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Risk Management Practices and Energy Projects' Performance

A survey of REG projects

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A thesis submitted in partial fulfillment for the degree of (Masters of Business Administration) of University of Rwanda.

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30th September 2019

CERTIFICATION

I conform that the dissertation entitled "**Risk Management Practices and Energy Projects' Performance: A survey of REG projects**" was carried out by **Bertrand NTWARI** under my guidance and supervision.

Supervisor: **Dr. Samuel MUTARINDWA**

Signed…….

Date…….

DECLARATION

I, Bertrand NTWARI declare that this thesis is my original work and has not been presented for a degree on any other award in any other University.

Date: ……/……/……

Signed ……

Bertrand NTWARI

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ABSTRACT

The main objective of this thesis was to assess how risk management is practiced in energy projects and how it affects projects' performance. This research is conducted mainly to assess the extend of usage of risk management in energy projects in order to check what should be done to improve energy projects performance as reflection of effective risk management. The research targeted energy project managers and other staff related to energy project management in the energy utility. This research used quantitative method of data collection, it is based on a scheduled questionnaire survey to collect the primary data using purposive sampling of nearly or fully completed projects. Data from respondents by rating on a Likert scale, were processed and analysed through SPSS. The extent of agree/disagree of respondents about research variables was assessed by using the Mean Score (MS). Risk management practice is documented, based on questionnaire survey in percentage through tables. Significant factors of the risk were identified by ranking the risk factors based on the response of respondents regarding their probability of occurrence. The objective of studying the impact was achieved through hypothesis testing using regression analysis between risk management practices (risk identification, risk assessment and risk treatment) as the independent variables with cost and time schedule as dependent variables. This study showed a positive linear relationship between risk management practices and energy project performance. Specifically, effective identification of risk analysis as well as risk treatment at planning and implementation of a considerable level of stage involve large statistical effect about the performance of project (proxies by a planned cost and time). Findings also revealed that risk management practices require a bit of improvement in energy projects.

The thesis has both academic and policy implications. It provides a deep understanding of risk management in energy projects which has not been has not been given important attention in the academic literature as most studies have a bias on banks and construction industries. The thesis contributes to practice as well. Findings from this study can help the project managers to enhance existing risk mitigation strategy which will be beneficial to the various stakeholders in energy sector to streamline the project development process and reduce the risks attached to energy projects.

Keywords: risk management practices; energy project cost performance; energy project time performance.

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List of abbreviations

REG: Rwanda Energy Group

SPSS: Statistical Package for Social Science

REG: Rwanda Energy Group

EUCL: Energy Utility Corporation Limited

EDCL: Energy Development Corporation Limited

OAG: Office of Auditor General

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CHAPTER I. INTRODUCTION

1.1.General Introduction

In both developed and developing countries, risk management is a concept which is used in all industries, from academics, energy sector, IT related business, industries, to the construction sector. Each industry has developed its own risk management standards, but the general ideas of the concept usually remain the same regardless of the sector.

Risk in generally signifies an uncertain event, situation, or condition which may occur. The risks associated to projects should have potential negative impact on the project performance (Flanagan, Norman and Chapman, 2006). Risk is associated to any project regardless the utilities and thus risk management should be of interest to any project manager. Risks differ between projects due to the fact that every project is unique, especially in the industries (Gould and Joyce, 2002).

Risk management become an important part of the management process for any project. In fact, risk management came into the foreground of business literature during the last two decades of the 20th century (Loosemore et al., 2006). It is described as the most difficult area within project management (Winch, 2002; Potts, 2008) its application is promoted in all projects in order to avoid negative consequences (Potts, 2008). One concept which is widely used within the field of risk management is called the risk management process and consists with four main steps: identification, assessment, taking action and monitoring the risks (Cooper et al., 2005). In each of these steps, there are a number of methods and techniques which facilitate handling the risks. Many organizations have become more proactive and aware of using analyses in projects. Likewise, risk management has become a timely issue widely discussed across organizations. However, with regard to engineering projects, risk management is not commonly used (Klemetti, 2006).

Today, the energy projects are one of the conducted expensive projects where the governments of different countries invest aggressively. It requires a hard infrastructure for generating, transmitting and distributing energy regulations (Pietrosemoli and Monroy, 2013). Therefore, appropriate planning and management especially are required in order to meet the building.

In Africa, 98% of North Africa, 47% of West Africa, 23% of East Africa, 25% of Central Africa and 43% of Southern Africa have access to electricity (Adesola and Feargal 2019). In Rwanda, the report form power Africa 2018 indicates that electrification rate is estimated at 30%, it has currently installed generation capacity of 218 Mw. The government of Rwanda has a target to

achieve electricity access at 100% not later than 2024. Rwanda Energy Group (REG) is the company in charge of energy, owned 100% by government. REG and its subsidiaries EUCL and EDCL were started in 2014 with the main objectives to enhance accountability and planning, to attract more investors, to operate efficiently and to have focused sectors.

In project management, various elements have influence on the projects performance. According to the Project Management Institute (2004), project risk management is one of the nine most critical parts of project commissioning. This indicates a strong relationship between managing risks and a project success. The study done by Wang and Gibson (2008), shows that time spent on project planning activities will reduce risk and increase project success. Other researchers on the project planning activity such as Morris (1998); Thomas, Jacques, P.H.J.R (2008) showed inadequate analysis and planning will lead to a failed project but the more planning there is in a project, the more successful the project will be. However, Akintoye et al., (2003) believes that many companies are starting to become aware of the risk management process, but are still not using models and techniques aimed for managing risks. This contradicts the fact that the industry is trying to be more cost and time efficient as well as have more control over projects. There are still many practitioners that have not realized the importance of including risk management in the process of delivering the project (Smith et al., 2006). Even though there is an awareness of risks and their consequences, some organizations do not approach them with established risk management methods.

In Rwanda, the annual reports (2016 and 2017) from the office of auditor general reveal different losses caused by energy projects' delay and cost overrun. The Audits' reports exposed different energy projects that suffered delays and abandoned contracts: in 2016, delay in electrification contracts was worth Frw 24,371,653,861 in several parts of the country being implemented under the REG/EARP.

Government has invested Frw 40,570,617,811 Gishoma Peat to Power plant whose construction started on 27 February 2013 and was expected to end on 30 May 2014 but was completed in 2017. The project financed by the loan had delayed and was not operational at the time of audit in September 2016. This affects expected cash flows required to finance loan repayments. The penalties are eroding value from the investment and increase the cost of investment. The audits identified that EWSA and subsequently EDCL had failed to make interest repayments amounting to Frw 2,529,743,565 for a loan obtained from a commercial bank at 15% to finance construction

of Gishoma Peat power plant. This resulted in payment of additional charges and penalties amounting to Frw 200,039,274 due to delayed repayments as at 31 December 2014. Even in subsequent period from January 2015 to June 2015, REG still failed to make interest repayments, resulting in unpaid interest of Frw 1,364,900,033 including additional charges and penalties of Frw 134,452,803 due to delayed repayments during this period.

On 19th November 2013, the former EWSA signed a contract with KALPATARU Power Transmission Ltd India (KPTL) for construction of 220 Kilovolt (Kv) transmission lines: Karongi -Rubavu-Goma-Kigali covering 179.6 Km. The project's cost was USD 26,386,234.89 taxes exempted and Frw 5,292,307,425 (including VAT). The cost of works was to be financed by the grant from African Development Fund (68.83%) and KfW (31.17%). The execution period was (22) months and the works were expected to be completed by 19th November 2015. However, the audit identified that works had not been completed on schedule and were still ongoing at the time of audit in December 2017. The delays in completion of works range between 172 to 503 days. These delays imply that intended benefits were not being realized in the envisaged time frame.

