

PROJECT MANAGEMENT PRACTICES AND PROJECT PERFORMANCE OF SELECTED HYDROPOWER PROJECTS MUSANZE- RWANDA.

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ABSTRACT

The purpose of this study was to see if there is a link between project management approaches and project performance in Rwanda's hydropower projects. This study included 429 participants from Mukungwa II, Rwaza, Subcontractors, Comeca, and EPC/Vizor. The sample size was calculated using Slovin's formula, and the sample size was 207. Data was collected using documentary and questionnaire techniques. Data analyzed by SPSS. The results indicate R square was 0.632 means that power productivity was initiated by the effectiveness of cost management at 63.2%. Results on regression analysis between effective communication and capacity factor of hydropower projects in Musanze District showed that R square was 0.391 means that capacity factor was increased by effective communication by 39.1%. This agrees that this model is acceptable as an effective communication has a significant impact on the capacity factory. Model summary of risk management and energy-based availability of hydropower projects in Musanze: The value of R square was 0.649 means that energy-based availability is affected by risk management at 64.9%. This specifies that the model is acceptable as risk management moderately affects the energy-based availability of hydropower projects in Musanze District. Model summary indicates R square was 0.363 means that time based availability increased by cost management at 36.3%. This agrees that this model is acceptable as cost management has a significant impact on time-based availability. It is recommended that greater effort should be put into classifying project management practices as per their significance.

Key words: Project, Management, Practices, Hydropower, Plants and Projects

INTRODUCTION

Background of the study

The world is evolving faster than ever, and the consequences of not adapting are becoming more apparent. As a result, executives must find a way to strike a balance between maintaining life as normal while simultaneously introducing change. Changing the world is done via programs. Periodic corporations for providing business items in accordance with an accepted business case is known as project management. To the contrary of operations, a project introduces good change, is short-term, cross-functional, and one-of-a-kind, as well as a degree of unpredictability (Axelos, 2019).

Government and corporate efforts have been bolstered, yet many community projects have deteriorated. In Machakos County, Kenya, CBO project performance is inefficient and ineffective. has shown that despite several attempts, projects are scarcely finished, neither within budget nor within the deadlines specified, resulting to the abandonment or failure of these initiatives (Musivo & Chege, 2022).

In Rwanda, there is a huge correlation between project management approaches and agricultural project performance. By far, getting stakeholders involved early on in the planning process had the most influence on the final outcomes of the program. Getting stakeholders involved later, during the implementation phase and during the review phase had the next greatest impact (Kobusingye et al, 2017).

Between 2016 and 2018, the Rwaza hydropower project's completion was feasible in large part by sound project management procedures. As a key source of renewable energy, hydropower dams are the world's greatest origin of power production. Quality control of materials, appropriateness of plan and specification, general management practices, skilled personnel, and inadequate supply of materials are critical factors affecting the operational, maintenance, and construction-performance of the Rwaza hydroelectric project. From the Clean Energy Transition, hydropower dams are a cost-effective solution for generating electricity. Yet, despite its obvious benefits, hydropower dam construction has been fraught with controversy. According to (Baurzhan *et al.* 2021).

Statement of the problem.

The Rwandan government has lofty goals for its power industry, including a goal of 512 MW installed power generating capacity and 100% universal access by 2023/24. By 2023/24, the goal is to have 52% of the connections be on-grid and 48% be off-grid. The power sector's aims, ambitions, and aspirations were evaluated and determined by doing a literature research, analyzing data, and visiting several branch-offices of the Rwanda-Energy Group (REG). Because of its longer lifespan, larger capacity-factor, and greater availability, hydropower got high generation-percentage (468.8%), in part due to Rwanda's recent upgrades and aggressive growth plans (Godwin, 2018).

However, hydropower plants in Rwanda face contextual challenges that negatively affect the sustainability of such systems. Challenges include long breakdown periods, low efficiency, carelessness, and inefficient operation. There are very few scientific studies of hydropower plants in Rwanda, with most of the previous literature composed of consultancy reports, government reports, single case studies, master theses, and conference papers.

For example, Bensch et al. (2011) examined social-economic impacts of rural electrification in Rwanda but do not analyze project management practices affecting the sustainability of generation systems. Geoffrey (2020) mentioned that there is decrease in river discharge during the dry season affects electricity production while the rainy season is characterized by high levels of sediment and soil erosion. This shortens turbine lifetime, causes unplanned outages, and increases maintenance costs. Further, He suggested that there is a need to increase local expertise to reduce maintenance cost.

No specific study conducted of project management-practices on performance of hydropower projects in Rwanda. In this regard, the present study aimed to assess how each practice on cost management, effective communication, risk management and scope management affect performance of hydropower projects in Musanze District.

Justification

This study may offer useful insights to hydropower projects plant management team to improve in funding to the management-aspects that are much major and challenging clarify the projects' performance.

This research had personal interest for make the investigator to gain much knowledge and skills related to project-management-practices and also helped researcher to know how contribute on projects performance.

The research was also be of great influence on the students of UoK while conducting their research hence using it as a reference book from UoK library, this helped them in gaining knowledge and skills. This research was important since it will be a link between results of analysis and theory.

The research provided basic understanding on project management practices and allow the researchers to research further. The final work served as an item of reference tomorrow studies and advanced studies and to the society and by taking into account my things, results and recommendations.

The study findings were of immense importance in the sense that they assisted management of listed hydropower projects in Musanze District and other projects to realize the determinants can affect its operations and performance of their activities.

Research objectives

The following are suggested objectives of the study, namely general objectives and specific objectives.

General objective

The objective of this research is to find the relationship between project management practices and project performance of selected hydropower projects in Rwanda.

Specific objectives

- i. To assess the effect of cost management on power productivity of hydropower projects in Musanze-District.
- ii. To examine how effective communication affect the capacity factor of hydropower projects in Musanze-District.
- iii. To determine the effect of risk management on energy-based availability of hydropower projects in Musanze-District.
- iv. To find out the effect of scope management practices on time-based availability of hydropower projects in Musanze District.

LITERATURE REVIEW

This section reviewed and synthesise conceptual review, conceptual framework and previously empirical review associated with project management practices and project performance theoretical review. Thereafter, relevant model discussed.

Conceptual review

Project cost management

The project cost management is typically one of the most sensitive aspects of a project. This procedure includes four practices: cost management planning, cost estimation, budgeting, and cost containment. The spending plan should be created using rigorous appropriate and suitable and monitored to ensure there are no unnecessary changes that irritate stakeholders. Cost benefit analysis is conducted at frequent status of the project intervals to make the project's progress at that point (Invensis, 2020).

