

## THE CAUSATIVE FACTORS LEADING TO COST OVERRUN IN DAM CONSTRUCTION PROJECTS IN RWANDA: CASE STUDY KINONI 1 DAM CONSTRUCTION PROJECT

**Innocent Gasasira**

Jomo Kenyatta University of Agriculture and Technology,  
Kigali, Rwanda.  
Email: innogast14@yahoo.fr

**Dr. Peter MBABAZI**

Jomo Kenyatta University of Agriculture and Technology,  
Kigali, Rwanda.  
Email : mbabazimbabazize@gmail.com

**Prof. Eugene Ndabaga**

Jomo Kenyatta University of Agriculture and Technology,  
Kigali, Rwanda.  
Email: eugenendabaga@gmail.com

### ABSTRACT

**T**his research project investigated the causative factors leading construction project to cost overrun in Rwanda; case study Kinoni 1 Dam construction in Kirehe District, the research project aimed to find out the causative factors from the contractors, the causative factors on the supervisor team, the causative factors on the client side and external causative factors which contribute to project cost overrun; The list of causes of cost overrun was subjected to a questionnaire survey and interviews, for the identification of the most important causes of cost overrun. The field survey and interviews included 60 respondents made up of 15 on contractor's side, 15 on supervisor team and 30 on side of clients. Importance of each cause was calculated on the basis of cumulative effect of occurrence and impact by comparing they mean. Pearson correlation analysis was used to evaluate relationship cost overrun and performance in Kinoni's 1 dam construction project; this research project found a strong relationship between cost overrun and performance in Kinoni 1 dam construction. The major causes of cost overrun in dam construction projects found by this research project are: slow decision making, poor schedule management, poor cost estimation, poor contract management, poor design/ delay in providing design, problems in land acquisition, wrong estimation/ estimation method, and poor soil investigations. The results showed that, there is an influence from the client and supervisor team, also strong connection between the factors from the contractor's side which contribute to construction project cost overrun. Key words: Client, contractor, consultant Cost overrun, project, and External factors

## **1. Introduction**

This research project is about the causative factors leading to cost overrun in dam construction projects in Rwanda; case study Kinoni 1 Dam construction in Kirehe District, this research project aimed to find out the causative factors from the contractors, the causative factors on the supervisor team, the causative factors on the client side and external causative factors which contribute to project cost overrun.

Azis (2010) outlines that cost is among the major considerations throughout the project management life cycle and can be regarded as one of the most important parameters of a project and the driving force of project success. Cost overrun should be avoided or minimized in order to avoid project failure.

This research project is therefore find out those causative factors leading to construction project cost overrun in a construction industry in Rwanda, using Kinoni 1 Dam construction in Kirehe District as a case study. The main problems are usually seen in the beginning and early stages of a construction project. The ability of making changes decreases throughout the progress of the project, at the same time as the costs of making them increases. Furthermore, the costs of the initial phases of a construction project represent a small portion of the total project cost. The design phase e.g. represents 5% of the total cost (Josephson & Soukkoriipi, 2005).

## **2. Statement of the problem**

Like in many other countries, cost overrun in construction is very serious issue the tendency of construction projects failing to finish within the original budget, increase in the amount of money required to construct a project is the rule of exception ‘Cost Overrun’. At the same time, the construction industry generates around 10% of national wealth (gross domestic product) in a typical modern society, which makes it the largest single creator of value in society (Winch, 2010). Efficiency in the industry is of obvious interest. Opinion groups as well as journalists and politicians agree that construction must be completed faster meet the expected budget.

## **3. Research objectives**

### **3.1. General objectives**

The main objective is to find out the causative factors leading to construction project cost overrun in Rwanda by using a case study of Kinoni 1 dam in Kirehe District.

#### **a. Specific objectives**

- i. To measure the factors from the contractors side which contribute to construction project cost overrun,
- ii. To identify factors from the government “client” side which factors contribute to construction project cost overrun,
- iii. To evaluate the factors from the supervisor team side which contribute to construction project cost overrun,
- iv. To establish the external factors that might cause cost overrun.

#### 4. Research Questions

1. What are the causatives factors from the contractor (E.M.P Ltd) side that lead to cost overrun in dam construction projects?
2. What are the causatives factors from the government (MINAGRI/KWAMP) side that lead to cost overrun in dam construction projects?
3. What are the causatives factors from the supervising team (SET-TUNISIE) side that lead to cost overrun in dam construction projects?
4. What are the causatives factors due to unforeseen geotechnical and environmental obstacles, such as legal and regulations amendments?

#### 5. Research Design

Study, used a descriptive research design, where qualitative and quantitative approach was used, analysis is done used for data collection

#### 6. Target Population

The target population of this study was total number of 60 key personnel worked on Kinoni 1 Dam

#### 7. Sample Design

The sample size of this study was 60 respondents by using Census survey method all population was taken into consideration.

#### 8. Sampling Techniques

Simple random sampling was used because the researcher considers this to give a true picture of the results and hence not being biased. Also a fair representation from each party 30 persons from Client side, 15 Key personnel From Supervising team and 15 Keys personnel at the contractor side were considered when sampling.

#### 9. Data collection instruments

To make this research successful, interviews and questionnaires both were used.

#### 10. Data analysis

Data analysis and interpretation of results have done by using the statistical package for social sciences (SPSS).

### 11. RESEARCH FINDINGS AND DISCUSSION

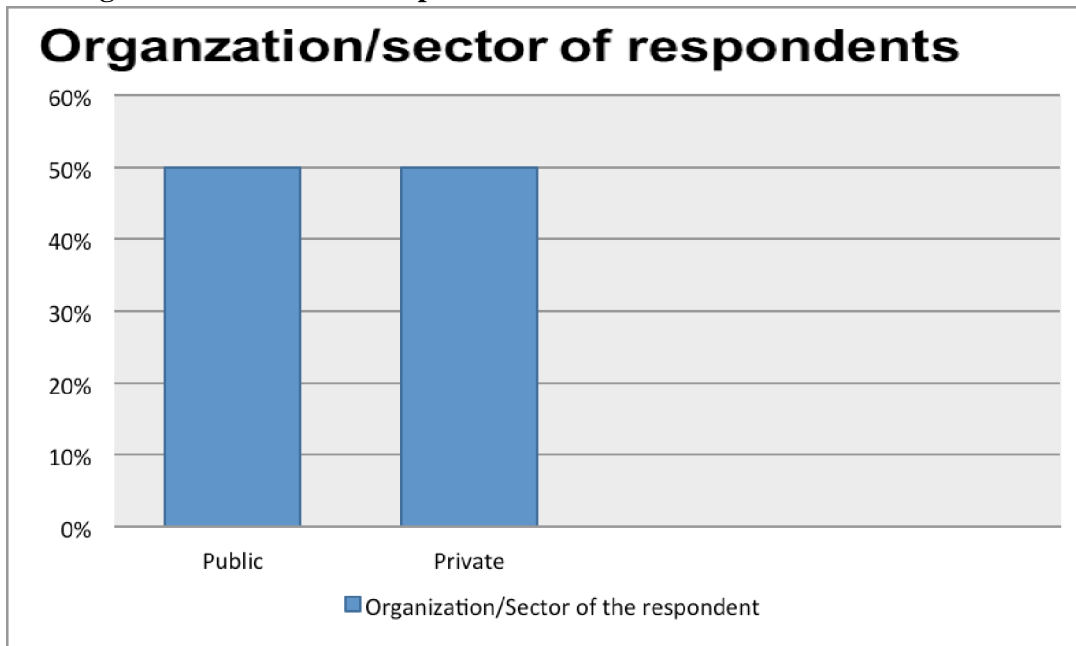
**Table: 11.1. Organization of the respondents**

Organization of the respondent	Respondents	Percentages
Public	30	50%
Private	30	50%
<b>Total</b>	<b>60</b>	<b>100%</b>

Source: Primary data (2015)

**Figure: 11.1. Organizations' sector of respondents**

**Figure: 11.1. Organizations’ sector of respondents**



**Table 11.1.2 Experience of the organization**

Level of experience/Year	Frequency	Percentage
0-5	29	48%
5-10	23	38%
Above 10	8	14%
<b>Total</b>	<b>60</b>	<b>100%</b>

**Figure 11.1.2: Presentation of experience of the organization of respondents**



**Source:** Primary data, 2015

As far as the organization of the respondents' level of experience is concerned as showed by the figure 11.1.2, none of them has an experience less than one year, thus the researcher is happy with the outcomes and consequently results may be factual as all companies of respondents are experienced in the industry. And hence 48% of the respondents have been working in Construction Company with an experience of the company in the industry between 1 – 5 years, 38% have rated that their organization's experience falls between 5-10 years in construction works and the rest 14% are those who were working in a company that have more than 10 years in construction industry. Since the great number of respondents are those who have been in construction for a long time, this gives an assurance that the information they provided is more valuable as they have enough experience in this kind of work.

