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Juma Jama & Dr. Lydia Gachengo, PhD

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RESOURCE MANAGEMENT PRACTICES AND SUSTAINABILITY OF WATER PROJECTS IN TANA RIVER COUNTY, KENYA

[1] Juma Jama & [2] Dr. Lydia Gachengo, PhD

[1] Masters Candidate, School of Business, Economics and Tourism, Kenyatta University, Kenya
[2] Lecturer, School of Business, Economics and Tourism, Kenyatta University, Kenya

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ABSTRACT

The general objective of this study was to assess the effect of project resource management practices on the sustainability of water projects in Tana River County, Kenya. The study was guided by the following specific objectives; to establish the effect of resource planning, resource scheduling, resource allocation and resource monitoring on the sustainability of water projects in Tana River County, Kenya. The study was anchored on theory of project management, theory of constraints theory of resource-based view. Descriptive survey was employed. This study targeted 83 project stakeholders consisting of 5 county officials under the County Environment, Water, Natural Resources & Climate Change, 13 project managers as well as 65 project management committee members. Resource planning, resource scheduling and resource monitoring were found to have a positive and significant effect on project performance. Resource allocation was found to have insignificant effect on sustainability of water projects in Tana River County. The study recommended on resource planning that according to job and efficiency requirement, more workers during busy hours, and fewer staff at slower times. The study recommended different approaches to task scaling and planning on asset management. The study recommended that project managers should be mindful of the scope of the project they are operating on, because the greater the nature of the project, the more they will decide how to distribute the money. The different techniques in use should include basic and common methods such as scientific analysis meetings such as earned value analysis and critical path analysis.

Key Words: *Resource Planning, Resource Scheduling, Resource Allocation, Resource Monitoring*

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INTRODUCTION

Global population increase continues and the pressure on crucial services such as water persistently escalates. Management of water encompasses use of participatory approaches in empowering the communities to guard their water resources (Eaton, et al., 2021). Projects of infrastructure among them water projects have a crucial role within societies of converging the economic development need and most importantly to change the citizens' quality of life (Onyango, Bwisa, & Orwa, 2017). The central role of public infrastructural projects in sustaining development is acknowledged in Chapter 27 of the 21st agenda of United Nations (UN Charter 1945). Likewise, Sustainable Development Goal 6 on water and sanitation (SDG 6) SDG 6 seeks to ensure safe drinking water and sanitation for all, focusing on the sustainable management of water resources, wastewater and ecosystems, and acknowledging the importance of an enabling environment. Nonetheless, above a billion individuals across the globe do not have the accessibility to clean water for drinking. This challenge is specifically acute in the rural regions and the small communities, in which collection of water may need physical effort hours, sources of way might be contaminated, or perhaps must be bought at very expensive rates to enable proper hygiene and health (Kagiri & Wainaina, 2017).

In China, two major water projects were initiated in the year 2014 to 2020; China's mega water projects and the South-to-North Water Diversion Project. The South-to-North Water Diversion Project in China is the largest of its kind ever undertaken. The project involves drawing water from southern rivers and supplying it to the dry north. This massive scheme has already taken 50 years from conception to commencement and is expected to take almost as long to construct (Hansen, Li, & Svarverud, 2018). The contributing factor to the delay and quality of South-to-North Water Diversion Project in China was the resource management (Geall & Ely, 2018).

In Africa, for instance in Ghana, a lot of delays in completion of water projects has been experienced (Agyeman, 2019). According to Sabastian and Nathan (2017) this scenario aggravates the already worse situation in regard to the living conditions of the general population in Ghana hence constraining the social economic advancement of the rural economy. Nonetheless, resource management practices is geared at expanding new services have been threatened by destabilizing the practical sustainability by encouraging hurried building of infrastructure as opposed to the long term, much required interests in operation and support. The completion of projects has become the major center of operation of nearly all African governments from the ancient periods. In South Africa, resource planning, sufficient resource allocation and resource monitoring in many governments departments are issues that influence project delays, incompletion of projects, poor workmanship and cost overruns therefore affecting the performance of the whole project. It is asserted that when delays and cost overruns set in, projects cannot be completed within the budget, time and scope (Oluwoye & Crawford, 2019).

Jacob and Gichuki (2020) observed that several Kenyan communities have hailed the effectiveness and viability of community water supply projects as a promising direction. The initial assumptions made about sustainability during project planning and design may alter with time, endangering a project's ability to continue operating. For instance, the majority of community-managed water projects rely on a steady supply of water, unchanging water regulations, and ongoing local management capabilities. However, Kariuki (2021) noted that excessive water use or even the effects of climate change, which could disrupt source recharge rates, could result in a reduction in water supply. Therefore, to be sustainable, community-managed water projects in Kenya need constant outside assistance long after the project is finished, as well

as meaningful participation at every stage of the project cycle.

According to Abrams (2018), sustainability pertains to the ongoing provision of consistent benefits to both project owners and beneficiaries, ensuring the continuity of the project. The objective is to ensure that the project continues to deliver the same level of functionality as initially intended, as outlined in the project plans, while also striving to enhance the quality of the product. In a study conducted by Nakagami, Kubota, and Setia wan (2016), it was demonstrated that the attainment of project sustainability relies on several key factors. These factors include the availability of adequate funds to cover maintenance and repair expenses, as well as the provision of well-trained and skilled service providers who can effectively design and implement high-quality water projects.

