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# Scope Control and Performance of Projects: A Case of Water and Sanitation Infrastructure Projects in Mombasa and Kilifi Counties, Kenya

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**Abstract:- Kenya is a predominantly arid country with limited water sources. As at 2019, access to improved water and sanitation was estimated at 63 percent and 31 percent of the population, respectively, compared to the target of universal coverage by 2030 (The Kenya Institute for Public Policy Research and Analysis -KIPPRI, 2019). To address this need to distribute this scarce resource, and in keeping with the SDG 6 goal of universal access to clean water to all, the government's efforts and focus was shifted to water projects. Whereas some gains have been made towards this goal, a Water Services Regulatory Board (WASREB) report on the performance of regional water utilities noted with concern that the worst performer was Mombasa County (seventh year in a row) and further highlighted with concern a continued decline in the performance of Kilifi County. Despite the numerous interventions in the water and sanitation sector in these two counties, there still lies a gap in attaining the SDG-6 agenda and projects continuously fail to perform as speculated. Deviation and changes of project scope mid-way has led to costly overruns both on time and cost hence the need to consider how to improve performance of water projects in the two counties. This study aimed at investigating the effect of scope control on performance of water and sanitation projects in Mombasa and Kilifi Counties, Kenya. The study was anchored on the management theory. 14 water projects were targeted with 46 respondents. Pilot tests showed the instrument was valid and reliable as confirmed by the supervisor and Cronbach Alpha results of 0.787. The SPSS version 25.0 and Ms. Excel were used for descriptive, regression, correlation and diagnostic tests. Correlation analysis results showed positive and significant association for scope control (r=.741) and the regression analysis yielded a regression coefficient of (β=.499), and a ($p<0.05$) indicating significant effect to performance of the water and sanitation projects. The study established that 55.8% change in performance of water and sanitation projects was due to scope control. Scope control involved continually updating project teams and monitoring project activities that improved performance of the water projects. Thus, it was concluded that performance of water and sanitation projects were influenced by scope control. It was recommended that scope control be incorporated when seeking to improve performance of the projects,**

***Keywords:-*** *Scope Control, Project Performance, Project Plan Updates, Changing Requests, Evaluating Project Progress.*

## I. INTRODUCTION

➢ *Background of the Study*

A project is any planned piece of work that is aimed at achieving or realizing a given goal or a set of goals. Projects range from small, medium to mega projects, but they all have a particular aim and are all unique (Kerzner, 2017). The project management institute (PMI) defines projects as temporary endeavors undertaken to create unique project services or results (PMI, 2017). The projects are performed by people or firms that are set to achieve the goals within set schedule, costs and clearly underlined parameters measuring the performance (Nicholas & Steyn, 2017). It can thus be inferred that projects have inherent characteristics of time, scope and quality since they have a timeframe for delivery, a clear goal or purpose and are expected to deliver quality outcome.

To deliver quality results and outcomes and within the stipulated timeframe, projects require effective management. Management of projects is simply the application of management functions of planning, organizing, staffing, leading and controlling in a project environment with an aim to execute a specific project mandate within a given timeframe and budget. According to Kariuki (2018) water and sanitation projects have shown failures due to lack of clear or realistic project objectives and changes in scope mid-project accounted for 41% failure in the projects. Olago (2019) in supply of water noted that many of water projects failed primarily due to lack of proper definition of the project scope stemming from improper stakeholder engagement. The lack of proper stakeholder engagement and objective setting had led to many water projects being abandoned. At the same time, a large majority of public projects in Kenya end up stretching long past the set project periods and budgets due to oversights in the role of project management (Kanda, Muchelule & Mamadi, 2016).

On scope control, it covers the elements of evaluating and changing the scope baseline based on request and recommendations made on the original project scope. A successful project is the one that aligns to the needs and desires of the project owners and beneficiaries, hence the

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need to make changes to incorporate their requests (Madhuri, Suma & Mokashi, 2018). Scope control is also an aspect of constant monitoring and evaluation of the entire project process in order to deliver a successful project within the stipulated timelines, budget and quality. Control scope is also used to manage the actual changes when they occur and is integrated with the other control processes. For success in scope control, there is need for constant reviews and updates since it only comes into play when project processes are going awry (Fashina, Abdilahi & Fakunle, 2020).