### 11.1.2. Education level of the respondents

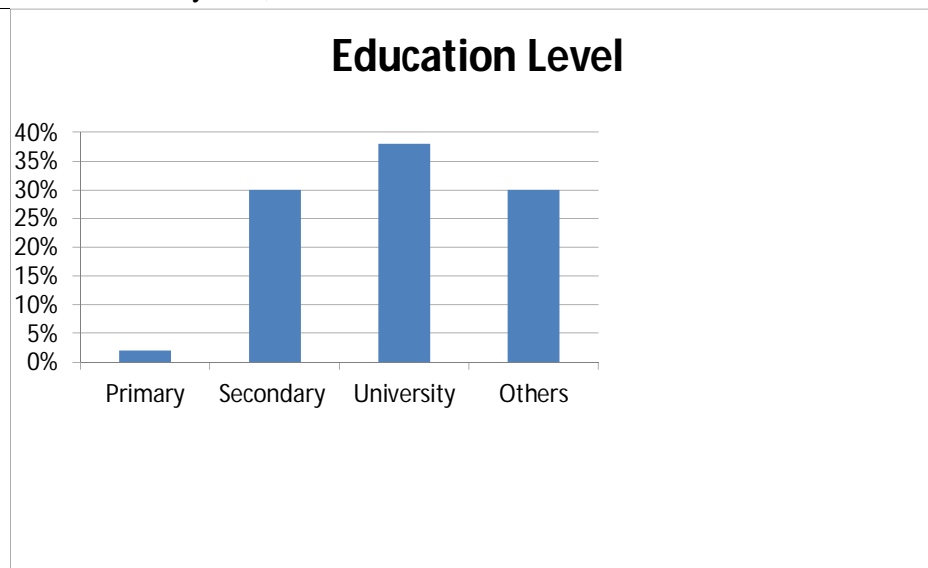
The level of education of respondents is also analysed in Kinoni 1 Dam construction in Kirehe District project. The researcher considered primary, secondary, university and post graduate levels of education as units of analysis.

Findings of the study show that majority of respondents were university graduates 38%, secondary school graduates covers 30%, other unspecified cover 30% which include those who attended vocational, Post graduate and technical schools and 2% had primary level. Figure 11.1.3 and Table 11.2.3 below show the percentage distribution by level of education of respondents.

**Table 11.1.3: Distribution of respondents' education level**

Level of education	Frequency	Percentage
Primary	1	2%
Secondary	18	30%
University	23	38%
Others	18	30%
<b>Total</b>	<b>60</b>	<b>100</b>

Source: Primary data, 2015



**Figure 11.1.3: Distribution of respondents' education level**

From the table and figure 11.1.3 a large number of 38% and 30% have the university and secondary level while 30% stands for others which includes master's level, PhD level, Vocational and technical schools whereas those who have primary level are only represented by 2% of the sample size. This enlightens that the researcher conducted his research in collaboration with highly educated respondents who are obviously capable of providing accurate and reliable information using the planned data collection instrument which was interview and questionnaire.

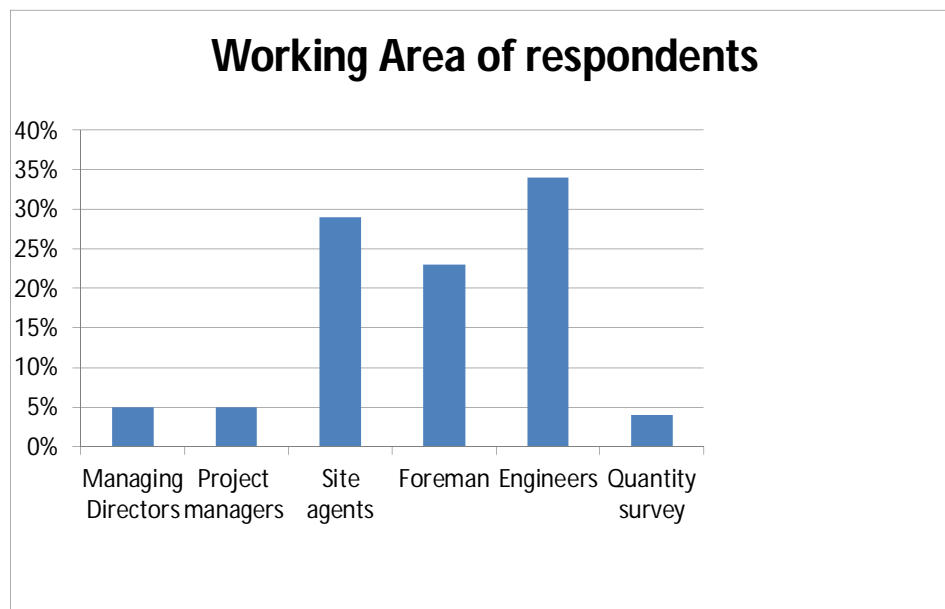
### 11.1.3. Working Area

The respondents are classified into their professional working areas and positions occupied in their respective organizations. Depending on the tasks found in Kinoni 1 Dam construction project, given that it is a construction industry; we ought to find Managing director, engineers, project managers, site agents, foreman (machinery), project Quantity surveyor. The details are displayed in the table and figure 11.1.4 here below:

**Table 11.1.4. Professional working areas of the respondents**

Position	Frequency	Percentage
Managing Directors	3	5%
Project managers	3	5%
Site agents	17	29%
Engineers	21	34%
Quantity survey	2	4%
Foreman	14	23%
<b>Total</b>	<b>60</b>	<b>100</b>

**Source:** Primary data, 2015



**Figure 11.1.4 Professional areas of the respondents**

Basing on the Figure 11.1.4, compared to other professional area of their daily work, a significant percentage is under project management team they are notably foreman with 23%; Engineers are represented up to 34% while site agents counts to 29%. This great number of respondents is the one who have day to day the management duties and what is going on this Kinoni Dam construction project and they do have enough experience about what is supposed to be done in this field. Therefore, this research gained accurate information from relevant people. If project engineers stands at 34%, it means that this number is enough to provide accurate information as they compose engineer’s team where decisions are taken such as corrective ones in case there are defects in construction or any other kind of managerial concern. Implementers (site agents) have been represented at 29%, QS at 4%, and lastly PM and MD makes 5% respectively into the sample size. The researcher is therefore happy with this case as the confidence level is high and henceforth the accuracy of the information.