Management of resources is the deployment of resources of the organization effectively and efficiently at the time they are required (Watt, 2017). On basis of project management, managing of resources is developing of techniques, processes and philosophies of the most appropriate approach of allotting resources to activities or tasks of a given project (Maserang, 2012). Management of resources within a project is inclusive of the procurement and deployment of external and internal resources that are prerequisite for project delivery. Its major focus is prioritization when it comes to utilization of resources, monitoring production and usage of resources and measurement of the effectiveness of resources (Engwall& Jerbrant, 2003; Petrovic& Van Bruwaene, 2004).

Water infrastructure projects are among the county projects highly marred with delayed completion, cost overruns and abortive works (Akali, 2018). Tana River County, among the counties who have experienced challenges in its general water infrastructure which is attributable to the high levels of marginalization both geographically and historically in this region which have persisted over the years (World Bank, 2019). In Tana River, the water sub sector has progressively grown over the years. The numbers of boreholes for instance that have been drilled by the County Government through the department are 30, the number of water pans constructed across the different parts of the hinterland are approximately 80, while those rehabilitated by the department are at least 100 over the period. The number of pipeline extensions to initially underserved areas has also increased drastically. The department has also increased in staffing in that it has employed water engineers, water quality officers, electromechanical officers, a ground water technician among other officers. However, the sustainability of water projects in Tana River County water has been ineffective. According to County Governance Watch (CGW) (2022) a number of water projects have stopped operating immediately after the development partners and other sponsors withdrawal.

Statement of the Problem

The economic development of nations particularly developing countries is hinged on the sustainability of water infrastructural projects implemented by governments (Calderon, Cantu, & Chuhan-Pole, 2018). These projects highly contribute to economic productivity and industrialization, increased job opportunities and poverty alleviation among other benefits. Nevertheless, the benefits accruing from these projects have been watered down by project failures and unsustainability (World Bank, 2021). According to World Bank report (2022) on water projects show that less than 16% water projects have remained to be useful to the social and economic lives of the community members in Tana River County, 59% of the water projects completed in 2021 have remained non-operational, and 25% facing on-off operations due to machine and resource management ineffectiveness.

Ochieng (2019) study examined the influence of resource management practices on performance of projects in global system of mobile communications companies in Kenya and found that awareness on importance of resource management is carried out among GSM companies in Kenya. However, the

study used qualitative data does not present the inferential analysis. Umulisa, Mbabazize and Shukla (2021) study examined the effects of project resource planning practices on project performance of Agaseke Project in Kigali, Rwanda and found that all project resource planning practices studied had a positive significant relationship on project performance. The context was on Agaseke project in Kigali. Ndayisaba and Mulyungi (2018) study investigated the effect of resources management on project success implementation and revealed that resources management has an influence of on project success implementation of strengthening livelihoods in rural Rwanda project Muhanga district. However, the study used cross-sectional research design and used a small sample size and hence may not be representative of whole population. Therefore, this study investigated the effect of project resource management practices on the sustainability of water projects in Tana River County, Kenya.

Objective of the Study

The general objective of this study was to assess the effect of project resource management practices on the sustainability of water projects in Tana River County, Kenya. The study was guided by the following specific objectives:

- To establish the effect of resource planning on the performance of sustainability of water projects in Tana River County, Kenya.
- To determine the effect of resource scheduling on the performance of sustainability of water projects in Tana River County, Kenya.
- To examine the effect of resource allocation on the sustainability of water projects in Tana River County, Kenya.
- To explore the effect of resource monitoring on the sustainability of water projects in Tana River County, Kenya.

LITERATURE REVIEW

Theory of Constraints

This theory describes the causes of the system constraints and also sheds light on the best ways to deal with these constraints (Goldratt, 2006). An organization operates with the help of systems. A system can be described as a collection of independent and interrelated process which works together in generating outputs from inputs when pursuing certain goals. The limitation for this system is a constraint which prevents the system from its efforts of achieving organizational goals (Noreen, Smith, & Mackey, 2008). Theory of constraints is applicable in this study since the planning, scheduling, allocation and monitoring of project resources are constraints that face project teams in counties when carrying out road infrastructure projects. The best way to handle such kind of a problem is to find ways of countering these challenges to remove barriers to sustainable water projects (Ruhl, 2011). Resource management is an important aspect in executing water projects and should be undertaken in an effective manner in order to improve success of these endeavors. Among the impediments affecting success of projects are inadequate resources that are poorly allocated to project tasks. These limitations highly contribute to failure of project completion resulting into inefficiencies and delays which might result in increased costs of projects. However, the supporters of this theory; Noreen *et al.* (2012) put more emphasis on the significance of project teams identifying the limitations and establishing effective ways to deal with these limitations at early stages to reduce their impact on road projects.

Resource Based View Theory

This is a theory by Barney (1991) which indicates that the possession of resources which are strategic provides a given organization with a superb chance of creating a competitive advantage over their rivals. This competitive edge can aid the organization in enjoyment of unassailable profits as when compared to similar competing groups. Managers of projects have a role of utilizing resources which are made available throughout the cycle stages of a project in ensuring their success as compared to implementation of projects of other institutions as follows; identification and

classification of the resources within the firm, estimation of capabilities and vulnerabilities in relation to their rivals, identification of opportunities in ensuring that resources are utilized in a better way, identification of capabilities of the firm, assessing the ability of resources to generate rent and how capable they are in terms of maintaining sustainability, selection of a the best resource exploitation strategy within the firm in relation to its rivals and identification of gaps in the resources that need to be bridged (Johnstone & Brenman,1996). This theory is an exploration of the desire for the right form of planning and implementation of projects on the basis of availability of resources. Based on this, management makes use of the readily obtainable resources and utilizing them for maximum success of projects in place. This theory is thus fundamental as it stresses on the correct form of planning, scheduling, allocation and monitoring of project resources towards ensuring that sustainability of projects.