On 19th November 2013, also Former Energy, Water & Sanitation Authority (EWSA) signed a contract with ISOLUX INGENIERIA S.A for the construction of Substations of 220 KV transmission system, Karongi-Rubavu-Goma–Kigali. The project's cost was USD 11,567,214 and Euro 7,430,437 taxes exempted and Frw 7,989,510,523 (VAT inclusive), all totaling to an equivalent of Frw 23,801,672,225. The cost of works was to be financed by a grant from African Development Fund (68.83%) and KfW (31.17%). Execution period was 15 months for (Shango and Birembo substations) and 22 months for (Bwishyura, existing Karongi and Murambi substations) from the date of contract signature. The expected completion date for all substations was 3 October 2015. However, the audit identified that the contactor had abandoned the works. EDCL has not yet contracted another contractor to complete the abandoned works and hence no progress with construction of the substations. Completed works may start deteriorating and electricity is not being transmitted to some areas as it was envisaged due to incomplete substations.

Generally, in project management there are many factors which can lead the projects to suffer unexpected outcomes, abandoned contracts, time and cost overruns. For instance, the risk management techniques have to be done in a methodical systematical way, when it is not well practiced it can delay, overrun cost or fail the project. Tzvi, Aoron and Dov (2002) in their research, they showed that due to poor risk management, some projects are still suffering and

facing cost overruns, delays, disappointing results and unexpected outcomes. Managing risks are not extensively practiced by project managers. Still they are considering risk management as it is not a part of their jobs and they do not use risk management tools and techniques in their projects. Therefore, all concerned organizations need to figure out serious measures to avoid or reduce risks and risks impacts. Zhou, Zhang and Wang (2007) noted that when the project is finalized within estimated time schedule and cost, therefore it is said to be project successful.

Various previous studies have attempted to address risk management issues and project performance, important among others are studies conducted by Nnadi, Enebe and Ugwu (2018) who studied on evaluating the awareness level of risk management amongst construction stakeholders in Nigeria, they found that a poor risk awareness among the stakeholders in construction affect project performance; Laurence (2016) studied on the effects of risk management at project planning phase on performance of construction projects in Rwanda, he showed that the risk management practices at planning stage had a large effect on project performance; Ezekiel, Patrick and Olluyinka (2013) studied on risk management practices and financial performance of listed banks in Nigeria, they found that risk managements practices have a significant effect on financial performance; Adeusi, Akeke, Adebisi, and Oladunjoye (2013) studied on risk management and financial performance of banks in Nigeria, that risk management issues do not only have impact project performance but also on national economic growth and general business development.

These studies highlighted are notable developments in the empirical literature on risk management and projects performance. The current study adds to this literature in several ways.

First, even though the variables that have been used are the same, they were used for the projects only related to the banks and constructions and little attention has been paid to the study of the above constructs in energy projects. This study addresses this empirical gap and assesses the extent to which risk management practices affect energy project's performance. Second, from a contextual point of view, this study covers energy projects performance in a developing country which was not adequately given equal academic attention. Energy is very important in developing countries because it contributes in all sectors of economy, it is a key pillar for sustainable development. As investments in energy projects are quite high and the improvement of energy infrastructures, it needs hard work by financiers, researchers, customers, builders, owners, and engineers to attempt to cause the minimum possible risk (Guido, Juan and Maria 2016). However,

many developing countries are still facing the challenge of lack of effective energy project performance due to poor risk management practices. This handicapping business and reducing economic growth of the country, therefore better project performance through effective risk management is required. While no one can avoid project risks, we may prepare and add risk management activities to project plans, putting place mechanisms, backups and extra resources that will protect the organization when something goes wrong.

1.2. Problem statement

In project management, completing project within planned time, cost, quality, safety and environmental sustainability objectives indicates project success (Zhou, Zhang & Wang 2007). Therefore, in Rwandan energy sector, we look for the well performing energy projects as reflection of effective risk management.

Today, Rwandan energy sector is still facing various executed projects that fail to meet their objectives, many energy projects yet still suffer delays, cost overruns, and even failures which leads the utilities as well the country in various losses and less profitability. Based on the annual report 2017 from the office of auditor general, the audits presented the cases of delayed and abandoned contracts that are still persisting in public entities. Those reports indicated that a total of 109 contracts worth Frw 206,817,279,066 had been delayed or abandoned. These comprise of (83) delayed and abandoned contracts worth Frw 158,354,746,771 identified during the year and (26) delayed and abandoned contracts worth Frw 48,462,532 from the previous annual report that have not been finalized and are still ongoing or abandoned. The delayed and abandoned contracts mainly comprised of energy and water projects managed by REG/EDCL and WASAC respectively. The abandoned contracts amounted to Frw 45,866,655,835 and the delayed contracts amounted to Frw 210,000,662,065.

Energy is very important in developing countries because it contributes in all sectors of economic development, furthermore it is considered as a key pillar for sustainable development. For this reason, fail to address the problem exposed by auditor general, the public utilities in years ahead will not be able to provide sustainable, reliable and affordable energy to the customers as well. Therefore, this will not only be handicapping business but also reducing economic growth of the country. Generally, abandoned contract, delays and cost overrun lead the utilities and the country as well to various losses and less profitability as it requires additional resources, budgets, labour, materials, machinery and equipment cost. Consequently, it affects significantly the economy growth of the country (Prakash and Piush, 2015).

Assaf and Al-Hejji (2006) indicated that most of the time, the variations during project implementation are a reflection of the unmanaged risks that take place during the initial stages of the project. Within the same line Nnadi, Enebe and Ugwu (2018) also postulated an additional supportive research and showed that less involvement of stakeholders in managing risks is responsible for the continuous spate of abandoned project, building collapse, cost and time overrun

which are the major risk effects. Morris & Hough (1987) noted that in many projects, risk management practices are not extensively applied, many project managers are still having habit of assuming that all their projects will be completed successful, they often fail to consider and analyze their projects risks before and prepare in case something goes wrong. This approach normally leads the project to delays, cost overrun, disappointing results and even failure.

Based on the related previous researches, perhaps Rwandan energy sector is facing the same problem. One of the main causes ahead, can be related to unmanaged risks and uncertainties. It is possible that in energy utilities risk management is practiced at low extend or is not effective at all. This can lead the project to fail, delay or cost overrun. Therefore, this study has been conducted to assess how risk management is practiced in energy projects and how it affects projects' performance.

Various previous studies have attempted to address risk management issues and project performance, important among others are studies conducted by Laurence (2016) studied on the effects of risk management at project planning phase on performance of construction projects in Rwanda, he showed that the risk management practices at planning stage had a large effect on project performance; Ezekiel, Patrick and Olluyinka (2013) studied on risk management practices and financial performance of listed banks in Nigeria, they found that risk managements practices have a significant effect on financial performance; Adeusi, Akeke, Adebisi, and Oladunjoye (2013) studied on risk management and financial performance of banks in Nigeria, that risk management issues do not only have impact project performance but also on national economic growth and general business development.

Even though the variables that have been used for the highlighted researches are the same, they were used for the projects only related to the banks and constructions and little attention has been paid to the study of the above constructs in energy projects. This study addresses this empirical gap and assesses the extent to which risk management practices affect energy project's performance. This thesis has both academic and policy implications, it provides a deep understanding of risk management in energy projects. Findings from this study can help also the project managers to enhance existing risk mitigation strategy which will be beneficial to the various stakeholders in energy sector to streamline the project development process and reduce the risks attached to energy projects.

1.3. Objectives of the research

1.3.1. Main objective

The main objective of this research is to assess the effectiveness of risk management practices in Rwandan energy utility.

1.3.2. Specific objectives

1. To assess the risk management practices in energy utilities.
2. To assess the performance of energy projects in energy utilities
3. To assess the relationship between risk management practices and energy project performance.

1.3.3. Research questions

1. How risk management is practiced in energy utilities?
2. what is the performance of energy projects in energy utilities?
1. What is the relationship between risk management practices and energy project performance?

1.3.4. Research hypothesis

1.3.4.1. General hypothesis

There is a relationship between risk management practices and energy project performance.

1.3.4.1. Specific hypothesis

H_o: There is no relationship between risk management practices and energy project performance.

H_1: There is a relationship between risk management practices and energy project performance.

1.4. Justification of the study

Based on the annual report June 2016 and June 2017 from the office of Auditor General, many energy projects yet still suffer delays, cost overrun, and even failure which leads the utilities in many losses and less profitability. Probably one of the main causes ahead, can be related to unmanaged risks and uncertainties. Therefore, this study has assessed how risk management is practiced in energy sector and whether they contribute in the energy projects' cost and time performance.

