



# Assessment on Factors Affecting the Performance of Public Funded Energy Construction Projects in Rwanda

## A Survey of the Seven Micro Hydropower Projects (MHPs)

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### Abstract

The main purpose of this study was to assess the factors that affect the performance of public funded energy construction projects in Rwanda using a survey of the seven (7) micro hydropower project (7 MHP). The objectives of the study included; to examine the effect of project size on performance of the 7 MHPs, to assess the effect of project procurement methods on the performance of the 7 MHPs, to establish the contribution of project budgetary allocation on the performance of the 7 MHPs, to assess the effect of project management skills/competences of managers on the performance of the 7 MHPs

Using a descriptive case study design and purposive sampling technique, 53 respondents were selected. A Likert scale questionnaire was used for data collection and the data analyzed by way of SPSS version 20 into tables. Results indicated that Project size and project procurement methods were positively correlated with project performance of the 7MHPs. A normal regression analysis performed to assess the predictive power of project management skills of managers, Project budget, Project complexity, Procurement methods found that these variables account for 48.4% (R squared 0.484) variance in the performance of the 7 MHPs. Thus, these variables were found to be statistically significant in predicting performance. The study recommends further analysis on the effect of project budget allocation and project on performance since results show that these variables are negatively correlated with performance of the 7MHPs.

**Keywords:** Project Size; Project Procurement; Project Budget; Project Management Skills; Project Performance.

## 1. Introduction

The study analyzed the factors that affect the performance of public funded energy construction projects in Rwanda using a survey of the 7 MHPs. Memon, Rahman and Azis, (2012) observed that delays and cost overruns are the most frequently occurring issues in construction projects worldwide. They further stressed that this trend in delay and running over-budget in construction projects is more severe in developing countries where these slippages sometimes exceeds 100% of the anticipated cost of the project.

Rwanda as a developing country has prioritized construction of micro hydro power projects to increase access to electricity to its population as indicated in the country's Economic development and Poverty Reduction Strategy

(EDPRS II 2013). The current limited rate of access to electricity at 23% is ambitiously planned to be 100% by 2018 (EDPRS II, 2013 P. 81). The development of micro hydropower projects was identified and prioritized as one of the cheap options aimed at providing reliable and affordable energy supply for off – grid Rwandans in hard to reach rural areas (EDPRS II, 2013), and one of the sustainable solutions to the energy crisis for the country. It is in this context that the 7 Micro hydropower projects (Rugezi-2.2 MW, Mukungwa II-2.5 MW, Janja- 0.2 MW, Gashashi-0.2 MW, Nyabahanga-0.2 MW, Nshili I-0.4 MW, and Nyirabuhombohombu -0.5 MW) were identified, as a mid-term solution (Cabinet resolution, 2006) to be constructed and add 6.2 MW to the country's total installed capacity (56 MW). The projects were implemented through an EPC contract which was signed between Ministry of Infrastructure and a Sri Lankan contractor, Hydro Power International (Private) Limited (HPI) on 10<sup>th</sup> November 2006. However, this contractor failed to complete the projects as per the agreed completion time line, which resulted into the termination of the contract on 1<sup>st</sup> March 2011 (Ministerial Resolution, 2011).

After the termination of this contractor, the Ministry of Infrastructure hired the supplier of the electro-mechanical equipment for the projects, a Chinese contractor known as Tianjin Mingshuo Technology Development Co, Ltd/MS-Techto complete the commissioning works on Rugezi MHP and to complete the remaining construction works on the 6 MHPs (Mukungwa II, Janja, Gashashi, Nyabahanga, Nshili I, and Nyirabuhombohombu).

Yet still, the projects were not completed on time which has resulted into additional costs associated with project schedule overruns as noted by Memon, et al, (2012).

Focusing on a survey of the seven (7) micro hydro power projects, this paper assesses factors which contribute to performance of public funded energy projects in Rwanda. These projects were initially scheduled to be completed by the end of 2009. However, due to implementation delays, the first project got commissioned in June 2011 while the last one to be commissioned was in December 2013. Moreover, the completed power plants experience frequent breakdowns which prevent provision of a reliable electric service to the population. This study thus comes in to assess the factors which led to delays on the project so as to make a contribution on how to avoid such problems on future projects in the energy sector in Rwanda.