Resource Dependence Theory

To increase control of power over resources and ensure successful completion of projects, project organizations try to minimize their own dependence or increase the dependence of others on themselves (Ulrich & Barney, 2014). In doing so, resource dependence theory proposes theoretically and empirically that project organizations concentrate more on resources which are critical for their long-term survival. A good portion of the work by Pfeffer and Salancik (1978) concentrates on how a project organization can manage resource dependence on its environment to ensure a successful outcome.

The theory is important because an organisation's ability to gather, alter and exploit raw materials faster than competitors can be fundamental to success. Resources are often controlled by organizations not in the control of the organization needing them, meaning that strategies must be carefully considered in order to maintain open access to resources.

Empirical Review

Resource Planning and Sustainability of Water Projects

A study by Abu El-alkass (2021) on the analysis of the system of managing resources of construction for contractors of the Gaza strip asserted that equipment planning in projects was necessitated by the need to establish the numerous types of equipment and their sizes which were either on direct purchase or on rent which aided in the control of the cost of the equipment in construction projects. It was also noted that planning of labor helped the contractors in maintaining the right number of employees at the right time with the capability to execute project tasks which were aimed at ensuring success of the project. The study highlighted that labor accounted for around 40%, which was an approximate cost in huge projects, hence maximization of productivity of labor termed as a requirement. However, this study was undertaken in a different setting hence there cannot be generalization of these findings in fitting the case of water projects in Tana River County.

Kumari and Vikranth (2021) undertook a study on planning of resources of the construction of highway projects of India. A survey was conducted. The study found that these projects suffered from underutilized resources which were attributed to lack of detailed and thorough planning and absurd decision making in site management. The study found that resource planning in most of these projects was confined to planning of time resources but planning on how the resources would be mobilized and utilized and planning according to resource capacity and availability was not considered. According to the study, material planning reduced the level of unnecessary wastage and ensured that all the required material for all project phases were available. The findings also demonstrated that manpower planning was fundamental in the achievement of project objectives since it ensured that in executing the projects, the right number and kind of project team, within the correct timing and place, and those

capable of completing the project tasks in an effective and efficient manner was available. However, this study will be on water projects in Tana River County.

A research by Shadrack (2018) on issues affecting practices of planning of resources in the construction sector within Kenya with a shift to contractors of the county of Nairobi. A descriptive design of research was used. It was discovered that even though resource planning in the industry was used to a great extent, much of it was non-structured. It was pinpointed that the growth of projects of construction within the county continued to be adversely impacted by delays in materials as well as deficits in equipment and labor when mostly required. The study established that equipment planning, labor planning, and material planning were resource planning practices mostly carried out in previous firms of contracting and where management at the top supported the endeavors. However, this study focused on construction projects carried out by private developers which are carried out in different contextual factors from that water projects sustainability.

Resource Scheduling and Sustainability of Water Projects

Dong, Li, Zhao, Li, and Yan (2021) conducted an assessment of resource scheduling in multi-software projects. The study utilized a comparative study design. The assessment revealed that resource scheduling was fundamental in providing project schedules that were effective besides enhancing efficiency in using project resources. It was emphasized that failure to perform resource scheduling would result to inefficiency in utilizing project resources and heightened costs. According to the research, resource scheduling provided a better view of how the project ought to be implemented which was attained through the placement of schedules within activities of the project, for instance the date for commencement and completion of the tasks and resources required to perform them. However, the contextual setting of this study varies from the one being focused. Also, this study utilized comparative design of study, which varies from the descriptive one being relied upon.

Memon and Zin (2021) analyzed the degree to which resource-driven scheduling was being implemented within the construction sector in Malaysia. A survey was undertaken. It was articulated that resource scheduling ensured that project activities were scheduled in a way that project deadlines were achieved utilizing the defined resource availability limits. The study discovered an increased usage commercial packages in undertaking resource scheduling among the firms including Microsoft Project and Primavera Project Planner. Some of the resource scheduling practices which were being implemented on an average extent encompassed resource calendars, assignment of resources to activities, resource priority, leveling, smoothing, stretching and also resource splitting. The study recognized that given that the time span for each project activity depended on resource availability, project challenges were experienced when project work proceeded without considering the manner in which labour, equipment and material constraints would affect the scheduling of the activities. However, a survey design was used which has challenges in validity and reliability of results.

Resource Allocation and Sustainability of Water Projects

Engwall and Jerbrant (2020) analyzed the resource allocation syndrome within the context of managing multiple projects. The study was anchored in qualitative case studies. Interdependencies among projects and lack of resources were pointed out as key concerns in multi-project environments. Competition between projects called for setting priorities and at times resource reallocations. It was established that many projects suffered from short run problem solving which significantly contributed to project delays. Due to inadequacy in allocation of resources, majority of them did not meet the project goals and

many lagged behind their schedules. However, the study will be used qualitative case studies hence a gap in the method of study as the current will rely on descriptive research design.