This study covers energy projects performance in a developing country which was not adequately given equal academic attention. It provides a deep understanding of the management in energy project, a strand of the review of literature that has not been given important attention as most studies have a bias on banks and construction industries. Some developing countries are still facing the problem of lack of effective energy project performance due to poor risk management practices, this handicapping business and reducing growth, therefore better project performance through effective risk management is required. For the practice relevant, this study will help the project managers to enhance existing risk mitigation strategy, this will be beneficial to the various players in energy sector to streamline the project development process and reduce the risks attached to energy projects.

1.5. Scope of the study

This study focused on the extend of usage of risk management practices in energy projects performance in respect to the planning and implementation stage in REG/EUCL.

For the factors to measure energy project performance, there are various indicators. Zhou, Zhang and Wang (2007) indicated that time, cost, quality, safety and environmental sustainability objectives are the project performance indicators. Within the same line Egan (1998) showed that to measure good performance, it consists of project performance indicators: cost, time, client satisfaction, safety, profitability and productivity. However, this study has considered only cost and time as they are the greatest important indicators used to measure the project performance and they are the fundamental criteria for success of any project (Bubashait and Almohawis, 1994; Ade, 2012). The advantage with time and cost is that are estimated or calculated at a time when least is known about the project. while the remaining indicators like safety, quality and client satisfaction

are phenomenon, they are the emergent properties of people different attitudes and beliefs, which often change over the development life-cycle of a project (Roger, 1999).

Based on the data related to the cost and time of different energy projects implemented under REG/EUCL, it was not able to obtain needed financial documents that could be used to measure cost in terms of efficiency because those documents have been declared as confidential documents. Furthermore, it was not able to obtain continuous data that could use panel (longitudinal) approaches. Hence, this study has used cross-sectional design to offset this limitation and it designed the instrument in a Likert-scale manner to measure the perceptions and views of respondents.

1.6. Organization of the thesis

This presents how the rest of this research is structured: Chapter two entails a descriptive literature on the variables under study. Chapter three summarizes the research methodology. Chapter four follows with analysis and discussion of findings. Chapter five concludes, provides academic and recommendations.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

This chapter presents different related literature related to project risk management. It is presenting theoretical and empirical review on risk management and energy projects performance. This literature review will be based on many different selected published papers, books, and other related documents.

2.2. Theoretical Review

The current Theoretical review of this study was guided by stakeholder's theory, contingency theory and agency theory.

2.2.1. Stakeholders Theory

The stakeholder theory was coined by Freeman (1984) as a management instrument and has over the years evolved with high explanatory potential on firm performance. Stakeholder theory focuses explicitly on equilibrium of stakeholder interests as the main determinant of corporate policy. The most promising contribution to risk management is the extension of implicit contracts theory from employment to other contracts, including sales and financing (Cornell and Shapiro, 1987). In certain industries, particularly high-tech and services, consumer trust in the company being able to continue offering its services in the future can substantially contribute to company value.

However, the value of these implicit claims is highly sensitive to expected costs of financial distress and bankruptcy. Since corporate risk management practices lead to a decrease in these expected costs, company value rises (Klimczak, 2005).

Therefore, stakeholder theory provides a new insight into possible rationale for risk management. However, it has not yet been tested directly. Investigations of financial distress hypothesis provide only indirect evidence (Smith and Stulz, 1985). In his study of the effect of stakeholder theory on risk management, Aabo (2002) investigates the relationship between the objectives of companies and the risk management strategy that the companies employ. The study showed a distinct difference between the two groups of companies in relation to actual risk management decisions which in turn have an effect on whether the risk management decisions will have a value addition or value retention effect on the company.

The theory is appropriate for the study since there is need to involve the interrelationship of credit management team in both short and long run profitability estimation and this will ultimately increases the profitability levels in an organization and minimize the level of risk exposure in listed Rwandan institution.

2.3. Empirical Review

2.3.1. Risk and Risk management

Risk is the future measurement of uncertainty on objectives and goals or the probability of unexpected outcome with an action (Laurence, Gene, Steve, Doug, and Road, 2013). Risk management is a continuous organized approach used to identify risk, to assess risk and to mitigate the identified risk but also risk monitoring and control in order to achieve successfully the risk reduction and their negative effects (Burgher and Hirschberg, 2014). According to the Project Management Institute (2004), project risk management is one of the nine most critical parts of project commissioning. This indicates a strong relationship between managing risks and a project success. its application is promoted in all projects in order to avoid negative consequences (Potts, 2008). The core advantage of managing risks, is to minimize the probability of occurrence of negative events associated to the project and maximize the positive events (Guido, Juan and Maria, 2016). The benefit that can gained from risk management practice is to make the best control level of a project and increasing the effectiveness of problem handling. However, it should be underlined that risk management is not a tool which ensures success but rather a tool which helps to increase the probability of achieving success. Risk management is therefore a proactive rather than a reactive concept.

To enhance project performance, an effective risk management should be taken into consideration. At the project's early stages, it is very necessary to apply risk management in order to make decision related construction methods, site selection and procurement issues (Kamalendra and Anjay, 2017). Wang, Dulaimi and Aguria (2004) describe risk analysis and process followed when risks are being managed, the process to manage risk includes systematic application of management policies and procedures such as identifying risks, assessing identified risks, treating identified risks and monitoring. Once the all risks associated to the concerned project are identified, they need to be assessed in order to check the level of risks and probability of occurrence. The risk mitigation, this step involves how the identified risks will be managed and

their negative impact, this will involve different techniques like avoiding, reducing or transferring identified risks.

In energy sector, there are three main areas of risk, the first area is related to expenses' price like fuel and electricity price that can affect the incomes. Second one is associated to technical risk where it points to the insecurity of investment's cost, maintenance and operation. Lastly, it addresses financial risks involving risk associated to the contract, interest rate's risk, and finally credit risk (Guido, Juan and Maria, 2016). Several times the energy projects are linked with internal and external risks during the implementation. Management risks and market risks most of the time are the time are classified as energy project risks. Therefore, development of measures needed in energy project management in order to minimize the negative effect of identified risks on the project

For the increase in investment related to finance projects, renewable energy requires the credit risk's identification and monitoring in project finance. The diversity about renewable energy resources and countries investing in renewable energy (including developing countries) drives the need for detailed analysis and a standardized approach, as each differing risk factors, political risks and market dynamics. The construction as a part of energy project operates in a very uncertain environment where conditions can change due to the complexity of each project (Sanvido et al., 1992).

For better risk management, the responsibility has to be shared by project's stakeholders like the government, contractors, designers and clients. This facilitate the project managers to handle efficiently identified risks within time and quality (Zhou, Zhang and Wang, 2007). For the appropriate risk management, team in charge of risk management should be composed by experienced and skilled people in monitoring and enhancement of risk management methodology (Loosemore, Raftery, Reilly and Higgon, 2006). The team also should involve all stakeholders like designers, clients, consultant, end users, contractors and project managers (Wood and Ellis, 2004). Here are the roles of each important stakeholder, contractor's role is responsible for project uncertainties associated to the poor productivity due to some changes, poor treatment of employees, site section, delayed payment. For the consultants, their role is to cope with the risk associated to the poor design like errors that can be found in the design, changes in design and design not well detailed. For the clients, they are in charge of risk associated to inflation, delays in payment, unsteady exchange rate, decision making from the force majeure (Nnadi, Enebe and

Ugwu, 2018). To enhance product performance, an effective risk management should be taken into consideration. At the project's early stages, it is very necessary to apply risk management in order to make decision related construction methods, site selection and procurement issues (Kamalendra, 2017).