Cost management is the process of estimating the eventual budget of the project given the information available at a specific stage of project development; this measurement of cost is the

beginning figure that enables the initiative to continue to another stages for completed design phase. Cost estimation is typically performed prior to the start of a project in order to keep costs under control (Kostalova & Tetreva, 2014).

Project communications management

Processes that are needed to secure accurate and suitable design, gathering of info to create and distribute it and save it are all part of project-communications management. Communications management includes three processes: This includes designing a communication strategy based on stakeholders' information needs and requirements and the available organizational resources. It's important to keep track of project's information through communications management plan so it is retrieved and needed in the future as needed. To find if or not the communication has been great in satisfying the info needs of project stakeholders, use control communication (Roseke, 2019).

Project management-communication takes on a variety of various non-direct guises. It's usual for projects to depend on non-direct sources of communication such as telephone conversations and the internet, as well as the intranet (project databases) and paper-based instructions (Ziek & Anderson, 2015).

Project risk management

In the words of PMI, a project's risk is everything that could've a positive or negative influence-on the project's goals if it happens. Negative risks, are threats. Modern methods to project management recognize the importance-of managing risk as an inherent part-of the project management-discipline in every project (Mwangi, 2018).

Seven steps are necessary for a successful risk-management strategy: What the program manager decides to do in terms-of risk management is up to him or her. Risk-identification is the procedure through which the most significant dangers are located and recorded in a risk register. Schedule, budget, operational, technical, and other unavoidable risk are the basic categories of risk. The most significant threats should be evaluated qualitatively for likelihood and impact, and then prioritized accordingly. Calculate the potential financial and schedule impacts of major risks to the project's budget and timeline using quantitative risk-analysis (Muute, 2019).

Project scope management

The term "scope" can apply to both the "product-scope" (the features and tasks that make up the item) and the "project-scope" in the context of a project (the work performed to deliver a product, service, or result with the specified features and functions). In some contexts, the term "project-scope" might be used to mean the size of the finished result. A "project-scope statement" is a file that outlines the scope-of the project (Roseke, 2019).

The management of the project's scope also includes the process of change management. To make sure that any changes are approved by the relevant authorities before being implemented, not to prohibit them. In order to win acceptability, it is required to consult at least one stakeholder whose interests will be harmed by the change in scope. Disagreements can only be resolved via the effective use of negotiation strategies and interpersonal skills. There must be periodical updates to the scope statement to reflect completed work, the project's current status, and any changes that have occurred (Invensis, 2020).

Project Management Practices

In the context of a project, a short-term endeavor is undertaken to produce a new product, service, or outcome. Leadership in an organization is influenced by a wide range of issues, such as the need to satisfy a variety of stakeholder demands and needs, the need to implement new business or technical strategies and the need to create, improve upon and/or fix existing goods, processes and services. In

order to meet the needs of a project, project management involves putting together a collection of knowledge, abilities, resources, and processes to get things done (Hassan, 2018).

To manage a project, one must use and integrate the specific project management methods that have been assigned to it. Integration, scope, schedule, cost, quality, resources, communication, risk management in procurement and stakeholder management are among the ten areas of knowledge that are incorporated into the project management process (Hartney, 2017).

Project performance

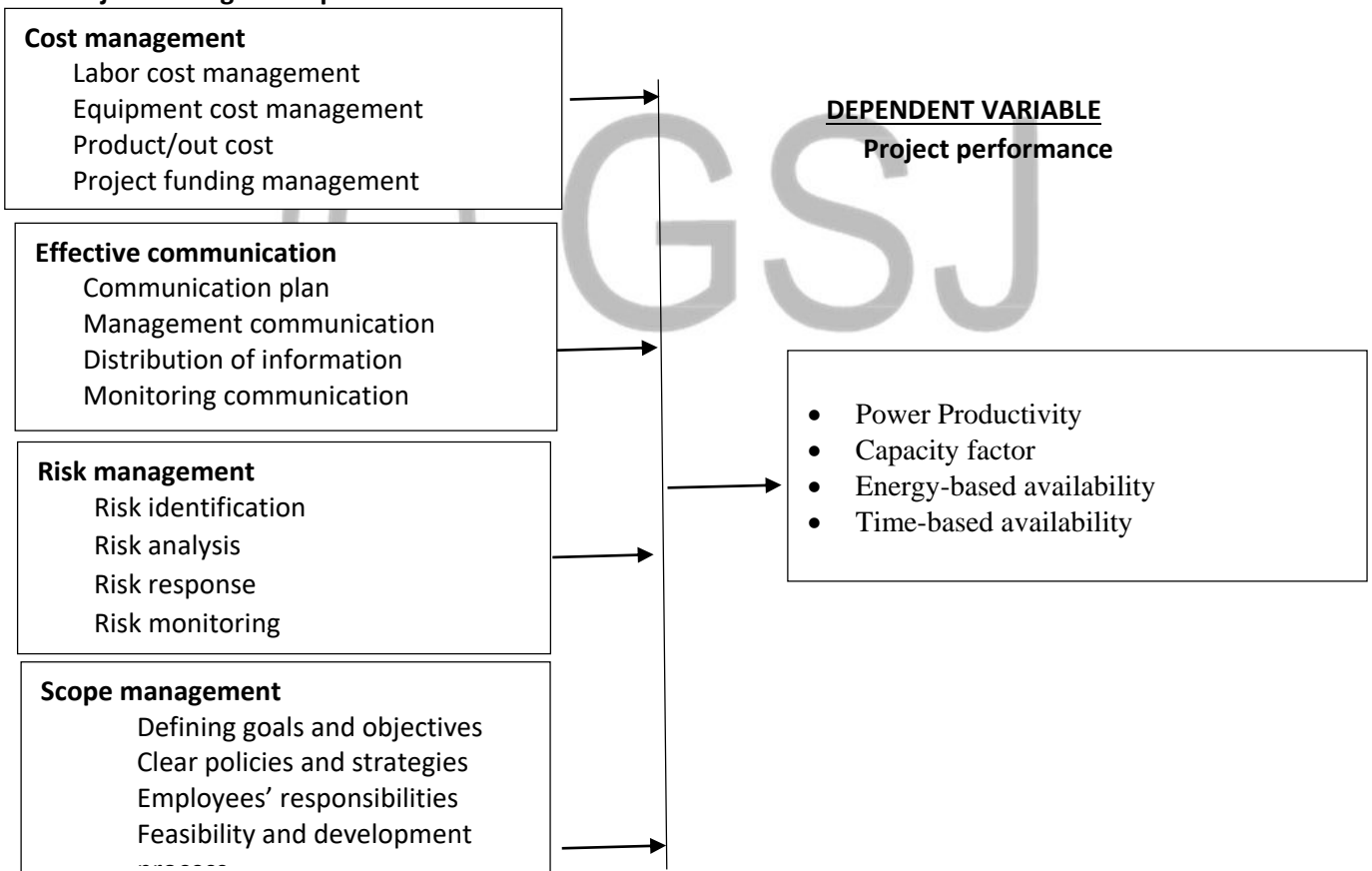
It is also possible to look at project performance in terms of equity, according to Serra and Kunc, (2014) They agree that a project's success may be judged by how well it meets its objectives, including those of time, budget, and quality, as well as by how well it provides value to the client while also being sustainable and palatable to them.