Bulle and Makori (2019) explored the role of resource allocation in the performance of projects carried out by Kenya Urban Roads Authority. The research relied on a descriptive study design. As per the study, allocating financial, physical and human resources to projects affected their performance. Resource allocation affected the speed and quality of project delivery ensuring that the cost specifications were observed as outlined in the project plans. The study laid emphasis on the sufficiency of resource allocations in enhancing and sustaining project performance. When the resources are appropriately allocated and utilized, there was an assurance of efficiency and effectiveness of projects resulting to superior project outcomes. However, the contextual background of this study looks on water projects undertaken by Tana River County.

Resource Monitoring and Sustainability of Water Projects

Mosago (2020) assessed impacts of financial monitoring on success of programs undertaken by international NGOs in Kenya. A mixed methods research design was used. There was a positive link between financial monitoring and programme performance for INGOs. The study underscored that the programme performance for INGOs could be greatly improved if on site visits, financial desk reviews and periodic financial review meetings were conducted. Financial monitoring needed to be conducted frequently. Thorough monitoring, reorienting and intensifying monitoring greatly contributed to more cost-effective, socially effective and successful programmes. Financial monitoring reduced the chances of funds being misallocated as they were utilized for the core business of the program's existence.

Ochieng (2019) investigated the degree to which resource management influenced the execution of projects undertaken by mobile communications firms within Kenya. Study relied upon the design of descriptive survey. Investigations revealed that enough efforts to monitor and control the project resources ensured that project funds were spent appropriately as planned and with proper authorization. The study noted that the tools for monitoring progress and how often financial auditing and reporting were undertaken helped to eliminate waste and served as a performance monitoring tool. Financial auditing was found to be very important in assessing the process and system used in capturing and reporting project costs. However, the study focused on projects undertaken privately by mobile communications firms which are different from public water projects undertaken by Tana River County hence the findings of the study cannot be automatically generalized to fit the case under study.

Conceptual Framework

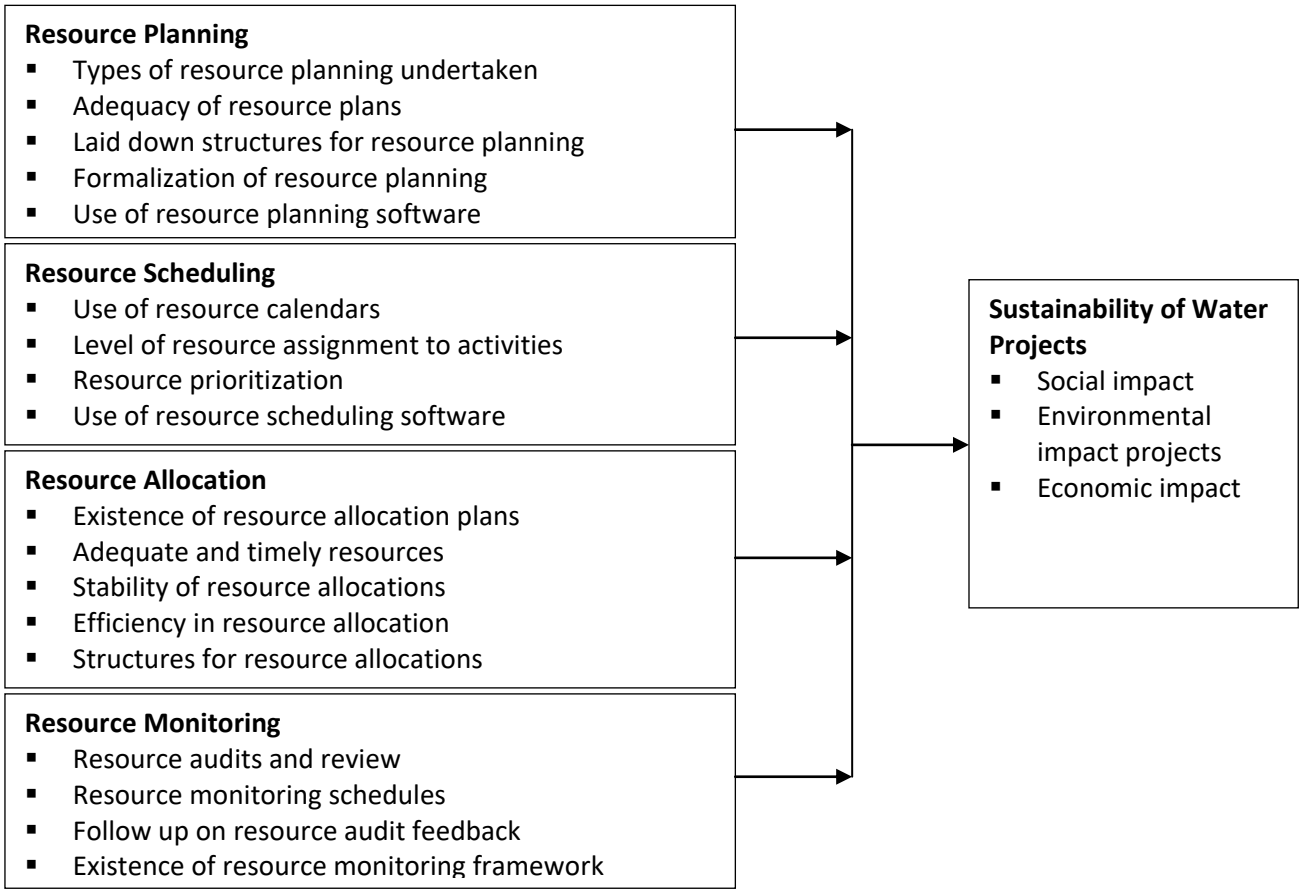

Figure 1: Conceptual Framework

METHODOLOGY

In this study, a study design of descriptive survey was employed. This study targeted 83 project stakeholders consisting of 5 county officials under the County Environment, Water, Natural Resources & Climate Change, 13 project managers as well as 65 project management committee members who were engaged in the 13 major water projects completed by the county government in Tana River County as well as all the county wide projects for the period 2017-2022 (Tana River County, Environment, Water, Natural Resources & Climate Change, 2023). Due to manageable small population, the researcher used a census.