## 2. Statement of the Problem

This study assessed factors affecting the performance of public funded projects using a survey of the 7 MHPs in Rwanda with intent to fill the knowledge gap on why delays occur in public funded energy construction projects in Rwanda. Assaf and Alhejji (2005) argued that construction projects especially public funded ones often experience cost overruns and delays in completion. Ravisankar, Anandakumar and Krishnamoorthy (2014) indicated that time overrun vary between 50% and 80% for projects completed worldwide. Shanmugapriya and Subramanian (2013) also indicated that 60% of public funded projects in India suffered time and over budget as they were rarely finished on time, or within the allocated budget. The energy construction projects like micro hydro power stations are not an exception. Schedule slippage as put by Memon et al, (2012) is associated with cost overruns which contribute to poor performance. He further observed that delays and cost overruns are one of the most frequently occurring issues in construction projects worldwide. In Vietnam for instance, the government acknowledged the construction delays and cost overruns as the big obstacle, especially with government-funded projects as a study of more than 4000 construction projects showed that projects were rarely finished on time, or within the allocated budget (Le-Hoai, Lee, and Lee, 2008).

Memon, et al, (2012) also argued that delay in construction projects is more severe in developing countries where slippages sometimes exceed 100% of the anticipated cost of the project. Owolabi, (2014) indicated that seven out of ten public funded construction projects in Nigeria suffered delays in their execution. In Ghana, Frimpong, Oluwoye and Crawford (2003) reported that 75% of the projects in Ghana exceeded the original project schedule. Similarly in Kenya, Kivaa (2000), found that delays are common and one of the causes of poor schedule performance in construction projects in Kenya is the inadequate initial contract periods.

Hence, like other developing countries in the world, Rwanda's energy sector construction industry particularly public funded projects face a lot of challenges such as the delay to complete the project in time, the expenditure exceeding the budget, and over dependence on foreign workers

The construction of the MHPs in Rwanda for instance was initiated over nine years ago in order to increase the country's electricity generation capacity by 6.2 MW; however they are not yet closed. The projects have experienced delay in execution and completion of projects activities. Moreover, even the output of the completed power plants of the projects do not provide reliable and stable power since the completed power plants experience frequent breakdowns. Despite

these challenges, the government of Rwanda together with local private investors continued to develop energy projects in order to enable the increase of the electricity generated capacity.

According to Memon et al, (2012) to avoid construction cost overrun and delays in construction projects, the very first and most important step is to identify and understand the causes and factors responsible so as to alleviate problems associated with the issue in the future. It is from this background that this study intends to fill the knowledge gap regarding factors contributing to delay and cost overruns in public funded energy projects in the Rwandan context.

### **3. Research Objectives**

#### **3.1 General Objective**

The general objective for this research is to assess the factors that affect the performance of public funded energy construction projects in Rwanda.

#### **3.2 Specific Objectives**

The specific objectives for this study are:

- i) To examine the effect of project size on performance of the 7 Micro hydro power project (MHP).
- ii) To examine the effect of project procurement methods on the performance of the 7 Micro hydro power project (MHP).
- iii) To establish the contribution of project budgetary allocation to the performance of the 7 Micro hydro power project (MHP).
- iv) To examine the effect of project management competences managers on the performance of the 7 Micro hydro power project (MHP).

#### **3.3 Research Questions**

The study was guided by the following questions:

- i) What is the effect of project size/complexity on performance of the 7 MHP?
- ii) What is the effect of project procurement methods on the performance of the 7 MHP?
- iii) What is the effect of project budgetary allocation to the performance of the 7 MHP?
- iv) What is the effect of project management competences on the performance of the 7 MHP?
- v) Is there a relationship between project size/complexity, procurement methods, project budget and project management skills of managers and performance of the 7 MHP?

### **4. Research Design**

The researcher used a descriptive survey design methodology. A descriptive study is concerned with describing the characteristics of a particular individual or of a group (Kothari, 2004). According to Zikmund (2003), surveys provide a fast, inexpensive, efficient and accurate way of investigating a population. Orodho (2003) argues that descriptive survey research designs are used to allow researchers to gather and summarize information, present and interpret data for clarification purposes. Descriptive research determines and reports things as they are, therefore establishing the current status of the population under study (Mugenda and Mugenda, 2003). By studying a population sample, a descriptive design provides qualitative descriptions of trends, perceptions and attitudes of the population.

### **5. Target Population**

The target population for this research consisted of 115 people involved in the implementation of the 7 Micro Hydropower project such as contractors and subcontractor, project team, and the supervising team for construction activities.