There should be verifiable performance targets in project performance reports that show progress toward project goals. Key assumptions and risks are highlighted as well as major difficulties identified and proposed remedial actions. The projects' evaluations for implementation progress and the possibility of attaining their development objectives are also included in these assessments (Ayatah, 2012).

Conceptual framework

INDEPENDENT VARIABLE

Project management practices



Source: Researcher, conceptualization 2022

Figure 1: Conceptual framework

Theoretical Review

This section of theoretical review discussed on Agency Theory, Theory of Change and Theory of Constraints. Researcher used Theory of Change by assessing how project scope, communication, cost management and risk management affect to project performance.

Agency Theory

The dilemma that comes when working parties have divergent aims and a division-of task is connected to the idea of agency theory. According to agency theory, at least 1 people ("the principals") employ a person ("agent") to do the task. The underlying assumption of the theory of agency is that, principals-and the agents are supposed to be cogent persons who top up their economic interests. Therefore, the breaking of ownership and management will provide choices by the agent that ain't always in the principal's best interest, and there will be expenses (agency costs) of bringing the agent's conduct into line (Kostalova & Tetreanova, 2014).

In 1976, Jensen and Meckling formulated this hypothesis. Conflicts between agencies may be split into 2 categories. There's a dispute between stock holders and debt holders in 1st, and a conflict between shareholders and management in next. Because managers don't have the whole company, disagreements between shareholders and management are inevitable. From incentives provided by debt holders, equityholders are compelled to spend less optimally than they otherwise would. From the argument, project managers of assets that are left to their own-devices are supposed to behave in the best interest of those who have selected them. i.e, the whole project should be done in a way that benefits the owners (Lan, 2010).

Every project is made up of a different stakeholders, including the government, financial institutions, personnel, and the people who will benefit. Consequently, power and interest are distinct for each stakeholder, and only some are principle and others are agent. The project-beneficiaries are principals while project managers act as agents. Since project-management and success are directly linked to human resource-planning and stakeholder management, it's vital to guarantee that each stakeholder's interests are maximized to achieve a successful-project (Bojesson, 2015).

Using agency theory, the researcher examined how scope management impacts project performance. If you want to avoid disputes or difficulties between beneficiaries and managers, you need to choose the correct individual for each job and build a clear reporting system and communication channel in your planning process.

Theory of Change

Modeling and assessing comprehensive network activities invented in the 1990s by the Aspen Institute Roundtable on Community Change (RCC). There are several theories of change, but this one is better comprehensive and detailed. When planning a project, it is necessary to consider the ToC since it's a way-of determining what you want to do, how you want to accomplish it, and when. Changes that you have prepared for needed to gauge the project's effectiveness (Schneider & Wiener, 2016).

Despite you have a better understanding into the problem and a defined aim, project-management can still be tough. Wondering about how to get from where you are now to where you want to be is easy with a Theory-of Change.

A Theory-of Change should take into consideration the priority changes the project wants to cause various alternatives that the project could take to bring the desired-changes and the justifications for why a particular strategy was chosen over other possible alternatives. ToC helps in thinking systematically about how the change we want can be in a complex external environment. It helps-in organizing and prioritizing what accomplished within the complexities of the real world and with the resources we have at hand. Thus, theory of change is closely related to project-planning and project-performance because when you plan , you also take strategies that will be useful to attain on objectives, goal and once goal is realized there's truth of dream or change or impact made by proper execution of plan made (Avis, 2015).

Researcher used ToC in the study-of affecting project-management practices and project performance by assessing whether the desired changes are well designed in project management process or whether the means for realizing desired changes suggested. Researcher also knew whether the

desired changes have attained just by measuring project performance as theory of change in project management practices can be regarded as inputs whose outcome was observable in the program-success.

Theory of Constraints

The assumptions of the TOC, as established by an Israeli physicist Dr. Moshe Eliyahu Goldratt, were first published in the 1984 book *The Goal: Excellence in Manufacturing* which gave comprehensive solutions for production management. One/three concepts of TOC is concentration, i.e. concentrate on the most significant subjects. It indicates that all processes and positions should be supervised, albeit the non-critical may have a certain autonomy. Most attention should be paid to jobs that are vital from the opinion of the system as a whole. The main purpose of every firm is to grow the profit. According to this opinion, restrictions are the fundamental hurdles in attaining the aims of enterprises. In other words, anything that gets in the way of obtaining greater profit is seen as limitation. The determining of the constraint is the basis for enhancing the production system. This theory must be addressed in project-planning process only by recognizing all hazards and risk linked to the program so that necessary measures should be made to address concerns that can affect project performance (Trojanowska & Dostatni, 2017).

Project managers has to plan how such triple project limitations should be managed as crucial to project-performance. Early identification of project constraints/challenges assists in the selection of appropriate methods to be executed so that the program stay competitive notwithstanding any aspect that can limit the project-success. Each of those three challenges of the program (scope , cost-and-time)has its impacts on project s' execution yet since these components have some relationship, one imperative bears an impact on the other two, in the long run influencing ventures expectations to a more significant degree (Muchelule, 2018).

Most projects are difficult to manage because they involve uncertainty, and involve three different and opposing commitments (due date, budget, and content). Triple constraints criteria (time, scope and cost) in project-management have been accepted as an indicator of project-success.

Empirical review

Cost management and performance of project

According to Issn (2010) study on cost performance for building construction projects in Klang Valley, there are four fundamental constraints that must be considered when developing plans: scope, cost, time, and quality. To successfully manage projects, it is necessary to consider whether the project falls within those four constraints. However, it discovered that there were numerous issues with cost performance in many countries. One of the major issues was project cost overruns.