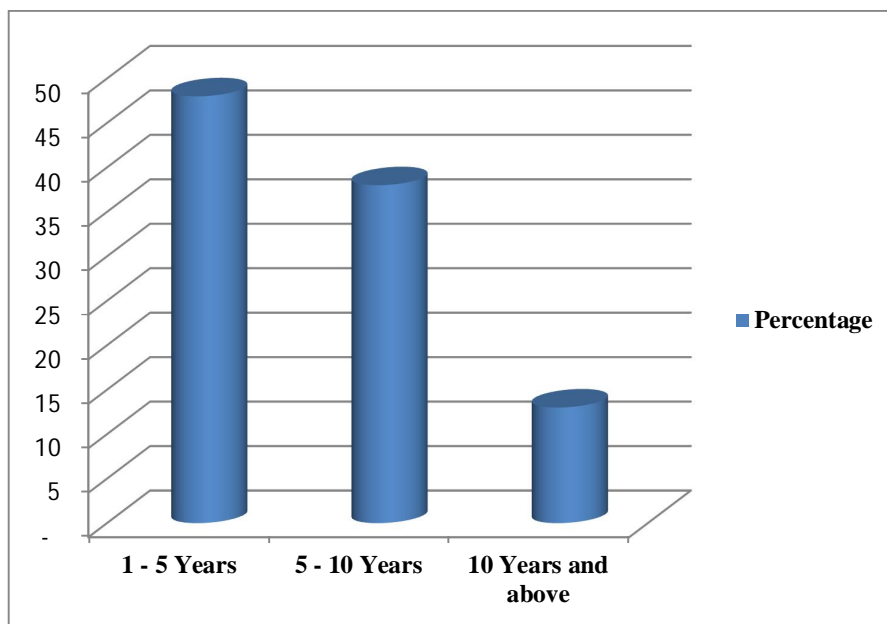
#### 11.1.4. Level of experience

The respondents were categorized by their level of experience as less than one year, between 1 – 5 years, between 5 – 10 years and above 10 years.

**Table 4.1.5. Experience of respondents 43**

Level of experience/Year	Frequency	Percentage
1-5	29	48%
5-10	23	38%
Above 10	8	14%
<b>Total</b>	<b>60</b>	<b>100</b>

**Source:** Primary data, 2015



**Figure 11.1.5: Presentation of experience of the respondents**

As far as respondents' level of experience is concerned as showed by the figure 4.1.5, none of them has an experience less than one year; consequently results may be factual as all respondents are experienced in the industry. And hence 48% of the respondents have been working in construction industry between 1 – 5 years, 38% have experience that falls between 5-10 years in construction works and the rest 14% are those who have more than 10 years in construction industry. Since the great number of respondents are those who have been in construction for a long time, this gives an assurance that the information they provided is more valuable as they have enough experience in this kind of work.

## **5. 11.2. Presentation of Findings**

The study analyzed and discussed about the following four objectives; to identify factors from the government "client" side which factors contribute to construction project cost overrun; to find out the factors from the contractors side which contribute to construction project cost overrun;; To evaluate the factors from the supervisor team side which contribute to construction project cost overrun and lastly to establish the external factors that might cause cost overrun.

### **6. 11.2.1. Findings on causative factors leading to cost overrun from client**

A construction project (as any project) is divided into four main phases: Initiation phase, Planning Phase, Execution Phase and Closure phase. This section was designed to explore the causative factors that are strictly found on client's side and therefore may cause risk related to cost over run through the different phases of Kinoni1 Dam construction project. These factors are very critical to any project if they are not given much attention and usually needs developing an alternative strategy that has a higher probability of success to avoid higher cost associated with accomplishing a project task.

As per figure 11.2.1 below the following factors are life-threatening to project cost overrun as earlier indicated; Lack of planning and co-ordination or less emphasis on planning; Change orders and / or lack of control on excessive change orders; Changes in plans and drawings; Inappropriate / inexperienced contractor; Failure on part of the employer to hand over possession of the site in accordance with the terms of the contract; Cost underestimation; Additional and / or enhancements required by clients or end users; Loss or damage due to excepted risks or employer's risk; Supplementary / additional agreement; Funding problems or client's shortage of finance or delayed payments to contractors; Executive bureaucracy in the client's organization

To establish whether these factors cause cost overrun in the project, the respondents were asked in different statements. Their responses were computed by making an aggregate of responses given by respondents to the 5-statements and 5 points Likert scale (1=least contribution to cost overrun; 2=low contribution to cost overrun; 3=contributing; 4=high contributing and 5=highly contributing; which sought to measure the prevalence and practice of factors leading to cost overrun categorized according to their percentages and means as follows:



**Table 11.2.1: Descriptive Statistics of the findings on Causative factors leading to cost overrun from client**

Causes/Statements	Highly.....least					
	5	4	3	2	1	Mean
Lack of planning and co-ordination or less emphasis on planning	36.3%	27.2%	4.7%	25%	6.8%	3.61
Change orders and / or lack of control on excessive change orders	9%	31.8%	2.27%	27.2%	29.5%	2.64
Changes in plans and drawings	13.6%	22.7%	4.5%	36.4%	22.7%	3.09
Inappropriate / inexperienced contractor	25%	29.5%	9%	15.9%	20.4%	3.23
Failure on part of the employer to hand over possession of the site in accordance with the terms of the contract	25%	29.5%	9%	15.9%	20.4%	3.23
Cost underestimation	29.5%	45.4%	9%	9%	6.8%	3.82
Loss or damage due to excepted risks or employer's risk	29.5%	6.8%	13.6%	15.9%	31.8%	2.89
Supplementary / additional agreement	4.5%	6.8%	6.8%	43%	38.6%	1.95
Funding problems or client's shortage of finance or delayed payments to contractors	31.8%	29.5%	22.2%	3.1%	8%	2.64
Executive bureaucracy in the client's organization	22.7%	22.7%	22.7%	9%	22.7%	3.30

From table 11.2.1, it is evident that out of the 10-statements that were introduced to respondents to have their say, 3-statements were strongly agreed on by majority of the respondents and these were statistically computed with a higher mean. 6-statements were agreed on by majority of the participants and these were indicated with highest mean and 1-statement was disagreed on by majority of the respondents and this was indicated by lower mean.

The response that was strongly agreed on by majority of the respondent was, "Lack of planning and co-ordination or less emphasis on planning." This was reported by 36.3% of the respondents and was represented by a mean of 3.61.

Among the responses that were agree on by majority of the respondents include; "Funding problems or client's shortage of finance or delayed payments to contractors" which was reported by 31.8% of the respondents and statistically computed with a mean of 2.64; while 29.5% reported that "Dam construction project Cost underestimation *contributes highly to cost overrun*", this was represented by a mean of 2.89. "Loss or damage due to excepted risks or employer's risk" was reported by 29.5% of the respondents and it was tabulated by a mean of 3.82.

Lastly, 25% of the respondents rated two points respectively “Inappropriate / inexperienced contractor and Failure on part of the employer to hand over possession of the site in accordance with the terms of the contract” contribute least to project cost overrun and they had a mean of 3.23 each.

This position was further supported by the views from the interviews conducted where by majority of the interviewees indicated that failure on part of the employer to hand over possession of the site in accordance with the terms of the may only delay the project, but it does not contribute to the cost overrun on high rate, as it can be easily managed. This point was raised by a respondent who supported his idea in the below quote.

*“Cost overrun in a project relies so much on how the organization controls its budgets because the client cannot haphazardly fail to deliver possession of the site if it is clearly stated in the terms of the contracts in which may delay the project as this one rely in much control form the project managers and directors...”*

On the other hand, from the Kinoni 1 Dam construction project discussions conducted with team leaders, it was evidenced that planning and co-ordination is very sensitive to cost overrun as it acts as a basis for startup of the project and development. The findings are directly in agreement to what earlier scholars had argued in the literature, such as Robert F. Cox (2007), project owners identified improper planning as main evaluator that contributes to assess the relative success of project in meeting the stated objectives and to identify what can be improved in the cost planning and control and thus influence the cost overrun rates.

In this case hence planning can to a large extent be improved on cost overrun since majority of the responses that were presented to respondents were agreed on, interviews were also in support of that positions as well as the Kinoni 1 dam construction project members views conducted in the area.