Junqueira and Passador (2019) reported that out of 318 global megaprojects in the fields of power, transportation, oil and gas, and mining industry between 1990 and 2010, a failure rate of 65% was reported. The failure rate for these projects was measured based on cost and schedule overruns. It is thus, thought that adoption of scope control will lead to success in implementation and delivery of high project performance. The performance of the projects is measured by the standards set in the project goals, with some of the common indicators including delivery of the project on time, maintaining the project budget, and delivering quality finished project. Nicholas and Steyn (2017) shared the importance of monitoring and evaluating the progress of projects for purposes of understanding if project implementation will lead to attaining the project goals. Successful projects according to Onubi, Yusof and Hasan (2020) need the collaboration and involvement of all stakeholders, clear communication lines and sufficient budget allocation to acquire raw materials, tools and hire experts.

When it comes to water projects, the performance is measured in terms of delivery of the specified project as aligned to the project design and its scope. It will be up to the project managers and supervisors to correctly interpret the design and scope of the projects for them to be able to deliver it. Thus, it will call for their expertise and seeking clarification from the project engineers and consultants such that the project team members can deliver the project as specified. Lastly, water project performance is as per satisfaction of the stakeholders, both the development partners and project financiers and beneficiaries who are the local residents who will consume the water project (Kanda, *et al.,* 2016). The study measured performance of the water projects in Mombasa and Kilifi Counties on the basis of timely delivery, delivering the project within the stipulated budget, delivering the project as per specifications in the project design and scope and satisfying the stakeholder.

Despite the need for water as a source of life, many water projects are delaying meaning that a huge population is unable to access safe drinking water, sanitation and hygiene which has a negative impact on education, health and food security. In 2019, only 63% water projects could be accessed by 31% of the population to get water and sanitation services. This is a low rate compared to the target of universal coverage and access by 2030 (The Kenya Institute for Public Policy Research and Analysis -KIPPRI, 2019). The Water Services Regulatory Board (WASREB) 2018 report noted that Mombasa County and its water boards had the worst performance record. There was a decline by 11% from 54% - 43% of water coverage in the county and there was critical water shortages reported by the over 1.1Million people living in the county. Kilifi County also faces water access challenges and it was reported to be the biggest loser in performance of water utilities. Despite the numerous interventions in the water and sanitation sector in these two counties, there still lies a gap in attaining the SDG-6 agenda. Hence the need to look at the water projects in the two counties –Mombasa and Kilifi.

➢ *Statement of the Problem*

The critical water shortages in the coastal areas of Mombasa and Kilifi have forced its residents to consider water projects for clean and safe water as an alternative to natural sources. The water projects have reported delayed completion dates meaning that the residents continue to suffer for lack of clean water sources. The water projects delay in completion is due to changes in scope and insufficient resources and stakeholder engagement. According to Gunduz and Yahya (2018) deviation in in project scope negatively affects performance of projects, as changes in the project scope increase the costs and expenses leading to overruns in costs, timelines and scheduling of the projects. There is need to consider what aspects of the project will lead to successful delivery of projects and since the key elements of a project is its scope; thus considering for how scope control influences performance of projects.

Reviewed studies have revealed some gaps including Moustafaev (2014) noting that despite the promise scope management holds in ensuring project success, it has been neglected when it comes to project management domain. Ndungu (2014) averred that only 33% of ongoing water projects in Kiambu County were on schedule meaning ¾ of projects show delays in completion and another 55% state that their delays were because of changes in project scope. Kanda, *et al.* (2016) reported that scope change was a major contributing factor for unsuccessful completion of water projects in Kakamega County where 75% of respondents affirmed that scope change interfered with the project success. These studies show conflicting results on the value and role of scope control to project success. The concern of this study therefore was to establish whether failure to adequately control and manage the project scope and lack of a holistic understanding of project scope techniques by managers and team members could be the contributing factor to failed projects. The current study focused on scope control and its effects on project performance.