### **6. Sample Design**

#### **6.1 Sample Size**

A sample size refers to the number of units or people that are chosen from which the researcher wish to gather information or data (Evans, 2000). For this specific research, a number of 115 people involved in the project constitute the sample frame from which the sample size was selected. The sample size was calculated using Solven's (1960) formula.

## 7. Sampling Techniques

Purposive sampling, also known as judgment sampling was used to select the sample for the study. This method was used primarily due to a limited number of people that have expertise in the area being researched. The sample size for this research was 53 people

## 8. Data Collection

### 8.1 Data Collection Instruments

A questionnaire was used for data collection in this study. Kirakowski (2000) defines a questionnaire as method of for the elicitation, and recording and collecting information. The data was collected using a structured questionnaire, which consisted of closed questions relating to four (4) selected independent variables, which were assumed to be determinants of the performance of public funded energy projects in Rwanda. The questionnaires were distributed to respondents in order to provide responses.

#### 8.1.1 Primary Data

The primary data was collected through questionnaires to gather information. A questionnaire is an instrument that consists of a set of questions to be responded to by a group of people in order to provide information to help the researcher answer questions on the research topic. Owen (2002) recommends use of questionnaires for its potential to reaching out to a large number of respondents within a short time; ability to accord respondents' adequate time to respond; offers a sense of privacy and confidentiality to the respondent.

#### 8.1.2 Secondary Data

This involved analysis of documents which have been prepared approved and filed for future reference. The researcher used some project records such as reports, minutes and concept papers.

## 9. Data Analysis

Ricardo (2005) maintains that after data is collected, it should be processed and analyzed. The data collected was processed and analyzed. This involved data coding, editing and tabulation especially quantitative data. Data analysis involved use of SPSS version 20 to derive frequency tables for descriptive statistics and correlation analyses. Pallant (2005) argued that correlation is used when one wishes to describe the strength and direction of the relationship between two variables.

## 10. Data Analysis, Presentation of Findings

### 10.1 Demographic Characteristics of Respondents

The three variables that were considered under demographic data: gender, level of education and work category of the respondents on the project as shown in the tables below.

	<b>Frequency</b>	<b>Percent</b>
<b>Male</b>	45	84.9
<b>Female</b>	8	15.1
<b>Total</b>	3	100.0

**Source: Primary Data**

Findings from the frequency table 10.1 shows that the number of respondents who were female is 8 represented by 15.1 % of the total number of respondents. On the other hand, the male respondents numbered 45 individuals whose proportion of the total number of respondents in terms of percentage is 84.9 %.

<b>Table 10.2: Descriptive Statistics for Respondents' Education Level</b>		
	<b>Frequency</b>	<b>Percent</b>
Diploma	3	5.7
Degree	17	32.1
Post graduate	16	30.2
Other	17	32.1
Total	53	100.0

**Source: primary data**

The second aspect of the demographics characteristic presented in this study is the level of education of respondents. The study findings in table 10.2 shows that out of the total of 53 respondents 3 were diploma holders constituting 5.7% of the total number of respondents. The degree holders were 17 representing a proportion of 32.1 %. There were 16 respondents with postgraduate education level.

<b>Table 10.3: Category of Respondents</b>		
	<b>Frequency</b>	<b>Percent</b>
Contractor staff member	24	45.3
Sub contractor staff member	7	13.2
Supervising team member	11	20.8
Project management team member	11	20.8
Total	53	100.0

**Source: Primary Data**

Findings from table 10.3 shows the respondents category on the project under study and there were four categories thus, 24 contractor staff representing 45.3 % of the respondents, 7 subcontract staff representing 13.2% of the respondents, 11 supervising team members and 11 project team members representing 20.8% each category.

## **10.2. Analysis and Presentation of Findings per Research Objective**

The researcher ran a correlation analysis to establish the effect of the independent variables on the dependent variable and answer research objectives 1 -4. Table 10.4 below presents the correlation analysis to show the effect of project size, project procurement method, project budget and project managerial skills of managers on performance of the 7 Micro hydro projects.

**Table 10.4: Correlations Analysis Between Project Size, Project Procurement Methods, Project Budget and Performance**

	Project Size	Procurement Methods	Project Budget	Project Managerial Skills of Managers	Performance
Project Size	1				
Procurement Methods	.221	1			
Project Budget	-.150	.299*	1		
Project Managerial Skills of Managers	-.302*	-.209	.122	1	
Performance	.476**	.523**	-.161	-.448**	1

\*. Correlation is significant at the 0.05 level (2-tailed). \*\*. Correlation is significant at the 0.01 level (2-tailed).