There are some challenges found in risk management. Firstly, there is a challenge of creativity and development during the application of risk management tools in order to mitigate efficiently risks associated to energy projects. The second area is related to the risk policy makers where there is a challenge in the use of standards in risk management instruments. Lastly, is to provide risk management assistance in finance and investment in order to attract investors (Lee and Zhong, 2015). The study done by Schoonwinkel and Fourie (2016) postulated addition consideration about the challenges faced by the project managers which are lack of formal way of assessing project scope (risk impact of change, time and cost), modification related to the projects not being recorded systematically, project modification not being well treated and risk management procedure that is not well implemented. However, there are still many practitioners that have not realized the importance of including risk management in the process of delivering the project (Smith et al., 2006). Even though there is an awareness of risks and their consequences, some organizations do not approach them with established risk management methods.

2.3.2. Energy projects' performance

When there is a multi-output companies in energy sector, attention has to deal with the cost and time when the regulation does not take into consideration analysis. Ade (2012) showed that Time and cost performance is the fundamental criteria for success of any project. Therefore, for the energy projects performance this study focused mainly on cost and time performance.

2.3.2.1. Project cost performance

The risk identification is an important and necessary condition for a sound and safe financial environment. Project performance is generally seen as combination of three factors made up of quality, cost and time. Bubashait and Almohawis (1994) indicated that cost is one of the greatest important indicators used to measure the project performance.

Kerzner (2009) emphasized on the factors that describe the effective project budget, where he showed that the appropriate project budget should be achievable and realistic regarding the work

schedule and project cost. The cost should be based on the appropriate estimates including best time and work schedule, engineering standards even contract allocation funds. Chan and Chan (2004) noted that in order to check if there is a mismatch whether there is a cost saving or over cost, the project cost performance is measured through the comparison of estimated cost from the contract and the total project cost. Cost processes include cost estimating to figure out the needed financial commitment for all resources necessary to complete the job.

Cost overrun is the difference between actual cost of a project and its Cost limit. It occurs when the resultant cost target of a project exceeds its cost limits where Cost limit of a project refers to the maximum expenditure that the client is prepared to incur on a completed building project while cost target cost refers to the recommended expenditure for each element of a project (Jackson and Steven, 2001).

People like owners, contractors, project managers and other related stakeholders need to use more success factors in order to avoid affecting the cost performance with failure factors and to obtain project success. The important success attributes are project manager competence in work affecting cost performance whole, feedback from all participants and monitoring. Those are the top priorities of the success factors affecting the cost performance. On other side for the project managers, lack of knowledge in operating, techniques, ignorance and decision-making reduced productivity and affecting cost performance (Abdelnaser, 2011).

In the study done by Ismael, Aftab, Sasitharan and Qadir (2012), indicated the major factors which can affect both time and cost performance. They indicated major factors concerning financial stuffs like delayed payment and procurement resources highly disturb the contractor's cash flow. Lastly breach of contract also affect cost and time performance. Al-Tamimi and Al-Mazrooei (2007) showed that managing risk is the channel to avoid poor financial performance which can lead the concerned organizations to the loss.

2.3.2.2. Project time schedule performance

During the project management, the estimated starting date and estimated finishing date for every activity are the part of project time performance. Project managers need day by day to assess and compare the estimated time with percent completed and the lasting duration of the tasks (Lawrence, 2015). On other side, Lekan and Dosunmu (2017) have studied on the main causes of the project time and cost overrun. They found that most of the time lack of funds, poor planning,

poor estimations, changes related to work and payment delays are the major causes of both project cost and time overruns.

Ismael, Aftab, Sasitharan and Qadir (2012) postulated addition consideration on the major factors which can affect both time and cost performance. They showed that design changes are the first leading factor to affect the project accomplishment. The management of financial resources found to be the leading second factor. On the subject of financial performance most of the time it can be affected by delays due to procurement of resources, payment delays and contract issues.

The critical chain method compares the amount of buffer remaining to the amount of buffer needed to protect the delivery date and thus can help determine the schedule status (PMI, 2008). The total float variance is an essential planning component to evaluate project performance. Project management software for scheduling such as MsProject and Itask provides the ability to track planned date versus actual dates and to forecast the effects of changes to the project schedule

2.3.3. Risk management practices and project performance

Tzvi, Aoron and Dov (2002) have conducted a research on risk management, project success and technology uncertainty. Based on data collected on over 100 projects performed in Israel in a variety of industries, they examine the extend of usage of some risk management practices such as risk identification, probabilistic risk analysis, planning for uncertainty and trade-off analysis, the difference in application across different types of projects and their impact on various project success dimensions. As the results from their research, they ended up by finding that risk management practices are not widely used, were more applicable to high risk projects. About the impact of risk management, they found that risk management is mainly on better meeting time and budget goals and less on product performance. As their conclusion risk management is still infancy at this time, more awareness to the application, training, tool development and research on risk management is needed. Within the same line, Roque and Marly (2013) conducted a research entitled understanding the impact of project risk management on project performance. Their research involved a survey of 415 projects at different levels of complexity in different industrial sectors in several states of Brazil. They used non-probability sampling and questionnaire based on respondent perception. The findings showed that applying risk management practices has a significant positive impact on project success. They have also indicated the positive effect of having risk manager on project success. They have also indicated the critical success factors such

paying attention to uncertainties during the project, application of risk management techniques, deeply understanding the business environment, demanding attention of project managers and risk managers.

An interesting related study done by Mudau and Pretorius (2009) worked on project control and risk management for project success: A South African case study. The objective of this study was to assess the contribution of control and risk management to project success. It was a qualitative study and descriptive methods have been used. Data was collected by using questionnaire, engineering project management and projects controls departments were involved in the survey. The collected data was processed and analyzed trough spreadsheet application. The main findings from this study indicated that risk management and project controlling have a significant influence on performance of a project and therefore on the success of the company. They indicated that by strengthening and focusing more on project controlling and risk management methods and processes, the performance of projects should be improved.

Nnadi, Enebe and Ugwu (2018) postulated an addition consideration, they conducted a research by evaluating the awareness level of risk management amongst construction stakeholders in Nigeria. During this research, a descriptive cross sectional survey design was adopted while stratified random sampling was adopted to select stakeholders. Structured questionnaire and telephone interviews were adopted for data collection. The study identified the level of risk management awareness among stakeholders to be relatively low at 57.25% comparing to the colossal damages cause by risks in the industry. The study also indicated that there is no statistically significant relationship between stakeholders and level of involvement in risk management. The discovered strength of association between stakeholders and their involvement in risk management is very weak. Within the same line, Assaf and Al-Hejji (2006) indicated that most of the time, the variations during project implementation are a reflection of the unmanaged risks that take place during the initial stages of the project.

On other side, Mardiana, Puji and Ayuu (2018) studied on the effect of risk management on financial performance with good corporate governance as a moderation variable. This study used a sample size of 5 companies in Indonesia. This study found that risk management has a positive significant impact on financial performance. Based on the findings, the researchers indicated that companies need to improve risk management to obtain expected returns by improving the company's financial performance as reflected in risk management. Within the same line, Love,

Holt, Shen, and Irani (2002) in their research entitled using systems dynamics to better understand change and rework in construction project management systems, they found that any modification related to the project due to uncertainties affect significantly project cost and time. Rework is perceived to have a greater impact especially on construction performance than change. When project managers are under time and resource constraints, they would rather avoid rework by modifying the design and specifications. This research indicated that amount spent on changes is more than double the amount spent on rework.

In Tanzania, Lyambiko (2015) has conducted a study which was guided by two objectives: To determine the operational risks management practices and financial performance in commercial banks in Tanzania and to identify the sources of operational risks exposures among commercial banks in Tanzania. The study adopted a descriptive research design a target population of 36 licensed commercial banks as at 31st December 2013 with a sample of the 36 commercial banks being analysed. Secondary data was collected from the financial statements of commercial banks between 2009 and 2013. A regression model was developed with bank performance being measured by ROA and the independent variables consisting of credit risk, insolvency risk and operational efficiency. The research findings established that the independent variables had varying degrees of relationship with financial performance of commercial banks. The research confirmed that operational efficiency was positively correlated with the financial performance of commercial banks while credit risk and insolvency risk negatively influenced the financial performance of commercial banks. Within the same line in Nigeria, Adeusi, Akeke, Adebisi, and Oladunjoye (2013) conducted the related research about risk management and financial performance of banks in Nigeria. This study focuses on the association of risk management practices and bank financial performance in Nigeria. Secondly data sourced was based on a 4 year progressive annual reports and financial statement. They indicated that risk management issues do not only have impact project performance but also on national economic growth and general business development. The final results from this study showed a significant relationship between banks performance and risk management. Therefore, the authors recommended banks to practice prudent risks management in order to protect the interests of investors.