#### 11.2.2. Findings on causative factors leading to cost overrun from Contractors

The second objective of the study was to find out the factors from the contractors side which contribute to construction project cost overrun. In order to cope-up with this one, respondents were introduced different items to have their say. Their responses were computed by making an aggregate of responses given by respondents to the 8-statements and 5 point Likert scale (1=least contribution to cost overrun; 2=low contribution to cost overrun; 3=contributing; 4=high contributing and 5=highly contributing), which sought to understand the cost overrun of Kinoni1 Dam construction project which were categorized according to their percentages and means as follows:

**Table 11.2.2: Descriptive Statistics on the findings on causative factors leading to cost overrun from contractors**

Causes/Statements	Highly.....Least					Mean
	5	4	3	2	1	
Inappropriate / inexperienced contractor	50%	45.4%	2.27%	2.27%	2.27%	4.05
Failure to identify problems and institute necessary and timely design and programming changes	22.7%	75%	2.27%	0%	0%	4.20
Contractor's bankruptcy	50%	45.4%	2.27%	2.27%	2.27%	4.34
Cost underestimation	28.5%	42.4%	10%	11.8%	5.8%	3.82
Difficulties in obtaining construction materials in the local market	72.7%	22.7%	2.27%	0%	0%	4.68
Complexity of construction projects	13.6%	22.7%	4.5%	36.4%	22.7%	3.09
Poor communication among contractor consultant and client	63.5%	27.2%	0%	4.5%	4.5%	4.45
Mistakes during construction or defective work	36.3%	27.2%	4.5%	25%	6.8%	3.61

From table 11.2.2, it was established that out of the 8-statements that were introduced to respondents, 5-statements were strongly agreed on by most of the respondents and these were indicated to have the highest means, 2-statements were strongly agreed on by the respondents and these were indicated to have the high means 1-statement was agreed on by most of the respondents and this had a low high mean.

Among the responses that were strongly agreed on by most of the respondents that the contractors sides' factors that contributes to cost overrun include; they are normally "*Inappropriate / inexperienced contractor* this was reported by 50% 4.05; *Contractor's bankruptcy* 50% of the respondents and it was measured with a mean of 4.34; *Difficulties in obtaining construction materials in the local market* was reported by 72.7% of the respondents and this was represented by a mean of 4.68; *Poor communication among contractor*

*consultant and client* was represented by 63.5% of the respondents and this was indicated with a mean of 4.45; while 36.3% also admitted that *mistakes during construction or defective work* contributes to cost overrun and this was tallied with a mean 3.61.

Among other two (2) points that the responses were intensely agreed on by most of the respondents that are factors from contractors that contributes to cost overrun include; *Cost underestimation* which stands at 28.5% of the respondents and this was indicated with a mean of 3.82; and also 22.7% rated that “*failure to identify problems and institute necessary and timely design and programming changes*” may contribute to cost overrun with its mean of 4.20.

One item that was agreed on by most of the respondents was “*Complexity of construction projects*”, this was reported by 13.6% of the respondents and was calculated with a mean of 3.09.

From the interviews that were conducted with managers of Kinoni1 Dam construction project , it was realized that most of them stood in support of the view that contractors causes and factors has a relationship with project cost overrun because one of them in his own words was quoted,

“To all of us, the amount of money may not be the first priority but fundamentally, if the contractor is not given much attention as per the schedule and scope of work as planned for in construction project, it affects the whole performance hence the cost overrun.”

He added

“ Inattention to these factors causes risks which affect many angles of the project”

#### 11.2.4. Findings related to external causatives factors leading to cost overrun in dam construction projects

The forth objective of the research was to establish the external factors that might cause cost overrun in Kinoni1 dam construction.

To understand these external factors in Kinoni1 Dam construction the respondents were introduced different statements to have their say. Their responses were computed by making an aggregate of responses given by respondents to the 7-statements and 5 point Likert scale (1=least contribution to cost overrun; 2=low contribution to cost overrun; 3=contributing; 4=high contributing and 5=highly contributing), which sought to understand the cost overrun of Kinoni1 Dam construction project which were categorized according to their percentages and means as follows:

**Table 4.2.4: Descriptive Statistics on external causatives factors leading to cost overrun in dam construction projects**

Causes/Statements	Highly.....Least					
	5	4	3	2	1	Mean
Fluctuation in the cost of labor and / or material or any other matter affecting the cost of the execution of the works and subsequent legislation that affect the project	9%	0%	0%	54.5%	22.7%	1.91
Changes in foreign exchange rate (for imported materials)	15.9%	40.9%	18.8%	4.5%	20.4%	3.52
Cost due to special risks which very often include outbreak of war, hostilities, contamination and other such risks	38.6%	15.9%	22.7%	13.6%	9%	3.68
Encountering of unforeseeable physical obstructions and conditions	15.9%	75%	4.5%	4.5%	2.7	3.91
Indemnities that the employer has contractually undertaken to assume	18.8%	15.9%	4.5%	36.3%	25%	2.59
Fossils or discovery of things of geological or archaeological interest	22.7%	75%	2.27%	0%	0%	4.20
Bad weather conditions	28.5%	42.4%	10%	11.8%	5.8%	3.82

The study findings in table 4.2.4 above, it is clear that out of 7-statements that were introduced to respondents, 3-statements were strongly agreed and these were computed with the highest mean, 2-statements were agreed on and these had a relatively higher mean, 1-statement was disagreed and 1-item was strongly disagreed and these were indicated with lower mean 1.91.

The responses that were strongly agreed on that the following three external factors contribute highly to cost overrun not only in Dam construction but also in any given construction project: “Fossils or discovery of things of geological or archaeological interest” this was reported by 22.7% of the respondents and had a mean of 4.20. 15.9% of the respondents strongly agreed that “Encountering of unforeseeable physical obstructions and conditions” and this was indicated with a mean of 3.91 and lastly 28.5% of the respondents strongly agreed that “Bad weather conditions.” This was computed with a mean of 3.82.

Whilst 38.6% of the respondents agreed on that the following two factors are also keen to cost overrun in Dam construction project “Cost due to special risks which very often include outbreak of war, hostilities, contamination and other such risks” and this was indicated with a mean 3.68 and finally respondents

counting to 15.9% agreed on “changes in foreign exchange rate (for imported materials)” computed with a mean of 3.52.

18.8% disagree that “indemnities that the employer has contractually undertaken to assume” is not a powerful factor to influence cost overrun in Kinoni Dam construction project and hence measured with the mean of 2.59.

As a final point those who strongly disagreed (9%) indicated that “fluctuation in the cost of labor and / or material or any other matter affecting the cost of the execution of the works and subsequent legislation that affect the project” is not pertinent to contribute on cost overrun as the previous factors cited above and was dignified with a mean of 1.91.

From the interviews conducted, it was evident that most of the managers indicated that external factors are very critical to cost overrun and comprise their basic doubts when undertaking any construction project.

From the Literature review external risks are items that are generally imposed on the project from establishments beyond the limits of the project. Interactions with citizens groups or regulators are typical external risks. Funding constraints and restrictions, shortage of material, inflationary trends are other common external risks. External risks tend to refer to items that are inherently unpredictable but generally foreseeable.

Compared with many other industries, the construction industry is subject to more risks due to the unique features of construction activities, such as long period, complicated processes, abominable environment, financial intensity and dynamic organization structures (Flanagan and Norman, 2003). Hence, taking effective risk management techniques to manage risks associated with variable construction activities is more important for the successful delivery of a project and thus avoids related risks of cost overrun.

### **11.3. Assessment of causative factors leading to cost overrun**

Construction projects are always unique, inherently complex, dynamic and involving multiple feedback processes. A lot of participants’ individuals and organizations are actively involved in the construction project, and their interests may be positively or negatively affected as a result of the project execution or project completion.

Different participants with different experience and skills usually have different expectations and interests. This naturally creates problems and confusion for even the most experienced project managers and contractors.

Cost overrun as a risk is a concept many construction companies thought about despite the fact that it is one of the largest expense items. Managing effectively cost helps the key project participants’ client, contractor or developer, consultant, and supplier to meet their commitments and minimize negative impacts on construction project performance in relation to cost, time and quality objectives.