### 10.2.1 Objective One: To Examine the Effect of Project Size on Performance on the 7 Micro Hydro Power Project

The first objective was to examine the effect of project size on performance on the 7 micro hydro power projects. The findings as revealed by a correlation analysis indicate that project size has a significant positive relationship with project performance at ( $r=0.476^{**}$ ,  $p \leq 0.01$ ). This confirms that the project is vast and allocated time for its construction is not enough. Also, project location (7 different districts) creates coordination challenges leading to delays and lastly, having a single contractor on the project has caused delay.

### 10.2.2 Objective two: To assess the effect of project procurement methods on the performance of the 7 Micro hydro power projects.

To answer the second objective of the study which was to assess the effect of project procurement methods on the performance of the 7 Micro hydro power projects. The researcher analyzed the respondents' perceptions of the variable with the help of correlation analysis to answer the objective of the study. The findings are presented in table 10.4 show that project procurement methods have a strong significant and positive relationship with project performance ( $r=0.523^{**}$ ,  $p \leq 0.01$ ). This implies that there cost overruns associated with project materials procurement. Similarly, reworks on the project also caused cost variations on the project budget and delayed contractor payments raised project costs due to payment of accumulated arrears.

### 10.2.3 Objective Three: To Assess the Effect of Project Budget Allocation to the Performance of the 7 Micro Hydropower Power Projects.

To answer the third objective of the study which was to assess the effect of project budget allocation on performance on the 7 micro hydro power projects and the researcher analyzed the responses on the variable with the help of correlation. The results as indicated in table 10.4 show that project budget allocation is negatively correlated with project performance at ( $r=-0.161$ ,  $p \leq 0.01$ ). This implies that budget allocation for the project negatively affects project performance. Hence, unplanned changes in specifications negatively affected project budget and delayed release of project finances also negatively affects timely execution of project activities.

#### 10.2.4 Objective Four: To Assess the Effect of Project Managerial Skills of Project Managers on the Performance of the Project.

The researcher analyzed the responses on the variable (project managerial skills) with help of correlation analysis to answer the objective of the study. The results as indicated in table 10.4 show that project managerial skills of managers is negatively correlated with project performance at ( $r=-0.448^{**}$ ,  $p\leq 0.01$ ). This implies that timely delivery of the project is not linked to the managerial skills of project managers. Clear reporting lines to avoid long procedures and delays on the project is negatively linked to performance and consideration of stakeholder views to ensure satisfaction, avoid rework and save time is also negatively linked to performance of the project.

### 11. Conclusion

The first objective of the study was to examine the effect of project size on performance on the 7 micro hydro power project. Results from the findings confirm that project size/complexity has a significant negative relationship with project performance ( $r=0.476^{**}$ ,  $p\leq 0.01$ ). This implies the size and complexity of the project positively affects the performance on the project. The second objective was to assess the effect of project procurement methods on the performance of the 7 Micro hydro power projects and findings show that project procurement methods have a strong significant and positive relationship with project performance at ( $r=0.523^{**}$ ,  $p\leq 0.01$ ). This implies that any positive change in project procurement methods is associated with positive changes in the performance of the 7 Micro hydro power projects.

The third objective was to assess the effect of project budget allocation on performance on the 7 micro hydro power projects and the results indicate that this variable has a negative relationship or effect on project performance at ( $r= -0.161$ ,  $p\leq 0.01$ ). The fourth and last objective was to assess the effect of project managerial skills of project managers on the performance on the 7 micro hydro power projects. The findings indicate that project managerial skills of managers is negatively correlated with project performance at ( $r= -0.448^{**}$ ,  $p\leq 0.01$ ). This implies that timely delivery of the project is not linked to the managerial skills of project managers. Clear reporting lines to avoid delays on the project is negatively linked to performance and consideration of stakeholder views to ensure satisfaction, avoid rework and save time is also negatively linked to performance of the project.

### 11.2 Recommendations

With reference to findings of the study, the following are suggested recommendations that the stakeholders involved in the 7 Micro hydro project can focus on for further improvement in its performance.

- i. The study recommends further analysis on the effect of project budgetary allocation on performance since results of the study indicate that this variable is negatively correlated with performance of the 7 Micro hydro power projects.
- ii. It is vital for the 7 micro hydro power projects to ensure that there are well streamlined project procurement methods as this was found to be strongly and positively correlated with the performance of the project.

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