For the construction as one of the main parts of energy projects, Laurence (2016) in his research entitled the effects of risk management at project planning phase on performance of construction projects in Rwanda, he indicated that risk management practices at planning stage has impact on

project performance. The objective of their research was to investigate the usage of risk management at planning level and the impact of these risk management on project cost and schedule performance. The study targeted architects, engineers, project managers, quantity surveyors, contractors and regulatory authorities in operation in Rwanda and key clients with major investments in the construction industry. About the extent of usage of risk management, the researcher indicated that risk management was widely used at 92%, the process was mainly informal and also the construction team members did not study risk management and project management. The findings showed that many projects did not benefit from professional input at planning stage and the impact of identified but unmanaged risks was found to be high in those projects. About project performance, the findings indicated that the cost and schedule development process was inefficient in many projects and led to inaccurate estimates that later affected negatively project performance.

After the investigation done by Mervat (2017) on the impact of risk management on project success, it is an empirical investigation in Jordanian ministry of environment. This study ended up with important results where it found a positive significant relationship between risk management components (risk planning, risk analysis, risk response, risk evaluation and review) and project success. The purpose of this study was to identify risk management and its impact on project success in Jordanian ministry of environment. The population of this study was environment projects in north, centre and south Jordan with total number of 62 projects. Descriptive analytical approach was used and structured questionnaire and was adopted for data collection on respondent perception.

There are found important statement in the research done by Mylene (2014), the research was conducted to assess how is the risk analysis essential in the project management process. This paper highlights the major role of the risk analysis illustrated during all the demonstration by the example of a press conference organization in January 2014. The results from this study reveal that a complete risk analysis increases the success probability of companies 'projects, the risk analysis is essential in the project management process and can be used as a success guarantee. This paper emphasizes that even if there are several tools that are available for companies, they have to use them carefully, cleverly and efficiently during the whole project management from the risk identification to its real facing.

2.4. Conceptual framework

This section clarifies how the analyzed variables through the research are related. The independent variable and dependent variables for this study are respectively risk management practices and energy projects performance.

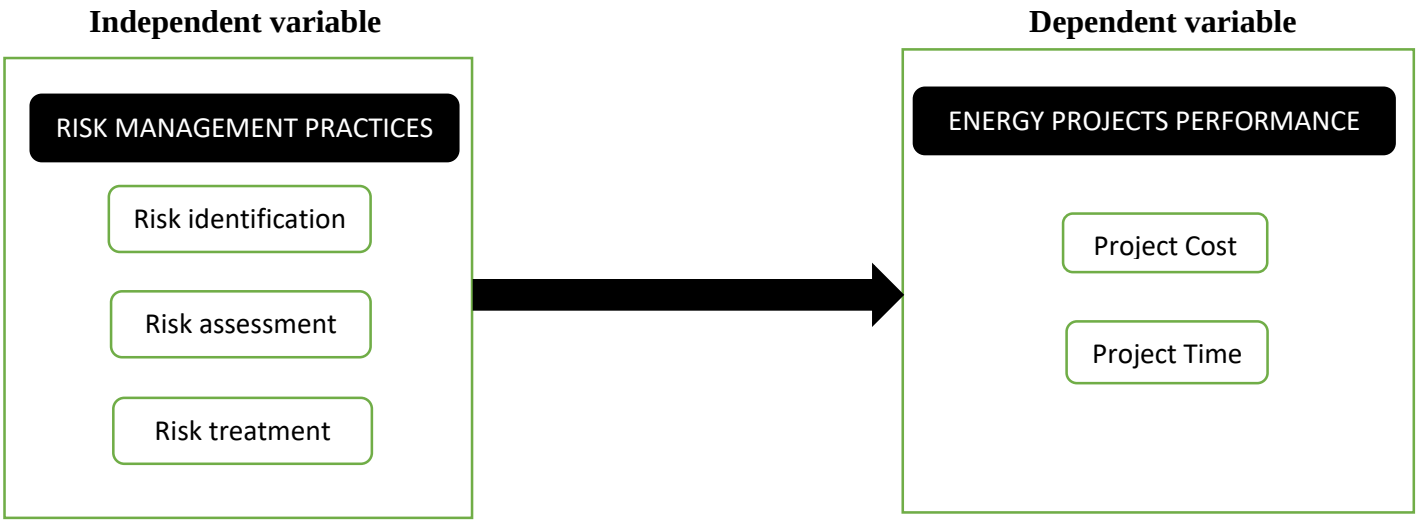

Figure 1: conceptual framework

For the independent variables, the risk management practices have been assessed based on ISO 31000 standards. ISO 31000 it provides indicators to be used for measuring risk management practices (Christopher, 2012). The risk management practices are measured through the risk identification, risk assessment and risk treatment.

For the dependent variables, have been measured trough the under studied project cost and project time schedule. For measuring the relationship between risk management practices and energy project performance, regression and correlation analysis have been used through SPSS.

Justification for study variables:

The Table 1 below, shows the used indicators for variables and the reason why they have been used.

Variables	Definition	Impact
Risk identification	Risk identification is a process of identifying and listing risks associated to the projects (Ungureanu. Braicu and Romania, 2015).	As one of the important risk management practices, it helps to assess if the project is worth taking, this may increase increases chances to complete the project within planned time, budget, scope and quality.
Risk assessment	Risk assessment is the process undertaken to analyze the risk levels and the probability of occurrence (Neil, Frey and Embrechts, 2005).	As one of the important risk management practices, it helps to assess if the project is worth taking, this may increase increases chances to complete the project within planned time, budget, scope and quality.
Risk treatment	Risk treatment is the process of taking measures in order to reduce identified risks by avoiding those risks, retain, or transfer them. (Sokratis, 2009)	As one of the important risk management practices, it helps to assess if the project is worth taking, this may increase increases chances to complete the project within planned time, budget, scope and quality.
Cost	It the amount that has to be paid.	When the cost is well managed, it helps the project managers to complete the estimated cost.
Time	In project management, this refer to the starting time and finishing time of different tasks.	When the time schedule is well managed, it helps the project managers to complete the estimated time.

Table 1.1: Justification of using variables (Source: Researcher)

2.5. Research gap

Previous studies have attempted to address risk management issues and project performance, Various previous studies have attempted to address risk management issues and project performance, important among others are studies conducted by Nnadi, Enebe and Ugwu (2018) who studied on evaluating the awareness level of risk management amongst construction stakeholders in Nigeria, they found that a poor risk awareness among the stakeholders in construction affect project performance; Laurence (2016) studied on the effects of risk management at project planning phase on performance of construction projects in Rwanda, he showed that the risk management practices at planning stage had a large effect on project performance; Ezekiel, Patrick and Olluyinka (2013) studied on risk management practices and financial performance of listed banks in Nigeria, they found that risk managements practices have a significant effect on financial performance; Adeusi, Akeke, Adebisi, and Oladunjoye (2013) studied on risk management and financial performance of banks in Nigeria, that risk management issues do not only have impact project performance but also on national economic growth and general business development.

These studies highlighted studies are notable developments in the empirical literature on risk management and projects performance. The current study adds to this literature in several ways.

First, even though the variables that have been used are the same, they were used for the projects only related to the banks and constructions and little attention has been paid to the study of the above constructs in energy projects. This study addresses this empirical gap and assesses the extent to which risk management practices affect energy project's performance. Second, from a contextual point of view, this study covers energy projects performance in a developing country which was not adequately given equal academic attention. Energy is very important in developing countries because it contributes in all sectors of economy, it is a key pillar for sustainable development. As investments in energy projects are quite high and the improvement of energy infrastructures needs hard work by financiers, researchers, customers, builders, owners, and engineers to attempt to cause the minimum possible risk (Guido, Juan and Maria 2016). However, many developing countries are still facing the problem of lack of effective energy project performance due to poor risk management practices, this handicapping business and reducing growth, therefore better project performance through effective risk management is required. While no one can avoid project risks, we may prepare and add risk management activities to project plans,

putting place mechanisms, backups and extra resources that will protect the organization when something goes wrong.