As discussed in the above points that causes of failure (causative factors leading to cost overrun) can rise from one of the said participants and in a given time it affects the overall performance of the project.

To this point respondents were asked to assess what are the main and critical causative factors leading to cost overrun.

### 11.3.1 Fundamental causatives factors leading to cost overrun

Three points made respondents discussions. Poor soil investigations and additional works; poor project management thus poor performance of works and poor cost control; as per below figure and 11.3.1, it is evident that their views are strictly close. It would mean that all of these causative factors are critical to project cost overrun.

**Table 11.3.1. Fundamental causatives factors leading to cost overrun**

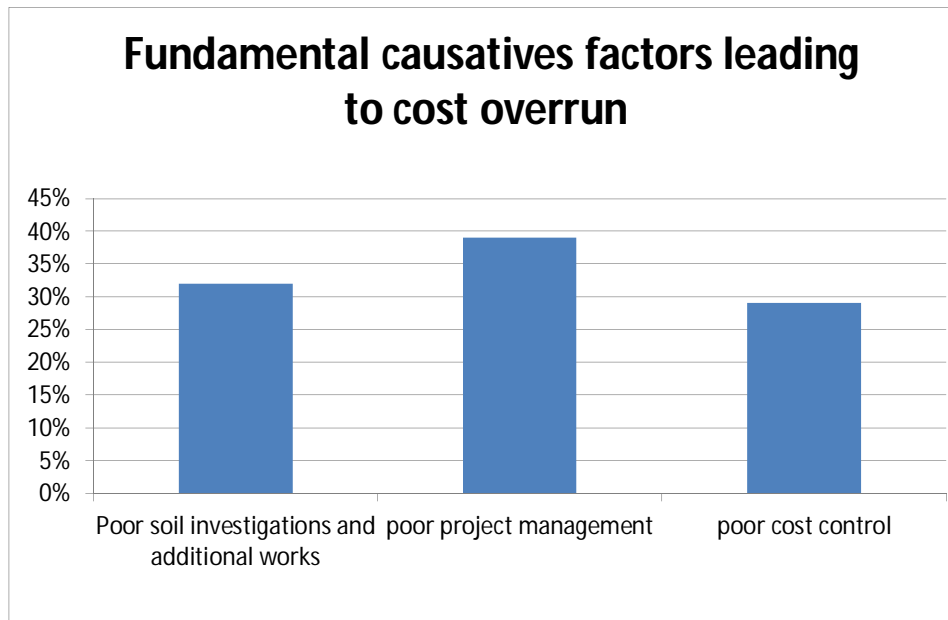
<b>Fundamental causatives factors leading to cost overrun</b>	<b>Frequency</b>	<b>Percentage</b>
Poor soil investigations and additional works	19	32%
Poor project management thus poor performance of works	23	39%
Poor cost control	17	29%
<b>Total</b>	<b>60</b>	<b>100%</b>

**Source:** Primary data, 2015

From the table and figure **11.3.1** a large number of 39% rated that Poor project management and thus poor performance of works make the principal life-threatening factor to cost overrun in construction project. 32% of respondents have agreed on poor soil investigations and additional works as major causative factor to cost overrun in Dam construction project while 29% of respondents stands on the point of poor cost control as the intrinsic causative factor of cost overrun in a project.

To these points, one may agree with respondents' views as each of respondents to this research represents his /her organization which makes parties on Kinoni's 1 Dam construction project. It would mean that one the above factor stands on project participants side mainly client, contractor and consultant.

The figure below shows clearly the findings statistically.



**Figure 11.3.1 Respondents views on fundamental causatives factors leading to cost overrun.**

**11.3.1. Frequency of cost overrun in Dam construction**

In project management there are challenges rising in one or another angle depending on the nature of the project. To this point the researcher has given possibility to respondents to expose their own experience on how frequently do dam construction projects in Rwanda experience cost overruns. By giving respondents from client, contractor and consultant a scale from 1 to 10 to show their own experience in Rwandan Dam construction, the researcher would conclude basing the respondents’ views and the level as signs of cost overruns in the dam construction projects.

The below table 11.3.2 show statistically how respondents rated their experience to cost overruns by using level 1 to 10.

**Table 11.3.2: Structured rating level of cost overrun in Dam construction**

Rating structure (1-10)	Frequency	Percent	Valid Percent	Cumulative Percent
1-3	7	12	12	12
3-6	8	14	14	26
6 and above	44	74	74	100
Total	60	100.0	100.0	

Source: Primary Data, 2015



**11.3.1. Cost overrun and performance**

As per respondents’ views, they all agreed that cost overrun has a direct relationship with performance. As a consequence the researcher has obviously established the correlation between cost overrun to with performance as per “table 11.3.3”, which shows the relationship between cost overrun and performance in Kinoni’s 1 dam construction project.

**Table 11.3.3: Correlations between cost overrun and performance**

Correlations between cost overrun and performance		Cost overrun	Performance
Cost overrun	Pearson Correlation	1	.468**
	Sig. (2-tailed)		.000
	N	60	60
Performance	Pearson Correlation	.468**	1
	Sig. (2-tailed)	.000	
	N	60	60

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

As per table 11.3, It shows that there is a strong positive relationship cost overrun and performance of construction project using correlations where (r=0.468). This implies that Cost overrun in Kinoni1 Dam contributes or not significantly to performance, hence implying a positive relationship basing on the strong positive correlation above.

**11.3. Relationship between causative factors and cost overrun in Dam construction project.**

After a presentation of findings related to the objectives of the study, it is therefore imperative to the researcher to establish the relationship between variable. This last one is done in margin of the conceptual framework; literature review and descriptive research design of this study.

As per the research case study, the part of conceptual framework analyses how causative factors leading to construction project cost overrun contributes to the end results of the project in terms of cost overrun in the lifecycle of Kinoni 1 Dam in Rwanda by MINAGRI/KWAMP as client, EMP Ltd as contractor and SET-TUNISIE as Supervisor team.

**11.3.1. Relationship between factors from the client and dam construction project cost overrun**

In the virtue to answer question one on whether factors from the client contribute to dam construction project cost overrun in Kinoni’s project a bivariate analysis was computed between one of the factors and project dam construction project cost overrun as they were reported by the respondents to find out whether there is a correlation between the two. Below are the results in table 11.4.1.

**Table 11.4.1: Correlation between factors from the “client” and construction project cost overrun**

		Change orders and / or lack of control on excessive changes orders	Additional and /or enhancements required by clients or end users
Change orders and / or lack of control on excessive changes orders	Pearson Correlation	1	.836**
	Sig. (2-tailed)		.000
	N	60	60
Additional and /or enhancements required by clients or end users	Pearson Correlation	.836**	1
	Sig. (2-tailed)	.000	
	N	60	60

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

From the table above 11.4.1 shows that a Pearson Correlation Coefficient value is ( $r=.836$ ). According to Critical Values of the Pearson Product-Moment Correlation Coefficient, when using the critical value table, the absolute value of  $r=.836$  indicates a positive relationship, strong relationship and a significant relationship ( $.000<.05$ ) between clients factors and project cost overrun. This implies that clients’ factors have a significant project cost overrun in Kinoni’s Dam construction project. This would mean that limiting and improving clients’ factors in Kinoni’s dam construction project would improve on cost overrun.

### 11.3.1 Relationship between factors from the contractor and construction project cost overrun

In the virtue to answer question two on whether factors from the contractor contributes to dam construction project cost overrun in Kinoni 1’s project an analysis was computed between two of the factors and project dam construction project cost overrun as they were reported by the respondents to find out whether there is a correlation between the two. Below are the results in table 11.4.2.