Antvik and Sjöholm (2013) studied the cost impact on project performance According to the study, cost estimation should be based on the scope of the project, the manageable sections framework, and the work plan. The study also discovered that in order for the project to be accurate, the cost of individual activities must be estimated based on specific activity conditions. Due to the various sources of uncertainty in a project, it is prudent to budget for actions with elevated danger and a limited amount of sophistication.

Effective communication and project performance

Cervone (2014) gives to the project team, the obligation of establishing excellent communication for attaining project success. As a result of these findings, it is safe to say that effective communication within the project team is a reliable indicator of project success. In addition to exchanging information between project stakeholders, communication serves as a tool for project managers to lay the foundation for a project. As a result, it's a necessary talent for a project's success.

Project outcomes were found to be linked to communication, according to Kwete and Maralise (2017). Successful project outcomes can be attributed to better communication. The importance of communication in practice is well-recognized, and this study's empirical evidence adds significantly to

the body of knowledge. This is demonstrated by the widespread use of frameworks and communication management technologies in industries where structured communications are managed. Furthermore, the findings show that project managers that place a high value on communication have a greater success rate in their projects than those who don't place such an emphasis on it. They have a high success rate on their tasks since they communicate effectively.

Risk management practices and project performance

Yelin et al (2011) analyzed nine case studies to identify the most essential risks that affect the success of PPP water projects in China. A content analysis of real-life risk events revealed eleven major dangers. They were then broken down into their component parts to determine their risk source and mechanism of risk distribution. Project managers in China see government risks as the most significant, according to the findings of a survey. As a result of the findings, industrial practitioners should not only consider their management talents, but they need also pay more attention to the entire balance of risks and benefits, and risk guarantee through rigorous contract structure.

It was analyzed by Olaniyi and Onaopepo (2012) that PPPs in Nigeria's water delivery infrastructure. A survey research approach was used, as was a thorough literature analysis and the extraction of potential indicators. After that, semi-structured interviews were held with 12 professionals who had been involved in PPP projects in order to get their own opinions on the things to be taken into account when evaluating the success or failure of a PPP project. The results of the interview were then compared to those found in the literature and included into the survey that was given out. An Likert scale of 5 points was employed. A total of 87 questionnaires were distributed to PPP experts, and a total of 53 responses were gathered. Spearman rank correlation and Kruskal-Wallis test were employed to examine the data. Consultants, contractors, government employees, and concessionaires all had sample means that were statistically identical, proving that there was no statistically significant difference among them.

Scope management and project-performance

Pourzolfaghar (2016) said that scope has an importance in project-success, from their research. Many projects get off to a wonderful start thanks to great concepts, substantial funding, and significant labor. However, the vast majority of them fail to make much of an impact. The inability-to clearly define the scope-of the project and the product at the outset is a major factor in projects that don't succeed. A well-defined and well-managed scope clarify the stakeholders receive a high-quality product at an agreed-upon price and within the set timeframes. Despite the widespread acceptance of the role-of project-success, the impact of scope on project-outcomes has received surprisingly little attention. The results of this survey suggest that scope should be adequately defined and controlled, the main causes and remedies for scope management failures.

A questionnaire survey was used to gather data for an empirical study by Miia and Lehtonen (2007), which studied the results-of large-scale construction projects in Finland. They found that goal setting (including the scope-of the project) is connected with portfolio management efficiency indirectly using linear regression of their results. For portfolio management efficiency, meeting scope targets could be regarded the most significant item since scope-is the product that implements strategy.

RESEARCH METHODOLOGY

In this chapter, the methodological approach to the survey is presented. The sample population and techniques used in sample selection and data collection shall be clearly described, showing the authorization for each. The examination incorporated both secondary and primary sources of data. The relevant data was collected using both qualitative and quantitative data collection techniques. To obtain a clear outcome, ethical considerations are studied during the data collection procedure.

Research Design

As the blueprint for data collection, measurement, and analysis, the research design describes the overall strategy used to integrate the many study components in a cogent and logical fashion that ensures the effectiveness of the research problem (Pallant, 2013).

A research design, according to Tabachnick and Fidelle (2018), is a structure for collecting and analyzing data. In this study's context, The quantitative method is based on the quantification of variables and can be used to numerically express phenomena.

Descriptive research allows researchers to analyze data and gain a deeper grasp of the study problem. It also has the advantage of allowing you to observe human behavior in the wild. Showing, characterization, and interpreting study results are all aspects of a description survey methodology.

Target Population

Table 1: Study Population

Nº	Category of study population	Number
1.	Staff from Mukungwa II	39
2.	Staff from Rwaza	35
3.	Subcontractors	65
4.	Comeca	140
5.	EPC/Vizor	150
Total		429

Sample Size and sampling technique

Since it is not easy to study the entire population due to insufficient means and time, a smaller sample is determined using a random sampling technique. Slovin's formula permits an investigator to find the population with the required level of accuracy. Slovin's formula provides the investigator insight of how large the sample-size got to be to justify a reasonable accuracy of results.

Researcher used the formula confidence-level of 95 percent (giving a margin error of 0.05) may be accurate enough. Plug the population size and required margin of error into the formula. The result equals the number of samples required to evaluate the population. The Slovin's formula to be used is calculated as follows:

$$n = \frac{N}{1 + (Ne^2)}$$

n= Number-of samples or sample size

N= Total population

e = Error-tolerance

The population size of this research is 429 from Mukungwa II, Rwaza , Subcontractors , Comeca and EPC/Vizor.

Researcher take a sampling error of 5%, and then the sample-size was:

$$n = \frac{429}{1 + (429 \times 0.05^2)}$$

$$n = \frac{429}{1 + (429 \times 0.0025)}$$

$$n = \frac{429}{1 + 1.0725}$$

$$n = \frac{429}{2.0725}$$

$$n = 206.99 \cong 207$$

Table 2: sampling table

Nº	Category of study population	Population	Sample-size
1.	Staff from Mukungwa II	39	19
2.	Staff from Rwaza	35	17
3.	Subcontractors	65	31
4.	Comeca	140	68
5.	EPC/Vizor	150	72
	Total	429	207

Stratified random-sampling is an approach to sampling that uses the division of a population into strata. In stratified random sampling, the strata are set based on the members' shared attributes or criteria. A random-sample from each stratum brought in a number proportional to the stratum's size when compared to the population.

Data Collection Tools

During research, Researcher used two sources of information: primary and secondary data. Documentary, questionnaire, and interview techniques were needed as tools of data collection.

The documentary technique is the data-collection procedure, which is based on reading books and other documents. This method aided the research in sifting through existing literature to gain a broader and deeper understanding of project management practices and performance issues. This technique allowed us not only to get information on the issue being studied but also to learn from different existing resources.