The gathering of primary data was performed by use of semi-structured questionnaires. The study pilot was carried out in Tana River County where the researcher selected 8 water project managers. The eight managers were exempted from the main study. The test of Cronbach alpha aided in evaluating reliability of the questionnaire.

There was application of both quantitative and qualitative approaches of analyzing data. Thematic analysis was performed on the open-ended questionnaires where data was summarized into themes and where possible coding done to summarize the information. Statistics in form of descriptions which are inclusive of means, frequencies, standard deviation and percentages were sundered out in order to portray the fundamental traits of data that has been collected.

Regression analysis was undertaken in determination of the link between resource management practices study namely; resource planning, resource scheduling, resource allocation as well as resource monitoring and sustainability of

water projects in Tana River County, Kenya. Therefore, by undertaking a multivariate regression analysis, there were quantification of each practice of managing resources upon the sustainability of water projects in Tana River County, Kenya. The presentation of the result was in tables and figures.

RESEARCH FINDINGS AND DISCUSSIONS

Response Rate

Tana River County respondents completed 83 questionnaires in total. Of the 83 respondents, 63 returned their questionnaires, yielding a response rate of 75.9%; the remaining 24.1% of respondents did not reply. The data gathered for the field was enough for analysis, as evidenced by the overall response rate of 75.9%.

Descriptive Analysis Results

Standard Deviation (SD) and Mean (M) were used to analyze the descriptive data. The following is how the findings are shown based on the study-specific variables.

Resource Planning and Sustainability of Water Projects

The section presents results on resource planning in water projects in Tana River County, Kenya. Table 1 presents results.

Table 1: Resource Planning and Sustainability of Water Projects

	Mean	Std. Deviation
There is thorough planning of all the resources used in carrying out water projects in the county	4.12	.72497
The resource plans adhered to throughout the water project cycles within the county are very adequate	4.04	.44521
There are established structures that guide project management teams when planning for water project resources within the county	4.28	.36116
The entire process for project resource planning in the county is highly formalized	4.10	.53996
The use of resource planning softwares/computer packages has been adopted by project management teams in the county	4.53	.45280
Aggregate Score	**4.21**	

Source: Field Data (2023)

With a standard deviation of 0.72497, the average mean of 4.21 from Table 1 data showed that resource planning was critical in establishing project sustainability in Kenya. The various types of equipment and their sizes that were either on direct purchase or on rent, which helped to control the cost of the equipment in construction projects, made equipment planning necessary, according to a study by Abu El-alkass (2021) on the analysis of the system of managing resources of construction for contractors of the Gaza strip. Based on Table 1 data, the mean of 4.53 showed that project management teams in the county had implemented resource planning software/computer packages to a larger extent, with a significant variance of 0.45280. These results are consistent with the study conducted by Kumari and Vikranth (2021) about resource planning for Indian highway building projects. According to the report, the underutilization of resources in these projects was caused by a lack of comprehensive planning and irrational site management decisions.

With a significant variance of 0.36116, the mean of 4.28 suggested that project management teams are guided by well-established processes when allocating resources for water projects in the county. This is consistent with research conducted by Shadrack (2018) on issues affecting resource planning practices in Kenya's construction industry, with a focus on contractors in the Nairobi County. The study found that although resource planning was used extensively in the industry, a large portion of it was unstructured. The resource plans adhered

to throughout the water project cycles within the county were very adequate (M=4.04) and there was thorough resource planning for all the resources (M=4.12).

Resource Scheduling and Sustainability of Water Projects

The respondents were further given a list of statements related to resource scheduling in the water projects undertaken within Tana River County state to state their level of agreement.

Table 2: Resource Scheduling and Sustainability of Water Projects

	Mean	Std. Deviation
The resources available are always considered throughout the process of scheduling when sustainability county water projects.	4.52	.56001
There is extensive use of resource calendars when undertaking water projects in the county	4.63	.59121
There is efficient assignment of resource to different project activities throughout water project cycles in the county.	3.73	.50319
Project managers have always successfully reorganized water project tasks and resources so as to achieve project objectives under limited resources and budget constraints.	3.30	.49867
There has been efficient prioritization of resources in cases of competing resource demands.	4.50	.49936
The use of resource scheduling softwares applied in the industry have been adopted by project management teams in the county	4.00	.49786
Aggregate Score	**3.99**	

With a standard deviation of 0.56001, the average mean of 3.99 in Table 2 data showed that resource scheduling was used successfully. Joshi and Patil (2013) used a case study methodology to evaluate resource scheduling in construction projects. Project resource scheduling was found to be a crucial activity for the effective completion of a project since it allowed for creative planning of project activities that were constrained by the resources that were available. According to the study, resource scheduling minimizes unanticipated project losses that might arise from significant variations in resource consumption.