The thesis has both academic and policy implications. It provides a deep understanding of risk management in energy projects which has not been has not been given important attention in the academic literature as most studies have a bias on banks and construction industries. The thesis contributes to practice as well. Findings from this study can help the project managers to enhance existing risk mitigation strategy which will be beneficial to the various stakeholders in energy sector to streamline the project development process and reduce the risks attached to energy projects.

CHAPTER 3: RESEARCH METHODOLOGY

3.1. Introduction

This chapter avail a summary of research methodology adopted for this study. The study is based on different scheduled questionnaires survey to collect data, sampling data and analyze them with different tools. The data will be documented and presented through charts and graphs.

3.2. Research design

This research has used a cross-sectional research design. It was not able to obtain continuous data that could use panel (longitudinal) approaches. This study used cross-sectional design to offset this limitation and it designed the instrument in a Likert-scale manner to measure the perceptions and views of respondents.

3.3. Population of the study

The study is intended to assess how risk management is practiced in energy projects performance. Therefore, the needed data were collected from REG, as REG is the critical institution in charge of energy. According to the objectives of this study, the population of interest is REG's energy projects that have been implemented between 2015 and 2018. The population size is 14 including project managers (project engineers and project technicians).

3.4. Sample selection method

The non-probability purposive sampling method has been used during this research. The purposive sampling method is time and cost effective, it also helped to select needed sample members based the skills, experience and relationship concerning the research subject.

3.5. Sample size

A sample size of 14 was determined based on the Kreijce and Morgan, 1970 table. The size of 14is exactly the unit of project management in REG/EUCL, therefore involves project managers (project engineers and project technicians).

3.6. Data collection

During this research primary data as well as secondary data have been collected from REG/EUCL as it is the case study. At a single point of time, data is collected on the entire study population, this has been done within the context of a cross-sectional study. The goal of collecting this data is to assess the relationship of a specific target point and the effectiveness of risk management practices in energy projects. The respondents were project engineers known as project managers, projects technicians and other members related to the area of project management in EUCL.

3.6.1. Primary data

The primary data have been collected by using the questionnaires. The questionnaires were distributed to the target group via email and hand delivery in order to obtain primary and reliable data from respondents. The questionnaires were based on the arranged process combining exploratory and questioning techniques. The variables on which primary data was collected include risk management practices and energy performance as cost and time schedule.
There was 100% response rate which means all respondents have filled the questionnaire. As this study had sample size of 14, I took time to discuss with every respondent and all 14 respondents have filled the questionnaire in appropriate way and the questionnaires returned on time for analysis.

3.6.2. Secondary data

Secondary data was collected from the OAG's annual reports (2016 and 2017), the financial and non-financial reports from REG on the selected projects both from published and non-published documents have been also taken into consideration.

3.7. Data collection instruments

Self-administered questionnaires have been used during this research. The questionnaire included closed ended questions which offered the respondents a like scale rating to ask the respondents how strongly he/she agreed or disagreed with a series of statements.

3.4. Data analysis method

Quantitative statistical analysis for the questionnaires was done by using SPSS version 20. Pearson's correlation and regression model have been used to assess the relationship between risk management practices and energy projects performance. The outcomes were presented trough charts and graphs.

3.8.Data reliability and validity

3.8.1. Data reliability

Cronbach Alpha method has been used to measure the reliability of the used instrument as various questionnaires items administered to respondents.

Variables	Cronbach's Alpha
Risk identification	.621
Risk Assessment	.773
Risk Mitigation	.626
Cost and time performance	.873

Table 3.1: Data reliability (Source: SPSS)

Results from Table 3.1, indicated that the questionnaire was reliable as observed from the Cronbach Alpha Values which were above 0.5 in either case respectively. The Alpha values meet acceptance standards for the research and reflecting a similarity in the research as sighted by (George and Mallery, 2003).

3.8.2. Data validity

Pearson correlation through SPSS has been conducted to test the validity of the questionnaires. Based the output Pearson correlation value, to identify whether an item questionnaire was valid, it has been done by looking at the value of significance for each item. Based on the obtained significant value by sig.(2-tailed) ≤ 0.05 , For this reason, the item was valid and meet acceptance standards (Hamed, 2016). Therefore, this research has only considered the valid items of questionnaire with a significant value which ≤ 0.05

3.9. Summary of research methodology

SN	Objectives	Source of data	Methodology	Researcher's own Analysis
1	Analyzing the risk management practices in REG's energy projects	Project managers	Questionnaire	Trend on how managing risk is practiced in REG
2	Identifying the significant factors of risks and the gap in the current risk management	Literature review, project managers, employee' experience	Questionnaires and literature	Key risk factors and the gap in in current risk management
3	Studying how risk management practices are related with energy projects performance	Project managers, employee's experience	Literature and questionnaires	The relationship between risk management practices and the energy project performance.

Table 3.2: source of data and researcher's own analysis (Source: Researcher)

CHAPTER 4: PRESENTATION OF THE FINDINGS

4.1. Introduction

This chapter presents the findings from this study. The results are presented in accordance with sets of questions and items in questionnaire respectively**.**

4.2. Demographic characteristics of respondents

Table 4.1 presents a total of 14 (Male 14) respondents participated during the research. The respondents were only male; the male respondents were 100% of the sample. Furthermore, 42.9% of the participants had the age between 26 and 30, 14.3% age between 31-35, 42% had age between 36 and 40.

Table 2.1: Age of the respondents (source: SPSS)

		Frequency	Percent
Male		14	100.0
Age	26-30	6	42.9
	31-35	2	14.3
	36-40	6	42.9
	Total	14	100.0

As far as education was 14 concerned, 57.1% had bachelor's degree, 7.1% had either master degree and 35, 7% had diploma.

Table 3.2: Field of the study and education level of the respondents (source: SPSS)

	Frequency	Frequency	Percent
Field of education	Engineering	13	99.0
	Others	1	1.0
	Total	14	100.0
Education level	diploma	5	35.7
	Bachelor	8	57.1
	Post graduate studies	1	7.1
	Total	14	100.0

In terms of work experience, 57.1% had worked between 1-3 years, 7.1% had worked for 4-6 years, 14.3% had worked for 7-9 years, and 21.4% had worked over 9 years.

Table 4.3: Experience of the respondents (source: SPSS)

		Frequency	Percent
Experience	1-3 years	8	57.1
	4-6 years	1	7.1
	7-9 years	2	14.3
	above 9 years	3	21.4
	Total	14	100.0

4.3. Descriptive analysis of risks management practices

Descriptive statistics of different risk factors related to the assessment of risk management practices in energy projects 'performance, is presented in this section.

Descriptive analysis of risk management practices

Descriptive statistics of risk identification, risk assessment, risk mitigation, cost of project and its time duration are undertaken in this section. For descriptive analysis mean and standard were used as the measures. The mean is a significant measure, during the study it provides the score of each subject while standard deviation indicates the deviation of the individual responses from the mean. Standard deviation indicates whether the responses are concentrating around the mean or scatted far. By comparing the obtained standard deviation with the obtained mean of the process identify the main critical areas in the analysis of risk management practices in energy projects 'performance. The smaller the mean score indicates the little effect of parameter in the practices.