A questionnaire is an approach to collecting relevant data that is organized. It usually has a series of written questions to which responders must respond (Ajayi, 2017). The questionnaire, which contained closed-ended questions, was addressed to the respondents. With closed-ended questions, the respondents were given different alternatives to choose from. In this respect, the questionnaire only relies on the literacy level of the interviewees. The questionnaire was distributed and placed in the hands of informants to be answered without any further assistance or supervision and then returned to the distributor (researcher) in a similar way within the schedule pre-determined.

Data analysis

Data analysis assisted the researcher in presenting the outcomes in the form of graphs and tables so that the reader could get a general understanding of the outcomes. The Statistical Package for Social Sciences (SPSS) required by the investigator. Frequencies were used by the investigator to analyze respondents' perspectives on each variable, while a Pearson correlation test was hired to determine the relationship among the study's variables.

Ethical considerations

The search for knowledge must not contradict some ethical principles, including the obligation to avoid hurting or embarrassing the respondents and respect their privacy. Researcher had to first ask ourselves the ethical relevance of any research with reference to the values and actions that we undertake to complete it. The researcher established measures to comply with ethical standards during the whole process of research. The researcher described the level to which results would be kept confidentially and stated that a participant's is voluntary and that they're free; they're free to explain to them what the study is all about.

RESEARCH FINDINGS

In this chapter, researcher presented, analyzed and interpreted findings regarding identification of respondents and specific objectives including effect of cost management on power productivity; effect of effective communication on capacity factor; effect of risk management on energy-based availability; and effect of scope management practices on time-based availability of hydropower projects in Musanze District.

Effect of cost management on power productivity of hydropower projects in Musanze District

Table 3: Cost management in hydropower projects

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Total
There is a cost management strategies for hydropower project.	80 38.6%	86 41.5%	20 9.7%	14 6.8%	7 3.4%	n=207 %=100
Management assesses expenses for each work package/activity to allocate spending.	71 34.3%	99 47.8%	17 8.2%	15 7.2%	5 2.4%	n=207 %=100
Management assigns expenditures over years to calculate periodic and total funding needs.	75 36.2%	77 37.2%	35 16.9%	15 7.2%	5 2.4%	n=207 %=100
Management utilizes financial management techniques and processes to monitor and control expenditures.	65 31.4%	115 55.6%	10 4.8%	17 8.2%	0 0.0%	n=207 %=100
Cost issues and potential improvements are identified, documented and forwarded to management.	135 65.2%	35 16.9%	17 8.2%	20 9.7%	0 0.0%	n=207 %=100
Cost estimates for project supplies were adequate.	115 55.6%	43 20.8%	13 6.3%	25 12.1%	11 5.3%	n=207 %=100
Well-estimated staff costs encourage the project team with fair pay.	85 41.1%	71 34.3%	20 9.7%	16 7.7%	15 7.2%	n=207 %=100
There is a reasonable estimate of the cost of tools needed to accomplish the project objectives.	75 36.2%	85 41.1%	32 9.7%	0 0.0%	15 7.2%	n=207 %=100

Source: Field data, August 2022

The findings in Table 2 showed the respondents' views on the cost management of hydropower projects in Musanze District, whereby 38.6% of respondents strongly agree and 41.5% agree that there is a cost management strategies for hydropower projects; the remaining 9.7% were neutral, 6.8% disagree and 3.4% strongly disagree. The majority of respondents agree that management assesses expenses for each work activity to allocate spending, whereby 34.3% strongly agree, 47.8% agree, 8.2% were neutral, 7.2% disagree, and the remaining 2.4% strongly disagree with the statement. Management assigns expenditures over years to calculate periodic and total funding, as confirmed by 36.2% who strongly agree, 37.2% agree, 16.9% are neutral, 7.2% disagree, and 2.4% strongly disagree. A larger number of respondents 31.4% strongly agree and 55.6% agree that management utilizes financial management techniques and processes to monitor and control expenditures, while 4.8% were neutral, 8.2% disagree and none of the respondents strongly disagree. The majority of respondents confirmed that cost issues and potential improvements are identified documented and forwarded to the management where by 65.2% strongly agree, 16.9% agree, 8.2% were neutral, 9.7% disagree while no respondent strongly disagree on mentioned statement.

Cost estimates for project supplies were adequate as mentioned by 55.6% strongly agree, 20.8% agree, 6.3% were neutral, 12.1% disagree and 5.3% strongly disagree. A significant number of

respondents agree with the statement that well-estimated staff costs encourage the project team with fair pay whereby 41.1% strongly agree, 34.3% agree, 9.7% were neutral, 7.7% disagree and 7.2% strongly disagree. Most respondents agree that there is a reasonable estimate of the cost of tools needed to accomplish the project objectives, under which 36.2% strongly agree, 41.1% agree, 9.7% were neutral, and 7.2% strongly disagree with the statement.

The findings are in agreement with Ivensis (2020) mentioned that project cost management is typically one of the most sensitive aspects of a project and includes cost management planning, cost estimation, budgeting, and cost containment. The spending plan should be created using rigorous appropriate and suitable methods and also monitored to ensure there are no unnecessary changes that irritate stakeholders. A cost-benefit analysis is conducted at frequent intervals of the project's status to determine the project's progress at that point.

According to the researcher, there is effectiveness in the cost management of hydropower projects in Musanze District because there is a cost management strategy for hydropower projects in which management assesses expenses for each work activity to allocate spending. Management assigns expenditures over years to calculate periodic and total funding. Management utilizes financial management techniques and processes to monitor and control expenditures. Cost issues and potential improvements are identified, documented and forwarded to management. The cost estimates for project supplies were adequate; well-estimated staff costs encouraged the project team; and there was a reasonable estimate of the cost of tools needed to accomplish the project objectives.

Table 4: Correlation between cost management and power productivity of hydropower projects

		Cost management	Power productivity
Cost management	Pearson Correlation	1	.795**
	Sig. (2-tailed)		.000
	N	207	207
Power productivity	Pearson Correlation	.795**	1
	Sig. (2-tailed)	.000	
	N	207	207

Source: Field data, July 2022

Table 4 shows the correlation results, which indicated a p value of 0.000 which is less than 0.05 with a Pearson correlation coefficient of 0.797. This indicates that there is a positive and strong relationship between cost management and power productivity of hydropower projects in Musanze District. The findings are in correspondence with Antvik and Sjöholm (2013) The study assessed the impact of cost on project performance. The study discovered that in order for a project to be successful, the cost of activities must be estimated in consideration of conditions. Due to various improbabilities in projects, it is prudent to budget for actions with elevated danger and a limited amount of complexity in order to maintain a strong relationship between cost and performance level of the project.