With a significant variance of 0.59121, the mean of 4.63 in Table 2 data suggests that resource calendars are heavily utilized in the county when working on water projects. These results are in line with those of Dong, Li, Zhao, Li, and Yan (2018), who evaluated resource scheduling in multi-software projects and found that, in addition to improving resource utilization efficiency, resource scheduling was essential to producing effective project schedules. The assertion that project managers have consistently successfully rearranged water project activities and resources in order to fulfill project objectives within restricted resources and budget restrictions was somewhat supported by the mean of 3.30, with a significant variation of 0.49867. This is at odds with the results of a study by Memonand Zin (2019) that examined the extent to which resource-driven scheduling was applied in Malaysia's construction industry. The study stated that resource scheduling made sure that project activities were planned so that project deadlines were met while making use of the specified resource availability limits.

Resource Allocation and Sustainability of Water Projects

The respondents were further given a list of statements related to resource allocation in the water projects undertaken within the county state to state their level of agreement.

Table 3: Resource Allocation

	Mean	Std. Deviation
There are established resource allocation plans that guide resource allocations towards execution of water projects in the county	3.93	1.066
There is always adequate and efficient allocation of resources needed in Sustainability of water projects in the county	4.80	.838
There is always stability in resource allocations as planned for all water project activities throughout the entire duration of the projects in the county	4.81	.527
There is timely allocation of resources needed in sustainability of water projects in the county.	4.83	.379
There are established structures that have been laid down to guide the entire resource allocation process in the execution of water projects in the county.	3.96	.455
Aggregate Score	**4.47**	**0.653**

Source: Field Data (2023)

With a standard deviation of 0.653, the average mean of 4.47 from the findings in Table 3 suggested that resource allocation was successfully used for the targeted water projects. The study conducted by Murithi, Makokha, and Otieno (2017) examined the factors that impact the timely completion of public construction projects in the Trans-Nzoia county of Kenya. The findings indicated that the distribution of resources within the project had a significant impact on the timely completion of public construction projects. Based on the data shown in Table 3, the average score of 4.83 suggests that the county has effectively allocated resources in a timely manner for the implementation of road projects, with a significant variation of 0.379. The resource allocation syndrome was examined in the context of managing several projects by Engwall and Jerbrant (2013), who found that many projects had short-term issue solutions, which considerably increased project delays. This conclusion is consistent with their findings.

As seen by the mean of 4.81 and standard deviation of 0.527, the respondents also overwhelmingly agreed that resource allocations for all water project activities are consistently stable during the course of the county's projects. The findings of the Gashuga, Kule, and Ndabaga (2016) study, which showed that funding distribution cut administrative expenses, improved project efficiency prediction, and decreased overall project risk, all corroborate this. The mean of 3.93 and the standard deviation of 10.65 indicate that the respondents agreed that the county has formed resource allocation plans that direct resource allocations toward the implementation of water projects. This is consistent with a 2015 study by Bulle and Makori that discovered project performance was impacted by the allocation of material, financial, and human resources. Allocating resources had an impact on the project's delivery speed and quality while guaranteeing that the project plans' cost criteria were followed.

Resource Monitoring and Sustainability of Water Projects

The respondents were further given a list of statements related to resource monitoring in the water projects undertaken within the county state to state their level of agreement. Table 4 summarizes the result.

Table 4: Resource Monitoring and Sustainability of Water Projects

	Mean	Std.Dev
The county has a recognized framework and tools for monitoring the use of Resources in executing water projects	3.4290	.45999
There is continuity in inspecting the physical and financial progress of water projects in the county against established resource plans	3.3343	.56663
The county transport and infrastructure committee make periodic visits to the water project sites and inspects the projects' books of accounts	3.2754	.59657
County project supervisors give emphasis to auditing and reviewing the use of water project resources at frequent intervals and on a timely basis	3.5217	.55666
Results and feedback from water project resource audits and reviews are always provided on time	3.4348	.66673
Resource audit follow-ups are implemented throughout lifecycle of water projects in the county	3.4348	.77567
Aggregate Score	**3.4005**	**0.6014**

Source: Field Data (2023)

The results indicated that the county has moderately recognized framework and tools for monitoring the use of resources in executing water projects (Mean=3.4290, Std Dev=0.45999). With a standard deviation of 0.604, the average mean of 3.405 from Table 4 data showed that resource monitoring has a moderately impact on how well water projects function in Tana River County, Kenya. In their evaluation of the key factors influencing the quality of construction projects in India, Jha and Iyer (2016) found that timely feedback and appropriate resource monitoring helped supervise the project managers' level of workmanship, which in turn raised the quality of the projects. Table 4 results show that, with a significant variance of 0.56663, there was moderate continuity in the county's water projects' physical and financial progress inspections, as shown by the mean of 3.3343. These results are consistent with those of a research conducted by Mosago (2018), which evaluated the effects of financial monitoring on the accomplishment of projects carried out by foreign non-governmental organizations in Kenya and discovered a favorable correlation between program performance and financial monitoring. The study emphasized that doing on-site inspections, financial desk checks, and monthly financial review meetings might significantly improve the program performance for INGOs.

As demonstrated by a mean of 3.5217 and a standard deviation of 0.55666, the respondents also stated that the project supervisors place moderate priority on auditing and reviewing the usage of road project resources on a regular and timely basis. This is corroborated by the results of the Ochieng (2019) study, which examined the extent to which resource management affected the way projects carried out by Kenyan mobile communications companies were carried out. It found that sufficient efforts were made to monitor and control the project resources to guarantee that project funds were used as intended and with the necessary authorization. The county transport and infrastructure committee visits the water project sites on a regular basis and reviews the project books, according to the mean of 3.2754 and standard deviation of 0.59657. Kamwana and Muturi's (2019) study agreed with these findings and found that financial resource monitoring had a positive and significant impact on the projects' success.