**Table 11.4.2: Relationship between factors from the contractor and construction project cost overrun**

		Lack of cost planning (monitoring during contract stages)	Cost underestimation
Lack of cost planning (monitoring during contract stages)	Pearson Correlation	1	.314**
	Sig. (2-tailed)		.046
	N	60	60
Cost underestimation	Pearson Correlation	.314**	1
	Sig. (2-tailed)	.046	
	N	60	60

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

From the table above 11.4.2 shows that a Pearson Correlation Coefficient value is ( $r=.314$ ). According to Critical Values of the Pearson Product-Moment Correlation Coefficient, when using the critical value table, the absolute value of  $r=.836$  indicates a positive relationship, strong relationship and a significant relationship ( $.000<.05$ ) between contractors factors and project cost overrun. This implies that contractors’

factors have a significant project cost overrun in Kinoni’s Dam construction project. This would mean that limiting and improving contractors’ factors in Kinoni’s dam construction project would improve on cost overrun.

**11.3.1 Relationship between factors from the supervisor and Dam construction project cost overrun**

In the virtue to answer question three on whether factors from the supervisor contributes to dam construction project cost overrun in Kinoni’s project an analysis was computed between two of the factors and project dam construction project cost overrun as they were reported by the respondents to find out whether there is a correlation between the two. Below are the results in table 11.4.3.

**Table 11.4.3: Relationship between factors from the supervisor and Dam construction project cost overrun**

		Insufficient geotechnical investigation	Additional costs due to variation of works
Insufficient geotechnical investigation	Pearson Correlation	1	.945**
	Sig. (2-tailed)		.000
	N	60	60
Additional costs due to variation of works	Pearson Correlation	.945**	1
	Sig. (2-tailed)	.000	
	N	60	60

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

From the table above 11.4.3 shows that a Pearson Correlation Coefficient value is ( $r=.945$ ). According to Critical Values of the Pearson Product-Moment Correlation Coefficient, when using the critical value table, the absolute value of  $r=.945$  indicates a positive relationship, strong relationship and a significant relationship ( $.000 < .05$ ) between supervisors factors and project cost overrun. This implies that contractors’ factors have a significant project cost overrun in Kinoni’s Dam construction project. This would mean that limiting and improving supervisors’ factors in Kinoni’s dam construction project would improve on cost overrun.

**11.3.1 Relationship between external factors and Dam construction project cost overrun**

In the virtue to answer question four on whether external factors from the supervisor contributes to dam construction project cost overrun in Kinoni’s project an analysis was computed between two of the factors and project dam construction project cost overrun as they were reported by the respondents to find out whether there is a correlation between the two. Below are the results in table 11.4.4.

**Table 11.4.4: Relationship between external factors and construction project cost overrun**

		Inflation or increase in the cost of construction material	Encountering of unforeseeable physical obstructions and conditions
Inflation or increase in the cost of construction material	Pearson Correlation	1	.415**
	Sig. (2-tailed)		.056
	N	60	60
Encountering of unforeseeable physical obstructions and conditions	Pearson Correlation	.415**	1
	Sig. (2-tailed)	.056	
	N	60	60

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

From the table above 11.4.4 shows that a Pearson Correlation Coefficient value is ( $r=.415$ ). According to Critical Values of the Pearson Product-Moment Correlation Coefficient, when using the critical value table, the absolute value of  $r=.415$  indicates a positive relationship, strong relationship and a significant relationship ( $.000<.05$ ) between external factors and project cost overrun. This implies that external' factors have a significant project cost overrun in Kinoni's Dam construction project. This would mean that limiting and improving external' factors in Kinoni's dam construction project would improve on cost overrun.

## 12. CONCLUSIONS AND RECOMMENDATIONS

The study was concerned with the causative factors leading to construction project cost overrun in Rwanda by using precisely in Kinoni 1 dam in Kirehe District The primary objective of the study was to investigate the link between causative factors and project cost overrun.

For this main objective to be met there were formed other four specific ones: To identify factors from the government "client" side which factors contribute to construction project cost overrun; to find out the factors from the contractors side which contribute to construction project cost overrun; to evaluate the factors from the supervisor team side which contribute to construction project cost overrun and to establish the external factors that might cause cost overrun. To get necessary information concerning the mentioned objectives, the researcher worked closely with the respondents through various ways such as questionnaires which got answered by the respondents from Kinoni project.

The respondents were the permanent employees whom their occupation is in construction project activities. The respondents were categorized in three groups basing on their working area and experience levels. For the education level, 99% were educated from secondary level to the master's level. While the primary level covers 2%. This facilitated the researcher to deal with the high educated respondents and to use modern communication channels like internet based and no complication uncouncted concerning the questionnaire.

Regarding their areas of specialization or working areas, none of the respondents has an experience less than one year, thus the researcher was happy with the outcomes and consequently results were factual as all respondents are experienced in the industry. And hence 48% of the respondents have been working in

construction industry between 1 – 5 years, 38% have experience that falls between 5-10 years in construction works and the rest 14% are those who have more than 10 years in construction industry. Since the great number of respondents are those who have been in construction for a long time, this gives an assurance that the information they provided is more valuable as they have enough experience in this kind of work.

12.1. Findings related to the objective of finding out the factors from the client which contributes to construction project cost overrun

The study findings indicated that clients' factors have a significant influence on project cost overrun in Kinoni's Dam construction. This is because most of the responses that were put forward to respondents were strongly agreed and agreed by majority of the respondents and these were indicated by higher means. For instance; most of the respondents agreed that: "Change orders and / or lack of control on excessive changes orders" and "Additional and /or enhancements required by clients or end users,"

These positions were further supported by the views from the interviews conducted where by majority of the interviewees indicated that these factors are very critical in Kinoni1 dam construction project. This was also the same line of argument documented from Kinoni1 discussions conducted team leaders who indicated that the clients' factors are the main pillars for cost overrun as it acts as a basis for a development of a construction project.

The findings are directly proportional to what earlier scholars had argued in the literature. An analysis conducted by Koushki et al. (2005) has shown that public and private sector projects exhibit similar patterns of cost overruns. They go on to reveal that the three main causes in order of frequency, severity, and impact are contractor-related problems, material-related problems and owners' "financial constraints. This research further found that cost overrun is in mainly influenced by project complexity, characteristics of the client or their representative and payment modality. In addition, the research reveals that cost overruns appear to be greatly influenced by both procurement and non-procurement related factors.

In this case thus, it can be reached by limiting clients factors to a large extent and by then limit the cost overrun since most of the responses that were presented to respondents were agreed on, interviews were also in support of that positions as well as the Kinoni's project views as conducted in the area.

12.2. Findings related to the objective of finding out the factors from the contractors side which contribute to construction project cost overrun

The second objective concerned to find the factors from the contractor's side which contribute to construction project cost overrun; Findings revealed that contractors factors have a significant influence on project cost overrun in Kinoni's Dam construction.

This is because most of the responses put forward factors which were strongly agreed and agreed by majority of the respondents and these were indicated by higher means. For instance; most of the respondents agreed that: Lack of cost planning (monitoring during contract stages); Cost underestimation have influence on project cost overrun. This would mean that once contractors factors are given much attention, a project would perform hence reduce cost overrun. This is evident from the responses that were agreed on by most of the respondents and these had higher means which depicted an influence.

These views were proportionate to what managers of Kinoni 1 dam construction project indicated contractors' factors are very fundamental factor for improving project cost overrun.

All these views are similar to what had earlier been established in the literature by Odusami (2010) reported that the factors which ranked the highest under related factors were economic stability, inadequate production of raw materials by the country and government policies (law and regulations). The factors ranking highest in the "construction-related" category were lack of contractor experience, incorrect planning and poor financial control on site. All these factors resulted in cost overruns in telecommunication projects in Nigeria. Furthermore, Ameh et al., (2010) discovered that factors which ranked the highest, under the variables that caused cost overruns in the "cost estimating" factors category, were the cost of materials, fluctuation of prices of materials and high interest rates charged by banks on loans received by contractors

Therefore, it is imperative to confirm that contractors' factors are very imperative to cost overrun.