Hereby, in consideration of study findings and other scholars, researcher identified that the cost management of hydropower projects is significantly correlated with their power productivity as an indicator of hydropower performance.

Table 5: Model Summary on cost management and power productivity

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.795 ^a	.632	.630	1.48735

a. Predictors: (Constant), Cost management

Source: Field data, August 2022

The results in Table 5 indicate the model summary on cost management and power productivity of hydropower projects in Musanze District, R was 0.795, R square was 0.632, and the adjusted R Square of 0.630 means that power productivity was initiated by the effectiveness of cost management at 63.2%. This specifies that this model is acceptable as the dependent variable (power productivity) moderately refers to the independent variable (cost management). This is in agreement with Tabachnick and Fidell (2018), who studied the cost impact on performance measurement. It suggested that cost estimation should be based on the scope of the project and the project plan. Researcher

discovered that in order for the project to be successful, the cost of activities must be estimated based on specific activity developments.

Effect of effective communication on capacity factor of hydropower projects

The second objective of the study was to examine how effective communication affects the capacity factor of hydropower projects in Musanze District. Results were analyzed in the sections below with descriptive, correlation and regression analysis.

Table 6: Effective communication in hydropower projects

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Total
Project identifies its customer segments as well as their needs and expectations	124 59.9%	62 30.0%	7 3.4%	8 3.9%	6 2.9%	n=207 %=100
Project identifies its suppliers as well as their needs and expectations	113 54.6%	53 25.6%	21 10.1%	6 2.9%	14 6.8%	n=207 %=100
The information is generated and disseminated within established systems and procedures to aid decision making processes	138 66.7%	56 27%	3 1.4%	0 0.0%	10 4.8%	n=207 %=100
All members of the team, as well as other key stakeholders, are aware of the reporting process.	88 42.5%	93 44.9%	20 9.7%	0 0.0%	6 2.9%	n=207 %=100
Management keeps its staff informed on a frequent basis about the status of projects, budgets, problems, and solutions.	87 42.0%	102 49.3%	14 6.8%	0 0.0%	4 1.9%	n=207 %=100
The lessons learnt are shared among staff members	104 50.2%	73 35.3%	9 4.3%	0 0.0%	21 10.1%	n=207 %=100
The information gleaned from the experience is saved for further use.	111 53.6%	68 32.9%	10 4.8%	5 2.4%	13 6.3%	n=207 %=100
This project makes certain that the wants and needs of both suppliers and customers are met and that lines of communication are open at all times.	66 31.9%	116 56.0%	17 8.2%	4 1.9%	4 1.9%	n=207 %=100

Source: Field data, August 2022

Table 6 indicates the results on effective communication in hydropower projects in Musanze District, whereby 59.9% of respondents strongly agree with 30.0% agree that the project identifies its customer segments as well as their needs and expectations. The remaining 3.4% were neutral, 3.9% disagree and 2.9% strongly disagree with the statement. The project identifies its suppliers as well as their needs and expectations, as confirmed by 54.6% who strongly agree, 25.6% agree, 10.1% were neutral, 2.9% disagree and 6.8% strongly disagree with the statement. The majority of respondents agree that the information is generated and disseminated within established systems and procedures to aid the decision making process, whereby 66.7% strongly agree, 27.0% agree, while 1.4% were neutral, none disagree and 4.8% strongly disagree with the statement.

All members of the team as well as other key stakeholders are aware of the reporting process, as confirmed by 42.5% who strongly agree, 44.9% agree, 9.7% were neutral, and 2.9% strongly disagree. A large number of respondents 42.0% strongly agree and 49.0% agree that management keeps its staff informed on a frequent basis about the status of projects, budgets, problems and solutions. The majority of respondents confirmed that the lessons learnt are shared among members, whereby 50.2% strongly agree, 35.3% agree, 4.3% were neutral and 10.1% strongly disagree on mentioned statement. The information gathered from the experience is saved for further use as mentioned by 53.6% strongly agree, 32.9% agree, 4.8% were neutral, 2.4% disagree and 6.3% strongly disagree. A significant number of respondents agree that hydropower projects make certain that the wants and

needs of both suppliers and customers are met and that lines of communication are open at all times, whereby 31.9% strongly agree, 56.0% agree, 8.2% were neutral, 1.9% disagree and strongly disagree. This correspondence with Roseke (2019) stated that effective communication includes designing a communication strategy based on a stakeholder's information needs and requirements and available organizational resources. It is important to keep track of project information through a communications management plan so that it can be retrieved and needed in the future as needed. Researcher found that there is effective communication in hydropower projects in Musanze District as the project identifies its customer segments as well as their needs and expectations. The project identifies its suppliers as well as their needs and expectations. The information is generated and disseminated within established systems and procedures to aid the decision-making process. All members of the team, as well as other key stakeholders, are aware of the reporting process. Management keeps its staff informed on a frequent basis about the status of projects, budgets, problems and solutions. The lessons learnt are shared among the members. The information gathered from the experience is saved for further use, and hydropower projects make certain that the wants and needs of both suppliers and customers are met and that lines of communication are open at all times.

Table 7: Correlation between effective communication and capacity factory of hydropower projects in Musanze District.

		Effective communication	Capacity factor
Effective communication	Pearson Correlation	1	.625**
	Sig. (2-tailed)		.000
	N	207	207
Capacity factor	Pearson Correlation	.625**	1
	Sig. (2-tailed)	.000	
	N	207	207

Source: Field data, August 2022

Statistical Correlation Table 7 shows a probability value of 0.000 which is less than 0.05 and a Pearson coefficient of 0.625. This indicates that effective communication is moderately correlated with the capacity factor of hydropower projects in Musanze District. Not far for Cervore (2014) mentioned that establishing excellent communication in the project team attained project success. As a result of these findings, it is safe to say that effective communication within a project team is a reliable indicator of project success and that it is a necessary talent for project success.

Based on those facts, researcher revealed that there is a significant relationship between effective communication and the capacity factor of hydropower projects in Musanze District.

