projects refers to the degree to which they meet established standards, specifications, and performance requirements. High-quality projects are structurally sound, resilient, and designed to withstand environmental factors and operational demands. Assessing project quality involves evaluating various parameters, including construction materials, engineering design, workmanship, and compliance with regulatory standards and best practices. High-quality dam projects contribute to the long-term sustainability and effectiveness of water management initiatives, enhancing their socio-economic and environmental impact.

Stakeholder satisfaction is a key indicator of project success and reflects the extent to which the needs, expectations, and interests of stakeholders are met throughout the project lifecycle. Stakeholders in dam projects may include local communities, government agencies, regulatory bodies, environmental groups, and project investors. Each stakeholder group may have different

priorities and concerns that need to be addressed. Engaging stakeholders through transparent communication, consultation, and participation fosters trust, builds consensus, and promotes collaboration in project decision-making and implementation. Monitoring stakeholder feedback and addressing concerns in a timely manner are essential for maintaining stakeholder satisfaction.

Empirical Review

Cost Forecasting and Performance of Dam Projects

Fazil, Lee and Tamyez (2021) investigation was on cost forecasting and its performance within the construction projects in Malaysia. It was noted that estimating of costs in construction projects is a critical element and valuable in avoiding cases of cost overrun. Through the use of cost estimation aspects, the article provided a way of measuring performance of cost estimation in construction sector. The researchers collected secondary data by reviewing 23 journals, 238 construction cost estimation papers in the past 31 years, revealing that only 33 papers concentrated on performance and outcomes of cost forecasting. The results identified the factors linked to performance of cost forecasting as based on elements of organizational control theory, contingency theory and task technology fit theory. The framework for cost forecasting was based on control themes such as control practices, overall project cost and assessing costs incurred by previous projects and applying it to the current study. The study created methodological gaps since it used secondary data by reviewing journals and its context was based on Malaysia construction sector.

Cost Tracking and Performance of Dam Projects

Maunda and Moronge (2016) conducted a study on project life cycle management and completion of public projects in Makueni Sub County, Kenya by utilizing descriptive research design. They found a positive correlation between the phases of project monitoring and evaluation, execution, and closure within project life cycle management.

Kissi, Agyekum, Baiden, Tannor, Asamoah and Andam (2019), investigated the impact of project monitoring and evaluation practices on the success of construction projects in Ghana. Emphasizing the importance of monitoring and evaluation in project implementation and management, the study focused on various practices such as fostering a learning culture, collecting and utilizing data and information, employing a participatory approach, and establishing feedback mechanisms. These practices formed part of the research instrument used to gather data from construction industry professionals in Ghana, as documented in The Strategic Journal of Business & Change Management (2019).

Utilizing Partial Least Squares (PLS) and Structural Equation Modeling (SEM), the study found significant effects of monitoring and evaluation practices on the success of construction projects. Additionally, it identified project scope and health and safety practices as factors influencing these M&E practices within construction projects. In conclusion, the study underscored the significance of monitoring and evaluation practices in enhancing project success rates, highlighting their critical role in project delivery.

METHODOLOGY

The descriptive survey research design was chosen for this study because it aligns well with the research objectives and provides a systematic approach to gathering data in a real-world context. This design is particularly suitable as it allows for comprehensive data collection in a natural setting without altering the environment or manipulating variables, which is crucial for understanding phenomena as they occur in real-life scenarios (Doyle, McCabe, Keogh, Brady, & McCann, 2020).

In this study, the research focused on eight major dam projects: Thiba, Kianjogu, Gitanga, Kakuzi, Kwa Waweru, Chinga, Makoka, and Mariera. These projects served as the unit of analysis. The unit of observation for this study consisted of individual stakeholders actively participating in these dam projects, including directors, project managers, contractors, and site engineers. Overall, the study targeted a total of 182 stakeholders, encompassing 29 directors, 29 project managers, 30 contractors, and 94 site engineers. This study adopted Yamane (1967) simplified formula to calculate the sample size which provided a sample size of 125. Stratified random sampling technique was used to select the sample.

The main data collection instrument for this study was questionnaires. Quantitative and qualitative data was generated from the closed-ended and open-ended questions, respectively. This data was analyzed using the descriptive and inferential statistics. The descriptive statistics were the means, standard deviations and frequency distributions. The inferential statistics were undertaken using the linear regression analysis and correlation analaysis.

FINDINGS AND DISCUSSION

Response Rate

The study targeted 125 respondents, comprising stakeholders involved in dam projects in Kirinyaga County. 94 valid responses were received, resulting in a response rate of 75.2%. This high response rate is excellent and meets the recommended threshold of 70% as suggested by Sekaran and Bougie (2016).

Descriptive Analysis

Descriptive statistics were used to assess respondents' agreement with statements related to the influence of cost control measures on the performance of dam projects in Kirinyaga County. This section provides a detailed analysis of each variable, highlighting key findings. The means and standard deviations were used to interpret the findings where a mean value of 1-1.4 was strongly disagree, 1.5-2.4 disagree, 2.5-3.4 neutral, 3.5-4.4 agree and 4.5-5 strongly agree. Standard deviation greater than 2 was considered large meaning responses were widely spread out and not tightly clustered around the mean.