➢ *Objectives*

The study objective was:

- To determine the effect of scope control on performance of water and sanitation projects in Mombasa and Kilifi Counties, Kenya

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## II. LITERATURE REVIEW

➢ *Theoretical Review*

- *Management Theory*

The study was anchored on management theory and the most prominent proponent of the theory was Henri Fayol. The principles and theories of management are based on his book on *Administration Industrielle et Generale* (1961). The management of organization is based on an amalgam of five functions; i.e. planning, organizing; coordination; command; and control and it operates under 14 principles of management. Faimus (2018) defined the five functions as follows: planning is about tasking ordering for attainment of organizational goals; organizing covers arraignment of resources within the organization for proper usage; coordination is about influencing the character of employees, motivating and guiding them towards achieving organizational goals; commanding is giving of instructions on the team of staffs in a way that the organizational goal can be attained and controlling is making comparisons between the goals and inputs and the outcomes and it is involves identifying deviations in the plan and taking corrective measures. The theory takes upon itself to give general rules and organizational principles that managers have to follow for success of the organization. The identified principles are not complete but their purpose is acting as guiding posts for the managers in organizations and leading to delivery of quality products and efficient services (Jones, Donaldson, Freeman, Harrison, Leana, Mahoney & Pearce, 2016).

However, the theory has been criticized as being too pro-management biased and only viewing workers as biological machines as well has having been limited in application since the principles were derived from Fayol's experience in mining hence the principles may not be entirely applicable in other types of modern organizations (Albrecht, Bakker, Gruman, Macey & Saks, 2015). The theory is relevant to the study since it provides a basis on which management principles are based and because management of projects is basically the application of management principles to the management of a project's scope. The theory therefore, exposed the adoption of scope control for highly performance and success of the initiated water and sanitation projects in Mombasa and Kilifi Counties.

➢ *Empirical Literature*

Controlling scope is about monitoring the project progress and its processes such as indicated changes are implemented. When conducting scope control also involve taking corrective actions and prevention measures to avoid instances where the project fails. Under scope control there is management of changes and its integration into the project processes (PMI, 2017). In project management there is scope creep that involves expansion of the project scope and it is done in a manner such that the time, costs and resource usage is not adjusted. It is inevitable that there will be some changes from the instant the project is initiated until it is completed, thus the need for scope control. Abdilahi, Fakunle and Fashina (2020) supported this and proposed that scope control allows for efficient resource utilization and cuts down on hassles and disruptions to the project processes. It is also useful in change management and controlling all the aspects of the lifestyle of the project. Scope control as a function is uniquely placed to aide in delivering high performing projects. To improve performances of projects there is need to ensure presence of proper control systems are present and in place.

Al-Rubaiei, Nifa and Musa (2018) critically reviewed project scope management through various perspectives and shares that scope management is a function of the overall project management process. Project scope management is critical since it has a direct influence on project costs, since any changes on the project scope means more expenses that are detrimental to project performance. Project scope management ensures success of projects in terms of time, cost and quality. The findings of the study showed that scope management encompasses the scope planning, defining the scope, collecting project requirements; validate the scope, creating WBS and scope control.

Nibyiza (2015) conducted a study on project scope change management equating as a tool for project success in Rwanda and focus was Akazi Kanoze project. The researchers noted that changes in project scope needed better scope control to avoid excessive expenses and consumption of time that will delay delivery timelines and negatively impact cost of the entire project. The study specifically considered the causes for scope change, adjustment of project activities, changes to project cost, time and service quality and challenges that are associated with changing the project scope. The data was collected from 30 project managers and project operations officers and found that at times it is necessary to change the project scope so as to attain the project goals and change in project scope and project activities cause changes in project cost, time and quality. Changes in project scope increase the risks of having incomplete projects, delayed projects and projects that are costly and go beyond the project budget.

In search for project success in view of changes in project scope, the concept of scope control must come in to ensure that the project budget can be maintained and little changes are made in such a way that the project goals are still met. According to Al-Rubaiei, Nifa and Musa (2018) in their study on project scope for the government funded projects in Oman. The researchers noted that scope management and scope control is important for success of projects in the construction sector. The scope management function is linked to project performance in terms of time, costs and quality of the project. Scope control enables the management of the project budget and leads to its success.

Turatsinze (2018) conducted a study on scope change management and success of projects in Rwanda. The study was a case study of the Rwanda social marketing project and its focus was on scope change management, the extent of its success and the relationship between scope change management and success of the projects. The study collected data from 77 participants who are employees in the projects and found out that scope change definition, its control and

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implementation led to success of the projects in terms of timely delivery, maintaining the project budget, participation of stakeholders, delivery quality projects and attaining the project goals. The project scope change management practices positively impacted the performance and success of the projects.