Table 8: Model Summary on effective communication ad capacity factor of hydropower projects

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.625 ^a	.391	.388	1.91408

a. Predictors: (Constant), Effective communication

Source: Field data, August 2022

Model summary the table indicates results on regression analysis between effective communication and the capacity factor of hydropower projects in Musanze District. The value of R was 0.625, R square was 0.391, and an adjusted R square of 0.388 means that the capacity factor was increased by effective communication by 39.1%. This agrees that this model is acceptable as an independent variable (effective communication) has a significant impact on the dependent variable (capacity factory). In line with what Kwete and Maralise (2017) found out, communication is linked with project outcomes. The importance of communication in practice is well recognized, and the findings show that project managers that place a high value on communication have a greater success rate in their projects than those who don't place such an emphasis on it. They have a high success rate in their tasks since they communicate effectively.

Effect of risk management and energy based availability of hydropower projects in Musanze District

The third objective of the study was to determine the effect of risk management on the energy-based availability of hydropower projects in Musanze District. Collected data is interpreted and analyzed by using descriptive, correlation, and regression tests.

Table 9: Risk management in hydropower projects

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Total
Project identifies the major risks and places into a risk register	86 41.5%	73 35.3%	32 15.5%	6 2.9%	10 4.8%	n=207 %=100
Project rates the major risks according to their likelihood and impact	74 35.7%	98 47.3%	25 12.1%	6 2.9%	4 1.9%	n=207 %=100
Project develops and communicates the risk response plans such that all parties are aware of how to respond to the occurrence of the risk.	86 41.5%	104 50.2%	4 1.9%	8 3.9%	5 2.4%	n=207 %=100
Project communicates the stakeholders when unexpected events occur	128 61.8%	54 26.1%	15 7.2%	4 1.9%	6 2.9%	n=207 %=100
All processes are inspected regularly to ensure proper working and prevent risk occurrences	88 42.5%	81 39.1%	28 13.5%	0 0.0%	10 4.8%	n=207 %=100
The risk register is inspected and risks that have expired are crossed off	108 52.2%	69 33.3%	0 0.0%	10 4.8%	20 9.7%	n=207 %=100
The management has set aside a risk budget to be used if the risks occur	83 40.1%	49 23.7%	31 15.0%	18 8.7%	26 12.6%	n=207 %=100
Risk management issues and recommended improvements are identified, documented and passed on to the management for future reference	22 10.6%	160 77.3%	15 7.2%	4 1.9%	6 2.9%	n=207 %=100

Source: Field data, August 2022

The findings in Table 9 showed the respondents' views on risk management of hydropower projects in Musanze District, where 41.5% of respondents strongly agree with 35.3% agree that the project identifies the major risks and places them into a risk register, the remaining 15.5% were neutral, 2.9% disagree and 4.8% strongly disagree. Majority of respondents agree the project rates the major risks according to their likelihood and impact, whereby 35.7% strongly agree, 47.3% agree, 12.1% were neutral, 2.9% disagree and 1.9% strongly agree with the statement. The project develops and communicates the risk response plans such that all parties are aware of how to respond to the occurrence of the risk, as confirmed by 41.5% who strongly agree, 50.2% agree, 1.9% were neutral, 3.9% disagree and 2.4% strongly disagree. A large number of respondents 61.8% strongly agree and 26.1% agree that the project communicates the unexpected events that occur to the stakeholders, while 7.2% neutral, 1.9% disagree and 2.9% strongly disagree. All processes are inspected regularly to ensure proper working and prevent risk occurrences, as confirmed by 42.5% who strongly agree, 39.1% agree, 13.5% were neutral and 4.8% strongly disagree. The majority of respondents confirmed that the risk register is inspected and risks that have expired are crossed off, whereby 52.2% strongly agree, 33.3% agree, 4.8% disagree and 9.7% strongly disagree with the mentioned statement. The management has set aside a risk budget to be used if risks occur whereby 40.1% strongly agree, 23.7% disagree, 15.0% were neutral, 8.7% disagree, and the remaining 12.6% strongly disagree. Most respondents 77.3% agree and 10.6% strongly agree, 7.2% were neutral, 1.9% disagree and 2.9%

strongly disagree that risk management issues and recommended improvements are identified, documented and passed on to the management for further reference.

Inline with Model (2012) clarified that there are a variety of ways to deal with risk; the dangers can either be fully eradicated, transferred to a third party, lowered to an acceptable level, or simply tolerated (risk acceptance). Risk mitigation is the most popular approach to risk management since risk elimination is sometimes unattainable or prohibitively expensive. Risk response is referred to when the possible impact is minor or when the risk is so low that it doesn't make sense to spend money avoiding or mitigating it.

Researcher concluded Hydropower projects in Musanze have effective risk management as the project identifies the major risks and places them into a risk register. The project rates the major risks according to their likelihood and impact. The project develops and communicates the risk response plans such that all parties are aware of how to respond to the occurrence of the risk. The project communicates the stakeholders when unexpected events occur. All processes are inspected regularly to ensure proper working and prevent risk occurrences. The risk register is inspected and risks that have expired are crossed off. The management has set aside a risk budget to be used if risks occur and risk management issues and recommended improvements are identified, documented and passed on to the management for further reference.

Table 10: Correlation between risk management and energy based availability

		Risk management	Energy based availability
Risk management	Pearson Correlation	1	.805**
	Sig. (2-tailed)		.000
	N	207	207
Energy based availability	Pearson Correlation	.805**	1
	Sig. (2-tailed)	.000	
	N	207	207

Source: Field data, August 2022

Table 10 shows the correlation between risk management and energy-based availability, whereby a probability value of 0.000 is significant as it is less than 0.05 while the Pearson correlation coefficient is 0.805. This indicates that there is a positive and strong relationship between risk management and energy-based availability of hydropower projects in Musanze District. In correspondence to Wanyonyi (2015) examined the effects of risk management on project outcomes in Kenya. The study found a statistical link between the accomplishment of projects supported by international development organizations and the reduction, avoidance, and acceptance of risk response plans.

Table 11: Model Summary on risk management and energy based availability

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.805 ^a	.649	.647	1.45403

a. Predictors: (Constant), Risk management

Source: Field data, August 2022

The results in Table 11 show the results on the model summary of risk management and energy-based availability of hydropower projects in Musanze. The value of R was 0.805, R square was 0.649 and an adjusted R square of 0.647 means that energy-based availability is affected by risk management at 64.9%. This specifies that the model is acceptable as an independent variable (risk management) moderately impacts the energy-based availability of hydropower projects in Musanze District. The same research conducted by Yelin *et al.* (2011) identified and allocated risks associated with PPP water projects in China. analyzed nine case studies to identify the most essential risks that affect the success of PPP water projects. Project managers in China see government risks as the most significant.

Effect of scope management on time based availability in hydropower projects in Musanze District

The fourth objective of this study was to determine the effect of scope management practices on the time-based availability of hydropower projects in Musanze District. Tables with frequencies, percentages, correlation, and regression analysis are used to present the findings.