Cost Forecasting

The first objective of the study was to establish the influence of cost forecasting on the performance of dam projects in Kirinyaga County. Cost forecasting was evaluated to determine its influence on dam project performance. Table 1 presents the descriptive statistics related to cost forecasting.

Table 1: Descriptive Statistics on Cost Forecasting

Statement	Mean	Std.Dev.
Cost forecasting for dam projects is conducted at appropriate intervals	3.742	0.834
The estimation of required materials for dam projects is accurate	3.681	0.913
The standard project forecasting method is reliable	3.921	0.781
Deviations in project cost from the forecasted values are effectively managed	3.803	0.857
Aggregate Score	**3.787**	**0.846**

The findings showed that the respondents agreed that cost forecasting for dam projects is conducted at appropriate intervals (M= 3.742 SD= 0.834); that the estimation of required materials for dam projects is accurate (M= 3.681, SD= 0.913); that the standard project forecasting method is reliable (M= 3.921, SD= 0.781); and that deviations in project cost from the forecasted values are effectively managed (M= 3.803, SD= 0.857). The aggregate score of 3.787 suggests that respondents generally agree that cost forecasting positively influences the

performance of dam projects. Respondents indicated that forecasting is conducted appropriately and the methods used are reliable, which are essential for mitigating risks associated with cost overruns. Accurate estimation of materials and effective management of deviations from forecasted values were also highlighted as crucial aspects.

The findings imply that reliable cost forecasting is perceived as a critical component in enhancing project performance by ensuring financial resources are adequately planned and managed. These results align with the findings of Fazil et al. (2021), who emphasized that accurate cost estimation helps avoid cost overruns, which is a significant issue in construction projects. Additionally, the study by Tamyez et al. (2021) supports the importance of control themes such as cost estimation and deviation management, underscoring their role in enhancing project performance.

Cost Tracking

The third objective of the study was to find out the influence of cost tracking on the performance of dam projects in Kirinyaga County. Cost tracking was evaluated to understand its influence on dam project outcomes. Table 2 provides the descriptive statistics.

Table 2: Descriptive Statistics on Cost Tracking

Statement	Mean	Std. Dev.
Project tasks related to dam construction are tracked effectively	3.894	0.802
Cost control and reporting procedures for dam projects are well established	3.849	0.831
Resource needs during the project life cycle are evaluated appropriately	3.782	0.861
Project blueprints are regularly reviewed to ensure cost adherence	3.869	0.803
Aggregate Score	**3.849**	**0.824**

The findings show that the respondents generally agreed that project tasks related to dam construction are tracked effectively (M= 3.894, SD= 0.802); that cost control and reporting procedures for dam projects are well established (M= 3.849, SD= 0.831); that resource needs during the project life cycle are evaluated appropriately (M= 3.782, SD= 0.861); and that project blueprints are regularly reviewed to ensure cost adherence (M= 3.869, SD= 0.803). The aggregate score of 3.849 suggests that respondents generally agree on the positive impact of cost tracking on project performance. Effective tracking of project tasks, established cost control procedures, and regular evaluations of resource needs were identified as key factors in maintaining financial control throughout the project lifecycle.

The findings imply that robust cost tracking practices are vital in ensuring that projects adhere to planned budgets and timelines. This aligns with the work of Maunda and Moronge (2016), who found that monitoring and evaluation practices, including cost tracking, significantly influence the successful completion of public projects. Additionally, Kissi et al. (2019) emphasize that continuous tracking and feedback mechanisms improve project management and mitigate the risk of financial mismanagement.

Inferential Analysis

Inferential statistics were used to determine the relationship between cost control measures and the performance of dam projects in Kirinyaga County. This section presents the correlation and regression analysis.

Correlation Analysis

Correlation analysis was conducted to assess the strength and direction of the relationship between the independent variables (cost forecasting and cost tracking) and the dependent variable (performance of dam projects). The results are presented in Table 3.

Table 3: Correlation Results

Variable		Performance of Dam Projects	Cost Forecasting	Cost Tracking
Performance	Pearson Correlation	1		
	Sig. (2-tailed)			
	N	94		
Cost Forecasting	Pearson Correlation	0.715*	1	
	Sig. (2-tailed)	0.000		
	N	94	94	
Cost Tracking	Pearson Correlation	0.728*	0.705	1
	Sig. (2-tailed)	0.000	0.076	
	N	94	94	94

*Correlation is significant at the 0.05 level (1-tailed).

The correlation coefficient between cost forecasting and performance of dam projects was 0.715 ($p < 0.05$), indicating a strong positive relationship. This suggests that improvements in cost forecasting are associated with enhanced project performance. Accurate forecasting helps anticipate financial needs and manage budget deviations, directly impacting the effectiveness of project management. This finding aligns with Fazil et al. (2021), who emphasized that accurate cost estimation plays a crucial role in avoiding overruns and ensuring project success.