Table 5.4:Risk management practices in terms of risk identification (source: SPSS)

Independent variable	Series of statement	N	Mean	Std. deviation
Risk Identification	We most often clarify what we mean by project risk.	14	1.5	0.519
	We regularly use a variety of risk identification tools and techniques, not just one. (eg: PESTEL, SWAT, etc.)	14	2.57	0.756
	Due to the institution policy, there is a consistent format that we always use to identify risks.	14	3.14	0.77
	Project managers consider the rights and views of stakeholders during risk management.	14	1.71	0.611
	We always capture project risks in a central repository.	14	2.29	0.726

Table 6.5: Risk management practices in terms of risk assessment (source: SPSS)

Independent variable	Series of statement	N	Mean	Std. deviation
Risk Assessment	We regularly assess the nature and type of possible causes and effects of the identified risks;	14	1.36	0.497
	We most often assess the manner in which risks are defined in our project.	14	1.79	0.699
	We always assess the space and time horizon of the frequency and consequence of the risk	14	2	0.392
	We regularly define risk levels.	14	2.57	0.646
	We always define possible risk limits.	14	2.5	0.76
	We define the combined effect of recurring or parallel risks (we combine effects of similar risks).	14	2.71	0.611
	We consider the opinion and advice of stakeholders on the identified risk and how they should be treated.	14	1.5	0.519

Table 7.6: Risk management practices in terms of risk treatment (source: SPSS)

Independent variable	Series of statement	N	Mean	Std. deviation
Risk treatment	We always choose the best risk treatment option (accept, avoid, control, transfer or monitor risk	14	1.36	0.633
	We regularly design risk mitigation plans by assessing user needs	14	1.86	0.535
	We always seek out the help of experts on risk mitigation	13	2.69	1.032
	We regularly prepare mitigation plan content.	14	1.79	0.579
	We always select the appropriate and skilled risk manager.	14	2.86	0.663
	We always develop high-level mitigation strategies and identify steps and actions to implement them	14	1.86	0.864
	We regularly avail resources for risk mitigation.	14	1.93	0.616
	We regularly do risk monitoring on all projects.	14	1.64	0.633

According to the results from Table 4.4, Table 4.5 and Table 4.6, on one side the statements with least average scores spread of mean and standard deviation are the fellows: clarification of what we mean by project risk with (mean=1.5; std. dev=0.51); consideration of the rights and views of stakeholders during risk management (mean=1.71; std. dev=0.611); project managers do not regularly assess the nature and type of possible causes and effects of the identified risks (mean=1.36; std. dev=0.497 of standard deviation); we most often assess the manner in which risks are defined in our project (mean=1.79; std. dev=0.699); we consider the opinion and advice of stakeholders on the identified risk and how they should be treated (mean=1.5; std. dev =0.519); we always choose the best risk treatment option (mean=1.36; std. dev=0.633); we regularly design risk mitigation plans by assessing user needs (mean=1.79; std. dev=0.579); we regularly do risk monitoring on all projects (mean=1.64 ; std. dev=0.633).

The drive reason of these least scores and spread, is that a great number of respondents have not common understanding on above statements.

However, on the other hand the statements with highest average scores of mean and standard deviation are the fellows: due to the institution policy, there is a consistent format that we always use to identify risks (mean=3.14; std. dev=0.77); we define the combined effects of similar risks (mean=2.71; std. dev=0.611); we always select the appropriate and skilled risk manager (mean=2.86; std. dev=0.663).

The main reason of these highest scores and spread would potentially be that a great number of respondents have common understanding on the mentioned above statements.

Table 8.7: Energy project cost performance (source: SPSS)

Dependent variable	Series of statement	N	Mean	Std. deviation
Cost	We usually spend a lot on the inputs	14	1.79	0.579
	We usually use the estimated total cost of the project	14	2.57	0.756
	We usually spend the extra cost on the project (overspend budget)	14	2.29	0.914
	We usually have contingency budget (budget for risk management)	14	1.71	0.994
	Our assets are put into their best use	14	1.5	0.65
	We continually review, evaluate, and improve processes in a quest for optimization	14	1.93	0.73

Table 9.8: Energy project time performance (source: SPSS)

Dependent variable	Series of statement	N	Mean	Std. deviation
Time schedule	Effective risk management contributes to the project completion on time	14	1.43	0.756
	Risk associated with suppliers (late deliveries, unexperienced suppliers, etc.) affect the estimated project timely completion due to late deliveries, when they are not well managed.	14	1.5	0.519
	Risk associated with planning (improper planning) affect the estimated project timely completion.	14	1.36	0.497
	Delayed payment (financial risk) affects the project timely completion	14	1.5	0.76

According to the results from Table 4.7 and Table 4.8, on one side, the statements with least average scores spread of mean and standard deviation are the fellow: we usually spend a lot on the inputs
(mean=1.79 ; std.dev=0.579); we usually have contingency budget (mean=1.71; std. dev= 0.994); our assets are put into their best use (mean=1.5; std. dev=0.65); risk associated with suppliers (late deliveries, unexperienced suppliers, etc.) affect the estimated project timely completion due to late deliveries, when they are not well managed (mean=1.5; std. dev=0.519), risk associated with planning (improper planning) affect the estimated project timely completion (mean=1.36; std. dev=0.497); delayed payment (financial risk) affects the project timely completion (mean=1.5 ; std. dev=0.76). The drive reason of these least scores and spread, is that a great number of respondents have not common understanding on above statement.

However, on the other hand the statements with highest average scores of mean and standard deviation are the fellow: we usually use the estimated total cost of the project (mean=2.57; std. dev=0.756); we usually spend the extra cost on the project (mean=2.29; std.dev=0.914). The drive reason of these least scores and spread, is that a great number of respondents have common understanding on the mentioned above statements.

4.4. Correlation analysis

The Pearson correlation coefficient analysis has been done in order to measure how the studied variables are related. Table 4.9 below is presenting the correlation between risk management practices (risk identification, risk assessment and risk treatment) and energy project performances main of cost and time performance.

The results of Pearson correlation coefficient analysis for this study are below;

Table 10.9: Correlation between risk management practices and energy project cost performance

		RI1	RI2	RI3	RI4	RI5	RA1	RA2	RA3	RA4	RA5	RA6	RA7	RM1	RM2	RM3	RM4	RM5	RM8
COST1	**Pearson Correlation**	0.38	-0.05	0.07	0.47	0.523	0.286	0.258	0.34	-0.1	0.09	0.03	0.13	0.015	0.142	0.298	0.31	-0.49	0.2
	Sig. (2-tailed)	0.18	0.87	0.8	0.09	0.055	0.321	0.373	0.24	0.84	0.77	0.92	0.66	0.959	0.628	0.324	0.28	0.08	0.51
COST2	**Pearson Correlation**	-0.2	0.46	.642*	0.05	0.1	0.234	0.104	0.26	0.38	0.4	0.21	0.2	-0.459	-0.16	.785**	0.13	0.48	-0.2
	Sig. (2-tailed)	0.5	0.1	0.01	0.87	0.734	0.421	0.724	0.37	0.18	0.15	0.46	0.5	0.099	0.577	0.001	0.67	0.08	0.53
COST3	**Pearson Correlation**	0.32	-0.03	-0.28	0.16	.679**	-0.07	0.103	0.43	0.09	0.11	0.3	-0.16	0.076	.562*	-0.36	0	0.07	-0.1
	Sig. (2-tailed)	0.26	0.91	0.33	0.59	0.008	0.805	0.726	0.13	0.75	0.71	0.31	0.58	0.796	0.036	0.233	0.94	0.81	0.8
COST4	**Pearson Correlation**	0.45	-0.07	-0.14	.615*	0.122	.689**	.679**	0.39	-0.1	0.1	0	.596*	.663**	0.062	0.207	.554*	-.533*	0.44
	Sig. (2-tailed)	0.11	0.8	0.63	0.02	0.679	0.006	0.008	0.16	0.77	0.73	0.95	0.02	0.01	0.833	0.497	0.04	0.05	0.12
COST5	**Pearson Correlation**	0.11	-0.16	-0.15	.580*	-0.163	0.357	0.254	0.3	-0.2	-0.2	-0.4	0.34	.654*	0.221	0.104	0.51	-0.36	.654*
	Sig. (2-tailed)	0.7	0.59	0.6	0.03	0.578	0.211	0.382	0.3	0.53	0.42	0.17	0.23	0.011	0.447	0.736	0.06	0.21	0.01
COST6	**Pearson Correlation**	0.31	-0.06	0.02	0	0.477	-0.14	0.118	0.27	0.09	-0.1	0	-0.31	0.226	0.366	-0.25	0.14	-0.02	0.44
	Sig. (2-tailed)	0.29	0.84	0.95	0.87	0.085	0.642	0.687	0.35	0.75	0.81	0.87	0.29	0.438	0.198	0.419	0.63	0.94	0.12