Sustainability of Water Projects

The study sought to investigate the sustainability of water projects in Tana River County, Kenya. The results were summarized in Table 5.

Table 5: Sustainability of Water Projects

	Mean	Std. Dev
The project was acceptable to the clients	2.9203	.52597
The project met the expectations of the stakeholders	2.9148	.49936
The project was delivered within the agreed budget	2.9013	.49162
The projects changed the social lives of the community members	3.0021	.76548
The community was able to improve their living standards	3.1123	.65430
The projects have changed the economy within the county	2.8769	.65476
The environment has changed due to the impacts of the water projects	3.5466	.54637
Aggregate Score	**2.9546**	**0.59858**

Source: Field Data (2023)

The aggregate result indicated that majority of the water projects in Tana River County were not sustainable (Mean=2.9121, Std Dev=0.50565). The water projects moderately changed the social lives of the community members in Tana River County, Kenya (Mean=3.0021, Std Dev=0.76548). To a moderate extent the community was able to improve their living standards (Mean=3.1123, Std Dev=0.65430). The projects have moderately changed the economy within the Tana River County (Mean=2.8769, Std Dev=0.65476). The study results indicated that the projects were moderately acceptable to the clients (Mean=2.9203, Std Dev=0.52597). The findings further indicated that the projects partially met the expectations of the stakeholders (Mean=2.9148, Std Dev=0.49936). Additionally, the findings indicated that the projects were not delivered within the agreed budget (Mean=2.9013, Std Dev=0.49162). The environment has moderately changed due to the impacts of the water projects in Tana River County (Mean=3.5466, Std Dev=0.54637). This implies that the water projects that were initiated and completed by various government entities within Tana River County in the years 2017 to 2022 were unable to meet the stakeholders expectations in relation to their social, economic and environmental impacts.

Inferential Analysis

Correlation Analysis

The result in this section presents the correlation results amongst variables under study. The results were presented in Table 6.

Table 6: Correlation Analysis

		Planning	Scheduling	Allocation	Monitoring	Sustainability
Planning	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	69				
Scheduling	Pearson Correlation	.431**	1			
	Sig. (2-tailed)	.500				
	N	69	69			
Allocation	Pearson Correlation	.012	-.338**	1		
	Sig. (2-tailed)	.924	.505			
	N	69	69	69		
Monitoring	Pearson Correlation	-.028	-.325**	.960**	1	
	Sig. (2-tailed)	.819	.206	.200		
	N	69	69	69	69	
Sustainability	Pearson Correlation	.594**	.617**	.704*	.734**	1
	Sig. (2-tailed)	.000	.000	.011	.005	
	N	69	69	69	69	69

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Source: Field Data (2023)

The relationships amongst variables indicated that resource planning, resource scheduling, resource allocation and resource monitoring were insignificant and weakly correlated at 95% confidence interval. However, the correlation between resource planning and sustainability of water projects was significant and strong (P=0.594, sig<0.05) at 95% confidence interval. The correlation between resource scheduling and sustainability of water projects was significant and strong (P=0.617, sig<0.05) at 95% confidence interval. The correlation between resource allocation and sustainability of water projects was significant and strong (P=0.704, sig<0.05) at 95% confidence interval. Further, the correlation between resource monitoring and sustainability of water projects was significant and strong (P=0.734, sig<0.05) at 95% confidence interval.

Li *et al.* (2018) study revealed that resource scheduling significantly influences sustainability of water projects. Gashuga *et al*. (2016) study that noted that the allocation of funds minimized administrative costs, it resulted to enhanced prediction of project efficiency and reduced the minimized the general project risk. Ochieng (2019) study revealed that enough efforts to monitor and control the project resources ensured that project funds were spent appropriately as planned and with proper authorization thus significantly affecting sustainability of projects.

Regression Analysis

The result under this section presents the model summary, analysis of variance and regression coefficients. The result on model summary presents the coefficient of determination which explains the extent with which the variables considered explained the changes in dependent variable. The analysis of variance presents the model goodness of fit and coefficients indicated the linear relationship amongst the variables.

Table 7: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.887[a]	.787	.774	1.48037

a. Predictors: (Constant), Planning, Scheduling, Allocation, Monitoring

Source: Field Data (2023)

The adjusted R^2, also called the coefficient of multiple determinations, is the percent of the variance in the dependent explained uniquely or jointly by the independent variables. Therefore, the four independent variables (resource planning, resource scheduling, resource allocation and resource monitoring) that were studied, explain 77.4% of the sustainability of water projects in Tana River County, Kenya as represented by the adjusted R square. This therefore means that other factors not studied in this research contribute 22.6% of the sustainability of water projects.

Table 8: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	518.382	4	129.596	59.136	.000[b]
	Residual	140.255	64	2.191		
	Total	658.638	68			

a. Dependent Variable: Sustainability of Water Projects

Source: Field Data (2023)

The p-value is 0.000b which is less that 0.05 thus the model is statistically significant in predicting how resource planning, resource scheduling, resource allocation and resource monitoring influenced the sustainability of government sponsored water projects, Kenya. The F calculated at 5% level of significance was 59.136. Since F calculated is greater than the F critical (p value =2.762), this shows that the overall model was significant.