### 12.3. Findings related to the objective of evaluating the factors from the supervisor team side which contribute to construction project cost overrun

The third objective of the study was focusing on factors from the supervisor team side which contributes to construction project cost overrun. The study findings indicated that factors from consultants are also critical to dam construction project cost overrun.

This is because most of the responses which were strongly agreed and agreed by majority of the respondents and these were indicated by higher means. For instance; most of the respondents agreed on two factors. The two items that were strongly agreed on by most of the respondents included; "Insufficient geotechnical investigation" and "Additional costs due to variation of works". This last position was supported by the opinions of key informants or managers of Kinoni 1 dam construction project that additional costs due to variation of works is totally related to project cost overrun and thus project performance, where one of the managers ascertained that they have some measures and strategies on variation of works which has helped so much their team to be efficient and effective in their services or works.

From this study fourth, from the Kinoni's project, it was crystal clear that most of the discussants didn't believe that dam construction would experience cost overrun, they wholesomely agreed that supervisors' factors are also keen in dam construction project had impacted on project performance and thus cost overrun.

On the other hand, according to several previous researches, it is readily known that a cost overrun is inherent characteristic for the construction industry in most countries. The most important cost overrun factors according to supervisor were preparation and approval of shop drawings, cost overrun in contractors 'progress, and payment by owners and design changes by owner, (Assaf, et al. 1995).

Poor site management and supervision, unforeseen ground conditions, low speed of decision making involving all project teams, Client initiated variations and necessary variations of works indicated by Chan and Kumaraswamy (1997) as the main causes of cost overrun.

### 12.4. Findings concerning the objective of establishing the external factors that might cause cost overrun

The fourth objective of the study was to establish focusing on the external factors that might cause cost overrun. The study findings indicated that external factors are also life-threatening to dam construction project cost overrun.

This is because most of the responses which were strongly agreed and agreed by majority of the respondents and these were indicated by higher means. For instance; most of the respondents agreed on two factors. The two items that were strongly agreed on by most of the respondents included “Inflation or increase in the cost of construction material” and “Encountering of unforeseeable physical obstructions and conditions”. This first position was supported by the opinions of key informants or managers of Kinoni 1 dam construction project that inflation or increase in the cost of construction material is totally related to project cost overrun and thus project performance.

On the other side, from the Kinoni’s project, it was crystal clear that most of the discussants have shown their thoughts that external factors are keen to cost overrun, they wholesomely agreed that external factors affects negatively dam construction project performance and thus cost overrun.

On the other hand, according to several previous researches, it is readily known that a cost overrun is inherent characteristic for the construction industry in most countries. External risks are items that are generally imposed on the project from establishments beyond the limits of the project. Interactions with citizens groups or regulators are typical external risks. Funding constraints and restrictions, shortage of material, inflationary trends are other common external risks. External risks tend to refer to items that are inherently unpredictable but generally foreseeable.

In the same context, Odeyinka et al. (2010) concluded that significant risk factors affecting the variability between tender sum and final account relate to the level of design information or lack of it at the pre-construction stage of a project. Such risk factors include changes in design, variations by the client, changes in scope of works and unexpected site conditions. A closer look at the study by Odeyinka et al. (2010) further indicates that for the commercial projects, the mentioned factors were significant. However, for educational project variations requested by the client, extremely bad weather, changes in scope of work and unexpected site conditions constitute major factors in this regard. Similarly, Kaliba, Muya and Mumba (2009) suggest that bad weather and scope changes alongside delayed payments are major factors that bring about cost overruns.

## **7. 12.5. Conclusions**

Conclusions in this study were made basing on the study objectives;

1. There is an influence of causative factors from the government “client” side which factors contribute to construction project cost overrun. This would mean that client or government entities should put so many efforts to see that they control their factors and save money from the public funds.
2. There is also a strong connection between the factors from the contractor’s side, which contribute to construction project cost overrun. This would mean that contractors’ factors dam construction projects should pay much attention on contractors’ factors in order to limit its effect to project performance and cost overrun.
3. There is likewise a positive influence of factors from the supervisor team side, which contribute to construction project cost. This means that the organization’s management or project managers are held to take corrective measures to avoid such risks.
4. There is also a strong connection between external factors that might cause cost overrun. This would mean that external factors in dam construction projects should be given much attention and hence guarantee likely consequences to project cost overrun.

## **8. 12. Recommendations**

The research was concerned with the causative factors leading to construction project cost overrun in Rwanda by using a case study of Kinoni 1 dam in Kirehe District. It is in this regard the recommendations were availed basing on research findings, conclusion as well as study area.

### **9. 12.1. To the government**

Government should be aware that causative factors leading to construction project cost overrun is the key valuable project tool especially in dam construction projects. It should be very careful to avail the project managers of the construction works to ensure that cost overrun measures is being conducted to prevent excessive costs in order to meet project objectives. It should also monitor and emphasize from the tender process to offer such tenders of construction projects as it might lead to the poor quality when the winner do not have required competitiveness.

### **12.2. To the project managers**

The project managers should ensure that measures are available and being conducted as routine activity but needed project management tool to attain the effectiveness and efficiency of the project. The rest of the project team should know the importance and reason of conducting these corrective measures are conducted periodically depending on the nature of work.

### **12.3. To the partners or resources providers**

The partners should let the beneficiaries participate in the activities as they are the one who know what they need and the exact specification. They should also make sure that the post completion satisfaction of the users is met not only receiving physical end result of the project and think that everything is fine.

### **10. 12.4. Suggestions for further study**

The study was carried out on the causative factors leading to construction project cost overrun in Rwanda. However, the further research can be conducted on the Effectiveness and Efficiency of using public funds on the luxurious and unaffordable housing projects in Rwanda.



---

**REFERENCES**

1. A.V.Hore, J.G.Kehoe,R.Mc Mullan and M.R. Penton (1997) *ConstructionI. Management, Finance, Measurement*.Palgrave Mac Millan Press Ltd.London.
2. Ali, AS, Kamaruzzaman S.N. 2010. *Cost performance for building construction projects in Klang Valley*. Journal of Building Performance ISSN: 2180-2106 Vol 1 Issue 1 (2010).
3. Alison Dykstra.( 2011). *Construction project Management, A complete introduction*.
4. Amankwa,O.P.J.(2003). *A human geography for secondary schools*, St.Francis Press, Ghana
5. Ameh, O.J., Soyngbe, A.A. and Odusami, K.T. (2010). *Significant factors causing cost overruns in telecommunication projects in Nigeria*. Journal of Construction in Developing Countries, Vol. 15(2), 49–67, (2010).
6. Assaf,S.A.AIHejjiS.(2006). *Causes of delay in large construction projects*’, International Journal of Project Management, 24(4),349-357
7. Azhar, N, Farooqui R.U. and Ahmed, S.M, (2008). *Cost overrun factors in construction industry of Pakistan*, First International Conference on Construction In Developing Countries (ICCIDC–I) “Advancing and Integrating Construction Education, Research & Practice” August 4-5, Karachi, Pakistan.
8. Azis, A.A.A, Memon A.H, Rahman I.A, Latif QBAI, and Nagapan S. (2012). *Cost management of large construction projects in South Malaysia*. IEEE Symposium on Business, Engineering and Industrial Applications.
9. Baloyi, L. & Bekker, M, (2011). *Causes of construction cost and time overruns: The 2010 FIFA World Cup stadia in South Africa*, Journal of Acta Structilia 18(1).
10. Bari, N.A.A. Yusuff, R, Ismail, N, Jaapara A. and Ahmad, N, (2012). *Factors Influencing the construction cost of industrialised building system (IBS) Projects*, Asia Pacific International Conference on Environment-Behaviour Studies, Salamis Bay Conti Resort Hotel, Famagusta, North Cyprus, 7-9 December (2011), Procedia - Social and Behavioral Sciences 35 (2012) 689 – 696.
11. Cantarelli, C.C., Flyvbjerg, B, Buhl, S.L, 2012. *Geographical variation in project cost performance: the Netherlands versus worldwide*, Journal of Transport Geography 24 pp 324–331.
12. Cantarelli, C.C., van Weea, B., Molin, E.J.E, Flyvbjerg, B. 2012. *Different cost performance: different determinants? The case of cost overruns in Dutch transport infrastructure projects*. Journal of Transport Policy 22(2012)88–95.
13. Chalabi, et al (1984) ‘*Causes of delays and overruns of construction projects in developing countries*’, CIB Proc., W-65, Vol. 2,
14. Chan,D.,and Kumaraswamy,A.(1997),“*Survey of time-cost relationships in HongKong Construction projects*”,Building Technology and Management Journal, **20**,5472.
15. Chandler (1978).*Construction managent*. Oxford : Oxford University press.
16. Cheng, M.Y., Tsai, H.C., Hsieh, W.S. (2009). *Web-based conceptual cost estimates for construction projects using Evolutionary Fuzzy Neural Inference Model*, Journal of Automation in Construction 18 (2009) 164–172.
17. Creedy, G.D, Skitmore, M. and Wong J.K.W. (2010). *Evaluation of risk factors leading to cost overrun in delivery of highway construction projects*. Journal of Construction Engineering and Management, 136(5), pp. 528-536.