➢ *Conceptual Framework*

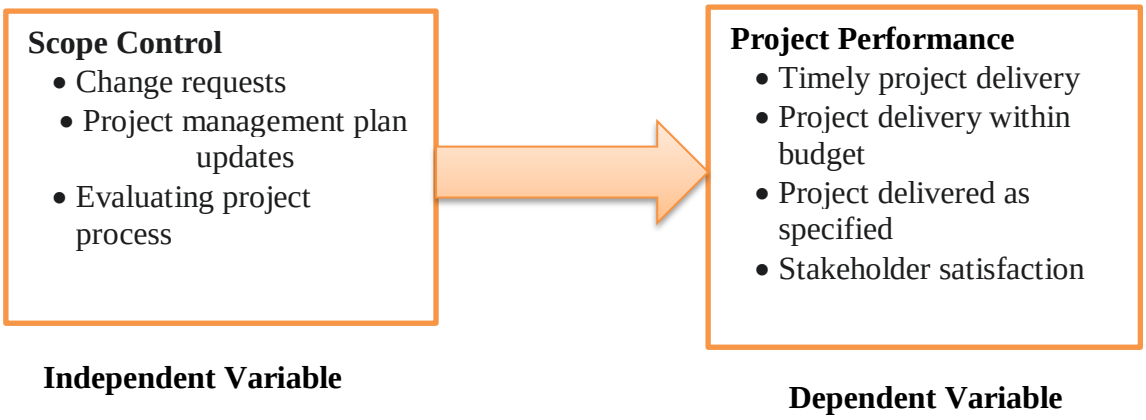


Fig 1:- Conceptual Framework

## III. RESEARCH METHODOLOGY

➢ *Research Design*

A research design is the blueprint that guides the research when undertaking the research exercise. For this study, descriptive research design was employed, and according to Ghauri, Grønhaug and Strange (2020) the design is used to guide the researcher to get data that is not manipulated and responds to the research questions.

➢ *Target Population*

The population of this study constituted 14 projects undertaken by the Coast Water Works Development Agency (CWWDA) within Kilifi and Mombasa Counties in Kenya. The researcher targeted the projects that have been done from 2012 – 2019 and focused on project teams in these projects including the project engineers, project consultants and project managers. The other respondents included Chief Executive officer CWWDA, the Technical Services Manger CWWDA, the Projects Engineer CWWDA, Social and Environmental officer CWWDA. The total target population included 46 project team members. Purposive sampling was employed in targeting the 14 water and sanitation projects and census sampling used such that the sample size was 46 respondents.

➢ *Data Collection Instrument, Procedure and Analysis*

The study collected primary data using questionnaires that were semi-structured having both open and close-ended questions. The instrument was pilot tested to check for its validity and reliability through using 9 senior project team members from Kwale and Taita-Taveta County in three water and sanitation plant projects. Construct validity was adopted through the help of the supervisor and internal consistency technique and Cronbach Alpha test results adopted to check for reliability of the instrument. The pilot test results showed the instrument was fit and ideal for use in the study.

The questionnaire was self-administered to the respondents who filled it and it was collected after one week. The research got approval letter from the university, research permit and permission from the water projects. Once all the data was collected, it entered into SPSS version 25.0 and Ms. Excel for further analysis. Descriptive analysis was done and frequencies, means and deviations in responses were obtained. The inferential statistics were done through correlation and regression analysis to show how the variables interact and the strengths in the relationship. The study adopted the following regression model:

$$Y = \beta 0 + \beta_1 X_1 + \varepsilon$$

Diagnostic tests were conducted for violations of any data assumptions the study may have made in the regression model. This was done through normality, multicollinearity and autocorrelation test.

## IV. FINDINGS

From the 46 questionnaires distributed, 33 were filled and returned, making the response rate of 71.7% for the study. On the demographic information, the gender revealed 87.9% of the response group was males while only 12.1% of them were females. There were 18.1% project consultants, the project engineers accounted for 36.3% and 45.5% of respondents held the role of project manager. On length working in the water projects, it was revealed that 6.1% had worked for 0-3 years; 18.1% had worked for 3-6 years, another 21.2% had worked for 6-9 years and majority at 54.5% had worked for over 9 years. Results also showed the education qualifications of the respondents where 9% were diploma holders; 45.5% were undergraduates and another 45.5% had attained a post-graduate degree.