Table 9: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	14.040	3.270		4.294	.000
	Planning	.781	.153	.336	5.100	.000
	Scheduling	1.264	.135	.648	9.360	.000
	Allocation	-.252	.330	-.162	-.764	.448
	Monitoring	1.167	.343	.709	3.398	.001

a. Dependent Variable: Sustainability of Water Projects

b. Predictors: (Constant), Resource Planning, Resource Scheduling, Resource Allocation, Resource Monitoring

Source: Field Data (2023)

The established regression equation by the study was:

$$Y = 14.040 + 0.781X_1 + 1.264X_2 + 1.167X_4$$

From the above regression model, holding all the independent variables studied constant, sustainability of water projects in Tana River County would be 14.040. As shown in table 9

resource planning, resource scheduling and resource monitoring had a positive and significant effect on sustainability of water projects in Tana River County, Kenya as indicated by sig-values. The relationships ($p < 0.05$) for three variables are significant with resource planning ($t= 5.100$, $p < 0.05$), resource scheduling ($t = 9.360$, $p < 0.05$), and resource monitoring ($t = 3.398$, $p < 0.05$). Resource scheduling was found to have a greater (beta=1.264) effect on sustainability of water projects in Tana River County compared to resource planning (Beta=0.781 and resource monitoring (Beta=1.167).

The study established that resource planning had a positive and significant effect on sustainability of water projects in Tana River County by beta value ($\beta= 0.781$, $p < 0.05$). This is in line with Kumari and Vikranth (2022) study found that these projects suffered from underutilized resources which were attributed to lack of detailed and thorough planning and absurd decision making in site management.

The study revealed that that resource scheduling had a positive and significant effect on sustainability of water projects in Tana River County by beta value ($\beta= 1.264$, $p < 0.05$). This is in agreement with Dong *et al.* (2018) study that revealed that resource scheduling was fundamental in providing project schedules that were effective besides enhancing efficiency in using project resources.

The study established that resource allocation had a insignificant effect on sustainability of water projects in Tana River County by beta value ($\beta= -0.252$, $p> 0.05$). This disagrees with Engwall and Jerbrant (2018) study which established that many projects suffered from short run problem solving which significantly contributed to project delays.

The study established that resource monitoring had a positive and significant effect on sustainability of water projects in Tana River County by beta value ($\beta= 1.167$, $p < 0.05$). This agrees with Ochieng (2014) study that revealed that enough efforts to monitor and control the project resources ensured that project funds were spent appropriately as planned and with proper authorization.

CONCLUSIONS AND RECOMMENDATIONS

The study concludes on resource planning that a key benefit to resource planning is that it helps organizations to fulfill task specifications efficiently. Project managers should recognize skill shortages or criteria for learning, helping to mitigate potential possible asset tensions or negative effects. Planning requires people to be assigned to work on the basis of a number of specific factors such as their capacity, expertise and position for project managers will always be certain that they have the right person for the right job.

The study concludes on resource scheduling that successful resource scheduling allows in different ways to solve problems related to resource availability and job efficiency. The allocation of capital lets you coordinate all things to prepare and complete the project efficiently. Efficient use of assets to accomplish the projects on time and within the allotted budget is an important aspect of any project scheduling management.

The study concludes on resource allocation that efficient resource allocation allows project managers prepare to allocate resources to the task and effectively manage them. Allocation of resources allows managers realize who is overwhelmed and who at that moment is available. Without much workload, managers can assign tasks to the available resource. Proper allocation of resources will help project managers identify the role of group member (s) or employee(s) in a specific task and make it easier for managers to delegate assignments based on their availability.

In terms of resource management, the study concludes that reporting requires daily tracking of key elements of project performance in terms of inputs, actions and outcomes. Good evaluation helps to know whether the expected goals are being accomplished as anticipated, which steps are needed to achieve the intended results during the implementation of the project, and whether these

measures have a positive impact on the execution of the project.

The study recommended on resource planning that according to job and efficiency requirement, more workers during busy hours, and fewer staff at slower times. Planning should be such as to cope efficiently with the project's needs, should be focused on the best use of the assets ' expertise, should be achieved well in advance and should consider the satisfaction and confidence of the workers at the same time.

The study recommends that different approaches to task scaling and planning on asset management. Of example, ahead thinking techniques can be used if a specific project date is established and the assignments are used to decide the timetable and the corresponding deadlines of completion. Additionally, project managers can use backward scheduling techniques when the date of delivery is set and the work has to be planned or scheduled to meet the deadline. Schedules were set and projected throughout the life cycle of the project. The project should begin with a specified planning strategy and this method is likely to change as the plan progresses and changes take place. The aim is to stay informed and agile and to resolve as quickly as possible all scheduling issues.

The study recommended that project managers should be mindful of the scope of the project they are operating on, because the greater the nature of the project, the more they will decide how to distribute the money. Identify the facilities by specifying the type of equipment to be used where the work activities are to be done and the storage required. Start by creating a project's high-level schedule consisting of its specifications and results and start tracking time and workload.

The study recommends that project management during the execution of the plan and should include cost-control strategies, deadlines and deliverables techniques, quality standards approaches and more. The different techniques in use should include basic and common methods such as scientific analysis meetings such as earned value analysis and critical path analysis. The project manager and other partners identify the best strategy, considering specific project goals, availability of capital, environmental factors and more.

Suggestions for Further Study

The current study focused on assessing the effect of resource management practices on sustainability of water projects in Tana River County, Kenya specifically on how resource planning, resource scheduling, resource allocation and resource monitoring affects sustainability of water projects in Tana River County. Therefore, further studies should be carried out on how resource management practices affect the sustainability of water projects in other Counties in Kenya.

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