18. Dawood, N. (1997), "Estimating project and activity duration: a risk management approach using network analysis", *Construction management and economics*, **16** (1), 41–48. Bourn, J. (2003), A report published by the National Audit Office, UK.
19. Doloi, H.K. 2011. *Understanding stakeholders' perspective of cost estimation in project management*, *International Journal of Project Management* 29 (2011) 622– 636.
20. Enhassi, A., Arain, F. and Al-Raei, S. (2010). *Causes of variation orders in construction projects in the Gaza Strip*, *Journal of Civil Engineering and Management*, 16:4, 540-551.
21. Enshassi, A., Al-Najjar, J. and Kumaraswamy, M. (2009). *Delays and cost overruns in the construction projects in the Gaza Strip*. *Journal of Financial Management of Property and Construction*, 14(2): 126–151.
22. Faradi, A.S. and El-Sayegh, S.M. (2006) 'Significant factors causing delay in the UAE Construction industry', *Construction Management and Economics*, 24(11), 1167-1176
23. Flyvbjerg, B., Bruzelius, N., and Rothengatter, W. (2004). *Megaprojects and risk: an anatomy of ambition*, *Journal of the Transportation forum* Vol.43, No 1 pp. 143-145.
24. Flyvbjerg, B., Garbuio, M., and Lovo, D. (2009). *Delusion and deception in large infrastructure projects: two models for explaining and preventing executive disaster*, *California Management Review*, vol. 51, no. 2, pp. 170-193. DOI: 10.1225/CMR423.
25. Flyvbjerg, B., Mette, K., Holm, S., and Buhl S.I. (2003). *How common and how large are cost overruns in transport infrastructure projects?* *Transport Reviews*, 2003, Vol. 23, No. 1, 71-88, ISSN 0144-1647 print/ISSN 1464-5327.
26. Frimpong, Y. and Oluwoye, J. (2003) 'Significant factors causing delay and cost overruns in construction of groundwater projects in Ghana', *Journal of Construction Research*, **1**(2), 175-87
27. Ganiyu, B.O., Zubairu, I.K. (2010). *Project cost prediction model using principal component regression for public building projects in Nigeria*, *Journal of Building Performance*, Vol 1 (1).
28. Kaliba, C., Muya, M., and Mumba, K. (2009), *Cost escalation and schedule delays in road construction projects in Zambia*, *International Journal of Project Management* 27 pp 522–531.
29. Kasimu, M. A. 2012. *Significant factors that cause cost overruns in building construction project in Nigeria*, *Interdisciplinary Journal of Contemporary Research in Business*. © (2012) Institute of Interdisciplinary Business Research 7 7 5 Vol 3, No 11.
30. Koushki, P. A., Al-Rashid K., and Kartam, N. (2005). *Delays and cost increases in the construction of private residential projects in Kuwait*, *Journal of Construction Management and Economics*, 23, 285-294.
31. Lee-Hoai, L., Lee, Y.D., and Lee, J.Y. (2008). *Delay and cost overruns in Vietnam large construction projects, A Comparison with Other Selected Countries*, *KSCE Journal of Civil Engineering* (2008) 12(6):367-377.
32. Love, P.E.D., 2012. *Plugging the Gaps' Between Optimum Bias and Strategic Misrepresentation and Infrastructure Cost Overruns*, *The Twelfth East Asia-Pacific Conference on Structural Engineering and Construction*, *Procedia Engineering* 14 pp. 1197-1204.
33. Love, P.E.D. 2002. *Influence of project type and procurement method on rework costs in building construction projects*, *Journal of Construction Engineering and Management*. DOI: 10.1061/(ASCE)0733-9364(2002)128:1(18).
34. Love, P.E.D. (2011). *Plugging the gaps between optimum bias and strategic misrepresentation and infrastructure cost overruns*, *The Twelfth East Asia-Pacific Conference on Structural Engineering and Construction*, *Procedia Engineering* 14 pp. 1197-1204.

35. Mahamid, I, and Bruland, A. (2011). *Cost overrun causes in road construction projects: Consultants' perspective*. 2nd International Conference on Construction and Project Management IPEDR vol.15 (2011) © (2011) IACSIT Press, Singapore.
36. Mahamid, I. (2013). *Effects of project's physical characteristics on cost deviation in road construction*, Journal of King Saud University – Engineering Sciences 25, pp.81–88.
37. Memon, A.H, Rahman I.S, Azis, A.A.A. (2011). *Preliminary study on causative factors leading to construction cost overrun*, International Journal of Sustainable Construction Engineering & Technology Vol 2, Issue 1.
38. Memon, A.H, Rahman, I.A, Abdullah, M.R, Azis, A.A.A. (2010). *Factors affecting construction cost in Mara large construction project: Perspective of Project Management Consultant*. Unpublished
39. Nawaz, P, Azman, N, Shamil M.B, Kamar S, (2010). *Sustainable construction practice: A review of change orders (co) in construction projects*, Proceedings of the International Conference on Environment (2010) (ICENV 2010).
40. Odeyinka, H, Weatherup, R, Cunningham, G, McKane, M, Larkin, K. (2010). *Assessing risk impacts on the variability between tender sum and final account*, The Construction, Building and Real Estate Research Conference of the Royal Institution of Chartered Surveyors Held at Dauphine Université, Paris, 2-3 September (2010).
41. Olawale, Y.A, and Ming, S. (2010). *Cost and time control of construction projects: inhibiting factors and mitigating measures in practice*. Construction Management and Economics, 28(5): 509-526.
42. Rahman, I.A, Memon, A.H, Karim, A.T. (2013). *Significant causes causing cost overruns in large construction projects in Malaysia*, Journal of Applied Sciences 13 (2): pp. 286-293, ISSN 1812 - 5654 / DOI: 10.3923/jas.2013.286.293.
43. Ramabodu, M.S, & Verster, J.J.P. (2010). *An evaluation of cost overruns in public sector projects: In the Free State province of South Africa*. Fifth Built Environment Conference held at the Southern Sun, Elangeni in Durban from 18 – 20 July (2010).
44. Sustainable construction practice: A review of change orders (CO) In: *Construction projects*, International Conference on Environment 2010(ICENV).
45. Toh, T.C, Ting, C, Alic, K.N, Aliaghad, U,G, Munira, O, (2012). *Critical cost factors of building construction projects in Malaysia*, International Conference on Asia Pacific Business Innovation and Technology Management, Procedia - Social and Behavioral Sciences 57 (2012) pp. 360 – 367.
46. Zawawi, N.A.W.A, Nik-Azman, F.I.B.N, Muhammad, S.B, Kamar, S. (2010).
47. Zimina, D, Ballard, G, and Pasquire, C. (2012). *Target value design: using collaboration and a lean approach to reduce construction cost*, Journal of Construction Management and Economics, 30:5, 383-398.