➢ *Descriptive Analysis*

| | Mean | Std. Dev. |
|---|---|---|
| The project scope is changed based on requests of the project stakeholders | 3.848 | 1.064 |
| There is constant monitoring of all activities of the water projects | 4.242 | 0.751 |
| The project scope is adopted to manage actual changes in the water projects | 3.939 | 0.788 |
| There is constant review of the different activities in each project phase | 3.970 | 1.015 |
| Project teams receive continuous updates on the progress of the water projects | 4.151 | 0.712 |
| **Overall Score** | **4.03** | **0.88** |

Table 1:- Scope Control

Table 1 shows the descriptive analysis results on project scope control and its effect on performance of water projects. The overall means score was (M=4.03) and average standard deviation was (SD=0.88) implying that many of the respondents agreed that scope control led to improved project performance. This is also shared in the PMI (2017) book that notes that scope control allowed corrective and preventive measures to be taken that can deliver quality projects to the stakeholders. Furthermore, Nibyiza (2015) revealed that changes in project scope and plans had negative impact on cost, time and often led to incompletion of projects. Thus, there is need to employ scope control that will help reduce the number of changes and ultimately lead to better results in terms of project outcomes. Turatsinze (2018) added that scope change management extended the success of projects through involvement of all stakeholders and effective communication. While Al-Rubaiei, *et al.* (2018) shared that scope management function is associated with performance of project in terms of costs, time and quality. Abdilahi, *et al.* (2020) noted that changes in the project are inevitable and must be included from the time the project is initiated until it is completed and handed over to the project owners.

| | Mean | Std. Dev. |
|---|---|---|
| The water projects are delivered on time as per the stipulated timeline | 3.454 | 1.201 |
| There is no budget overruns in the water projects | 3.000 | 1.089 |
| Delivery of the water projects are as per their specifications | 4.000 | 0.968 |
| The water project stakeholders' are satisfied with the project quality | 3.969 | 0.636 |
| Each project phase maintains the budget lines in its expenses | 3.545 | 0.869 |
| **Overall Score** | **3.594** | **0.97** |

Table 2:- Performance of Projects

On performance of the projects, the respondents agreed that project scope management had affected the performance of the water and sanitation projects in Mombasa and Kilifi Counties. The average overall score was (M=3.594, SD=0.97). Nicholas and Steyn (2017) revealed that successful projects had features such as timely delivery, on budget and of high quality. Onubi, *et al*. (2020) also revealed that performance is a measure of functionality and the capacity to deliver the stated features and quality. Similarly, Kanda, *et al.* (2016) shared that the water projects that are completed should be able to satisfy the stakeholders including beneficiaries (local communities), project financiers and other developmental partners. Kerzner (2017) revealed the need to cut costs to keep projects within the allocated budget lines. In addition, Ngure (2019) noted that timely delivery of the completed projects improve satisfaction rates of the water and sanitation projects to the beneficiaries and other stakeholders

➢ *Correlation Analysis*

| | | Project Performance |
|---|---|---|
| Project Performance | Pearson Correlation | 1 |
| | Sig. (2-tailed) | |
| | N | 33 |
| Scope Control | Pearson Correlation | .741** |
| | Sig. (2-tailed) | .000 |
| | N | 33 |
| *. Correlation is significant at the 0.05 level (2-tailed). | | |
| **. Correlation is significant at the 0.01 level (2-tailed). | | |

Table 3:- Correlations

The results in table 3 shows that there was a positive and significant effect between scope control and project performance (r=.741, p-values of 0.000)

➢ *Diagnostic Tests*

| | Skewness | | Kurtosis | |
|---|---|---|---|---|
| | Statistic | Std. Error | Statistic | Std. Error |
| Performance of Projects | -1.329 | .221 | 1.747 | .438 |
| Scope Control | .521 | .221 | -.393 | .438 |

Table 4:- Normality Test

Normality test was carried out to check if the data was normally distributed, and the results based on the values of Skewness and Kurtosis, which were in the range of -3 and +3. These findings signify that the dataset is normally distributed.

| | Collinearity Statistics | |
|---|---|---|
| | Tolerance | VIF |
| Scope Control | .301 | 2.912 |
| **Overall VIF** | **.301** | **2.912** |

Table 5:- Multicollinearity Test

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The results shared show that VIF value ranges from 1-10 and the analysis showed that VIF value was 2.912 and within the range of 1 and 10. The results indicate that there was no multicolinearity condition in the data set and imply that the data is suitable for running regression analysis.

| Model | Durbin-Watson |
|---|---|
| 1 | 1.793 |

Table 6:- Autocorrelation Test

Serial correlation was checked through conducting autocorrelation test using the Durbin Watson and findings were 1.793 which can be rounded off to the nearest whole number of 2 and shows positive autocorrelation.