A correlation coefficient of 0.728 ($p < 0.05$) between cost tracking and performance suggests a strong positive relationship. Effective cost tracking allows project managers to monitor expenditures in real-time, adjust plans accordingly, and maintain control over project costs. This finding supports the study by Kissi et al. (2019), which identified monitoring and evaluation practices, including cost tracking, as key factors in achieving project success.

Regression Model Summary

The model summary provides an overview of the regression model's explanatory power, indicating how well the independent variables explain the variability in the performance of dam projects.

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.890[a]	0.792	0.785	0.542

a. Predictors: (Constant), cost forecasting, cost tracking

The R-squared value of 0.792 indicates that 79.2% of the variance in the performance of dam projects is explained by the combined effect of cost forecasting and cost tracking. This high R-squared value suggests that the independent variables provide a strong fit for the model, demonstrating their significant impact on project performance. The adjusted R-squared of 0.785 further confirms the model's robustness, accounting for the number of predictors.

The findings imply that cost control measures play a critical role in determining the success of dam projects in Kirinyaga County. The substantial explanatory power of the model highlights the importance of implementing these measures to enhance project outcomes. The results are consistent with Dulaimi et al. (2001), who found that integrated cost management practices

significantly improve project performance by reducing uncertainties and ensuring effective resource utilization.

Analysis of Variance (ANOVA)

ANOVA was used to test the overall significance of the regression model, indicating whether the independent variables collectively have a statistically significant impact on the dependent variable.

Table 5: ANOVA Results

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	31.142	2	15.571	25.562	0.000[b]
Residual	55.432	91	0.609		
Total	86.574	93	15.571	25.562	

a. Dependent Variable: Performance of Dam Projects in Kirinyaga County, Kenya

b. Predictors: (Constant), cost forecasting, cost tracking

The F-statistic of 25.562 with a p-value of 0.000 indicates that the regression model is statistically significant. This means that cost forecasting and cost tracking have a significant effect on the performance of dam projects. The low p-value confirms that the observed relationships are not due to random chance, validating the overall fit of the model. The significant ANOVA results suggest that the combined effect of the independent variables is crucial for enhancing project performance. The findings align with Zwikael and Globerson (2006), who reported that comprehensive cost management approaches significantly improve project efficiency and success rates by addressing financial and operational risks.

Regression Coefficients

The regression coefficients provide detailed insights into the impact of each independent variable on the performance of dam projects. The coefficients indicate the strength and direction of the relationship between each cost control measure and project performance.

Table 6: Regression Coefficients

	Unstandardized Coefficients		Standardized Coefficients		
Variable	**B**	**Std. Error**	**Beta**	**t**	**Sig.**
(Constant)	1.187	0.324		3.663	0.001
Cost Forecasting	0.316	0.084	0.241	3.762	0.001
Cost Tracking	0.351	0.078	0.289	4.500	0.000

The coefficient for cost forecasting (B = 0.316, p = 0.001) indicates that an increase in the effectiveness of cost forecasting leads to a significant positive effect on project performance. This suggests that accurate forecasting methods enhance financial planning and control, reducing the likelihood of cost overruns. Fazil et al. (2021) support this finding by highlighting that systematic cost estimation practices are essential for maintaining project budget integrity.

The coefficient for cost tracking (B = 0.351, p = 0.000) suggests a significant positive relationship between cost tracking and project performance. This finding implies that monitoring expenditures and adjusting strategies as needed are critical for maintaining project cost control. Kissi et al. (2019) noted that continuous cost tracking helps identify financial discrepancies early, allowing for timely corrective actions.

The fitted regression equation based on the coefficients from the analysis is:

Performance of Dam Projects = 1.187 + 0.316Cost Forecasting + 0.351Cost Tracking

This equation shows how each of the independent variables (cost forecasting and cost tracking) contributes to the overall performance of dam projects in Kirinyaga County.

CONCLUSIONS, AND RECOMMENDATIONS

Conclusions

The study concludes that cost forecasting plays a vital role in the performance of dam projects in Kirinyaga County. Accurate forecasting methods enhance financial planning and control, allowing project managers to anticipate financial needs and manage budget deviations effectively. This, in turn, helps to avoid cost overruns and ensures project success.

Cost tracking is essential for maintaining control over project expenditures throughout the project lifecycle. Effective tracking of project tasks, established cost control procedures, and regular evaluations of resource needs ensure that projects adhere to planned budgets and timelines. Continuous monitoring and feedback mechanisms improve project management and mitigate financial mismanagement risks.

Recommendations

It is recommended that dam project managers in Kirinyaga County enhance their cost forecasting practices by adopting advanced forecasting tools and techniques, such as predictive analytics and software that integrate real-time data. Training programs should be implemented to equip project stakeholders with skills in accurate cost estimation and management of budget deviations. Regular reviews and updates of forecasting models should also be conducted to align with changing project dynamics and market conditions.

Project managers should adopt integrated project management systems that allow for real-time cost tracking and reporting. These systems should provide detailed insights into resource allocation, project tasks, and financial expenditures. Regular training on the use of these systems will help ensure that project teams can effectively monitor costs and make timely adjustments. Emphasizing continuous evaluation and feedback mechanisms will further enhance the accuracy of cost tracking and decision-making.

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