Table 12: Scope management practices in hydropower projects

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Total
The project has clear vision, mission, objectives and goals	80 38.6%	86 41.5%	20 9.7%	14 6.8%	7 3.4%	n=207 %=100
The project has established a set of well-defined policies and procedures.	71 34.3%	99 47.8%	17 8.2%	15 7.2%	5 2.4%	n=207 %=100
Every member of the team is aware of their responsibilities and roles within the project.	75 36.2%	97 46.9%	22 10.6%	11 5.3%	2 1.0%	n=207 %=100
Delegation and monitoring of work packages are delegated by the management.	65 31.4%	115 55.6%	10 4.8%	17 8.2%	0 0.0%	n=207 %=100
Design and development methods are examined by the staff to ensure their practicality.	135 65.2%	35 16.9%	17 8.2%	20 9.7%	0 0.0%	n=207 %=100
The project's management has devised a training and promotion strategy.	130 62.8%	24 11.6%	11 5.3%	31 15.0%	11 5.3%	n=207 %=100
Before implementing the scope adjustment, it is approved by the board.	85 41.1%	71 34.3%	20 9.7%	16 7.7%	15 7.2%	n=207 %=100
Project's top brass has set aside money in the event that things need to be changed.	75 36.2%	85 41.1%	32 15.5%	15 7.2%	0 0.0%	n=207 %=100

Source: Field data, August 2022

Table 12 indicates the results on scope management in hydropower projects in Musanze District, whereby 38.6% of respondents strongly agree with 41.5% agree that the project has a clear vision, mission, objectives, and goals, remaining 9.7% were neutral, 6.8% disagree and 3.4% strongly disagree with the statement. Project has established a set of well-defined policies and procedures as confirmed by 34.3% who strongly agree, 47.8% agree, 8.2% were neutral, 7.2% disagree, 2.4% strongly disagree with the statement. The majority of respondents agree that every member of the team is aware of their responsibilities and roles within the project, whereby 36.2% strongly agree, 46.9% agree, 10.6% were neutral, 5.3% disagree and 1.0% strongly disagree with the statement. Delegation and monitoring of work packages are delegated by the management, as confirmed by 31.4% who strongly agree, 55.6% agree, 4.8% were neutral and 8.2 disagree. A large number of 65.2% of respondents strongly agree and 16.9% agree that design and development methods are examined by the staff to ensure their practicality. The majority of respondents confirmed that management of the project has devised a training and promotion strategy, whereby 62.8% strongly agree, 11.6% agree, 5.3% were neutral, 15.0% disagree and 5.3% strongly disagree. Before implementing the scope adjustment, it was approved by the board as confirmed by 41.1% who strongly agree, 34.3% agree, 9.7% were neutral, 7.7% disagree and 7.2% strongly disagree. There are 36.2% strongly agree, 41.1% agree, 15.5% neutral and 7.2% disagree that project's top brass has set aside money in the event that things need to be changed. In agreement with Yausheva (2019) mentioned that poor development of scope might lead to the failure of a given project if it is unclear or incomplete. The project' success will be enhanced if the scope is precise, reasonable, agreed upon, and well defined.

Researcher revealed that hydropower projects in Musanze District have scope management as they have a clear vision, mission, objectives, and goals. Project has established a set of well defined policies and procedures, every member of the team is aware of their responsibilities and roles with the project, Delegation and monitoring of work packages are delegated by the management. Design and development methods are examined by the staff to ensure their practicality. The management of the

project has devised a training and promotion strategy. Before implementing the scope adjustment, it has been approved by the board, and the project's top brass has set aside money in the event that things need to be changed.

Table 13: Correlation between scope management and time based availability of hydropower projects

		Scope management	Time based availability
Scope management	Pearson Correlation	1	.602**
	Sig. (2-tailed)		.000
	N	207	207
Time based availability	Pearson Correlation	.602**	1
	Sig. (2-tailed)	.000	
	N	207	207

Source: Field data, August 2022

Statistical Correlation Table 13 shows a probability value of 0.000 which is less than 0.05 and Pearson coefficient of 0.602. This indicates that there is a moderate relationship between scope management and time-based availability of hydropower projects in Musanze District. According to Pourzolfaghar (2016)'s research, scope is important in project success. Many projects get off to a wonderful start thanks to great concepts, substantial funding, and significant labor. However, the vast majority of them fail to make much of an impact. The inability to clearly define the scope of the project and the product at the outset is a major factor in projects that don't succeed.

Table 14: Model Summary on scope management and time based availability of hydropower projects

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.602 ^a	.363	.360	1.95782

a. Predictors: (Constant), Scope management

Source: Field data, August 2022

Model summary Table indicates results on regression analysis between scope management and time-based availability of hydropower projects in Musanze District. The value of R was 0.602, R square was 0.363 and an adjusted R square of 0.360 means that time-based availability increased by 36.3%. This agrees that this model is acceptable as an independent variable (cost management) has a significant impact on the dependent variable (time-based availability). In line with Muhammed and Ajibade (2014), around 70% of Saudi Arabian project delays are the effect of inadequate scope-planning. According to their findings, ineffective project management was the primary cause of delays.

CONCLUSION

Researcher rejected the null hypothesis and confirmed the alternative hypothesis, which means that cost management has a significant relationship with power productivity of hydropower project in Musanze District. The researcher rejected the null hypothesis while the alternative hypothesis is confirmed, which means that effective communication has a significant relationship with the capacity factor of hydropower projects in Musanze District. The researcher rejected the null hypothesis and confirmed the alternative hypothesis, which means that risk management has a significant relationship with energy-based availability of hydropower projects in Musanze District. The researcher rejected the null hypothesis while the alternative hypothesis is confirmed, which means that scope management has a significant relationship with time-based availability of hydropower projects in Musanze District.

Recommendations

Greater effort should be put into classifying project management practices as per their significance. Cost management in projects should be prioritized immediately due to the enormous benefits it has on projects and, by extension, organizations.

Projects should encourage and facilitate more open lines of communication between departments. All members of the project team, as well as the organization's workers and other interested parties, should have an opportunity to provide input and participate in making decisions. As a result, the project benefits from a wide range of perspectives and higher quality of judgments.

Suggestions for further researchers

Following the completion of the investigation, it was determined that some research, if feasible, should be conducted: The effect of monitoring and evaluation on performance of hydropower projects in Rwanda. The effect of stakeholders involvement on performance of hydropower projects in Rwanda.

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