➢ *Regression Analysis*

The model of summary, goodness of fitness and regression coefficient was analyzed and results presented in this section:

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .747[a] | .558 | .495 | 2.52865 |

Table 7:- Model Summary

The correlation coefficient is at 0.747 an indication that scope control had strong and positive relations to performance of the water projects in Mombasa and Kilifi Counties. The coefficient of determination is presented by the R square at 0.558, meaning that 55.8% of changes in the performance of the water projects in Mombasa and Kilifi County as influenced by scope control.

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Regression | 225.936 | 1 | 225.936 | 39.123 | .000 |
| Residual | 179.033 | 31 | 5.775 | | |
| **Total** | 404.970 | 32 | | | |

a. Dependent Variable: Performance of Projects

b. Predictors: (Constant), Scope Control

Table 8:- ANOVA

The ANOVA statistics were calculated at 0.05 significance level shows that F calculated (39.123) > F critical (4.16) implying fitness of the model and it was accepted for use in the study. The p-values 0.000 is less than the standard set at 0.05 implying that scope control affected performance of the water projects in Mombasa and Kilifi Counties.

| Model | Unstandardized Coefficients | | Standardized Coefficients | T | Sig. |
|---|---|---|---|---|---|
| | B | Std. Error | Beta | | |
| (Constant) | 8.691 | 2.187 | | 3.974 | .000 |
| Scope Control | .499 | .097 | .448 | 5.141 | .000 |

a. Dependent Variable: Performance of Projects

Table 9:- Regression Coefficient

The Resulting Equation takes this form:

**$Y = 8.691 + 0.499X_1$**

**Y = Performance of water and sanitation projects in Mombasa and Kilifi Counties and $X_1$ = Scope Control**

The regression coefficient results showed that scope control has positive and significant effect to performance of water projects in Mombasa and Kilifi Counties (β=.499, p-values = 0.000 < 0.05). This is also echoed by Nibyiza (2015) who shared that using scope control helps in reducing the number of changes in the project which have negative impact on costs and timelines. Therefore scope control improves project performance outcomes through cutting costs and time wastage hence delivery projects on time and as per the budget estimates. Furthermore, Al-Rubaiei, *et al.* (2018) shared that scope management function is associated with performance of project in terms of costs, time and quality.

## V. SUMMARY, CONCLUSION AND RECOMMENDATIONS

### *A. Summary of Findings*

The study's main aim was to determine the effect of scope control on performance of water and sanitation projects in Mombasa and Kilifi Counties, Kenya. The study was anchored on management theory and employed descriptive design. The data was collected from 14 projects under the Coast Water Works Development Agency (CWWDA) within Kilifi and Mombasa Counties in Kenya. Respondents included project managers, project engineer and project consultants and the response rate was 71.7%.

The study set out to assess how scope control affected performance of water and sanitation projects in Mombasa and Kilifi Counties. The respondents also strongly agreed that scope control influenced performance with mean scores of M =4.03. The regression analysis showed significant relationship between the two variables with beta at β=.499 and the association was positive due to p-values = 0.000 < 0.05.

### *B. Conclusion*

The beta results of β=.499 showed that scope control had the large effect to performance of the water projects in Mombasa and Kilifi Counties. Therefore, the conclusions were such scope control had positive and significant effect to performance of the water and sanitation projects. Scope

control practices involved constant monitoring, evaluation and reviews and sharing the information to all internal and external stakeholders.

*C. Recommendations*

The study suggests installing control measures in the scope to reduce problems of delays that have negative impact on cost and time. Furthermore, quality of the projects can only be assured through continuous monitoring and evaluation and sharing of feedback, update on progress and views. This study has revealed that improvement in project performance is linked to adoption of scope control element; hence recommendations are made that other water projects in different regions, or any other project type should use scope control practices when seeking high performance.

Future researchers can consider other types of projects such as building and construction projects in the same location. Alternatively, other researches can cover water and sanitation projects in other counties like Kisii, Nyamira or Kiambu for comparison purposes. At the same time, research can also be done on other factors that influence performance of projects. The regression coefficient showed 55.8% of performance of the water and sanitation projects was due to scope control. The residual effect of 44.2% that was outside the scope of this study can form a research base for future researchers.

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