Table 11.10: Correlation between risk management practices and energy project time performance

		RI1	RI2	RI3	RI4	RI5	RA1	RA2	RA3	RA4	RA5	RA6	RA7	RM1	RM2	RM3	RM4	RM5	RM8
PC1	**Pearson Correlation**	0.39	-0.06	-0.25	.618*	0.04	.585*	0.478	0.52	-0.2	-0.1	-0.4	.588*	.620*	0.354	0.158	.578*	-0.33	0.51
	Sig. (2-tailed)	0.17	0.85	0.4	0.02	0.892	0.028	0.084	0.06	0.44	0.65	0.18	0.03	0.018	0.215	0.607	0.03	0.25	0.07
PC2	**Pearson Correlation**	-0.14	-0.2	-0.39	0.49	0.204	0.149	-0.11	0.38	-0.2	-0.3	-0.2	0.14	0.117	0.277	-0.02	-0.1	0	-0.1
	Sig. (2-tailed)	0.63	0.5	0.17	0.08	0.484	0.611	0.718	0.18	0.43	0.31	0.4	0.63	0.69	0.337	0.938	0.66	1	0.69
PC3	**Pearson Correlation**	0.15	-0.38	-0.34	0.36	-0.304	0.378	0.237	0	-0.4	-0.5	-.651*	0.45	.541*	-0.08	-0.13	0.29	-.533*	0.44
	Sig. (2-tailed)	0.61	0.18	0.23	0.2	0.29	0.183	0.415	1	0.11	0.06	0.01	0.11	0.046	0.779	0.674	0.32	0.05	0.12
PC4	**Pearson Correlation**	0.29	0	-0.13	.663**	0	0.509	0.362	0.52	-0.2	-0.1	-0.3	0.49	.560*	0.379	0.315	.612*	-0.31	.560*
	Sig. (2-tailed)	0.31	1	0.65	0.01	1	0.063	0.203	0.06	0.59	0.82	0.25	0.08	0.037	0.182	0.294	0.02	0.29	0.04

Note: ** significant at 0.001 level; * significant at 0.05 level

Source: SPSS

The results from Table 4.9 and Table 4.10 indicated that there is a significant positive correlation between RI3 and COST2. There is a significant positive correlation between RI5 and COST3.There is also a significant positive correlation between the risk identification (RI4) and COST3.There is a significant positive correlation between the risk identification (RI4) and COST4.There is a significant positive correlation between the risk identification (RI4) and COST5. There is a significant positive correlation between the risk assessments RA1, RA2, RA7 and COST4. The findings show that There is a significant positive correlation between RM3 and COST2. A significant positive correlation between COST3 and RM2, RM3 and COST2, between RM3 and COST3, RM1, RM4, RM4 and COST.

However, a negative significant correlation was revealed between RM5and COST4. This finding showed a significant positive correlation between COST5 and RM1, RM7 and RM8.

This analysis showed a significant positive correlation between PC1 and RI4 as well as between PC4 and RI4. There is a relationship between RA1, RA7 and PC1. However, a negative correlation was found between RA6 and PC3. There is a significant positive correlation between PC1 and RM4as well as RM1, there is also negative correlation between PC3 and RM5 also was manifested. Between PC4 and RM1, RM4, RM7as well as RM8 found a significant and positive correlation.

4.5. Regression results analysis

This study has used linear regression analysis for attaining key purpose which is to evaluate the relationship between risk management practices and energy projects performance.

The model stands for measuring the relationship between risk management practices (risk identification, risk assessment and risk treatment) and energy project performance (cost and time).

Model estimation

This study has used a single estimated equation entitled ordinary least squares (OLS) method. The linear regression needs less data to find out its estimates, it is powerful and easy to check the assumptions for model like linearity, variance and constant (Hutcheson and Sofroniou, 1999). OLS has advantage of having simplicity operation since fractal dimension can be easily calculated in common software such as Excel, SPSS and Mat lab.

Regression equation:

$$y_i = \beta_0 + \beta_1 RI_i + \beta_2 RA_i + \beta_3 RM_i + \varepsilon_i$$

y_i: stands for energy project performance (project cost performance cost and project time performance).

$\beta_1 - \beta_3$: represent the coefficient of the independent variables

RI: stands for a set of risk identification

RA: stands for a set of risk assessment

RM: stands for a set of risk treatment or Mitigation

ε_i: is the error term assumed to be normally distributed with zero mean and constant variance.

i: related project

Table 12.11: Relationship between risk management practices and energy project cost performance

Dependent Variable	**COST**			
Estimation method	OLS MODEL			
independent Variables	**Estimate**	**Std. Error**	**t-statistic**	**p-Value**
(Constant)	-0.117	1.101	-0.107	0.919
RI4	0.569	0.288	1.973**	0.105
RA1	0.386	0.521	0.741	0.492
RA2	0.394	0.615	0.64	0.55
RA7	-0.053	0.521	-0.101	0.923
RM1	0.576	0.28	2.054**	0.095
RM4	-0.416	0.482	-0.861	0.428
RM5	-0.303	0.264	-1.148	0.303
RM6	0.288	0.313	0.922	0.399
RI5	-0.12	0.203	-0.591	0.568
RM3	0.605	0.148	4.098***	0.002
RI5	-0.105	0.142	-0.74	0.478
RM1	0.075	0.216	0.346	0.737
RM7	0.585	0.18	3.248***	0.01
RM8	0.568	0.189	3.002***	0.015
R Square	0.903			

Adjusted R Square	0.748			
Observations	14			
df	8			
F-value	5.815***			
Prob (F-statistic)/ Sig.	.034a			

Source: SPSS

Notes: * denotes significant as 10% confidence level (1.645); ** denotes significant as 5% confidence level (1.96); *** denotes significant as 1% confidence level (2.576).

The results from Table 4.11 show that RM3 (seek out the help of experts on risk mitigation) with an estimate of 0.605, t statistic of 4.098 and the p-value of 0.002; RM7 (avail regularly resources for risk mitigation) with estimate of 0.585, t statistic of 3.248 and p value 0.01; RM8 (regularly do risk monitoring on all projects) with estimate of 0.568, t statistic of 3.002 and p value of 0.015 are statically significant at 99% of confidence level and have a positive relationship with project cost performance. Among the factors analyzed, these have been considered since showed high confidence level.

From the results of beta coefficients, RM3, RM7 and RM8 had positive coefficient of 0.605, 0.585 and 0.568. This means an increase in RM3 (involving the experts in risk mitigation) by one unit leads to an increase in better cost performance by 60.5%. An increase in RM7 (avail regular resources for risk mitigation) by one unit leads to the improvement of cost performance by 58.6%. A unit increase in RM8 (risk monitoring in all project) leads to an increase in better cost performance by 56.8%. The obtained estimated coefficients for RM3, RM7 and RM8 are also high, this mean the higher the value of the coefficients the higher the probability of project to successful (Roque and Marly, 2013).

The obtained positive coefficients infer that RM3, RM7 and RM8 have a positive effect on energy project cost performance. When the company has effective risk management practices the energy project has a higher chance to be successful through a better cost performance. The findings concur with those of Ongore (2011) who found a significant positive relationship between the risk management practices and financial performance.

The regression analysis from Table 8 indicated the significant relationship between risk management practices and energy project cost performance for 74.8 % of variance (R square adjusted = 0.748). It means that 74.8% of variation in energy project cost performance were

explained by the variation in risks management practices. While the remaining 25.2% can be attributed to the other variables not considered by this study model.

The obtained significant positive relationship between RM3, RM7, RM8 and project cost performance implies that the utilities in energy sector should involve the experts during risk mitigation, avail regularly resources for risk mitigation and regularly do risk monitoring on all projects in order to enhance project cost performance.

The more risk management is effective the more project cost is effective. The findings agreed with the work done by Berk (2005) who showed that the better risk awareness the better financial performance and effectiveness. The findings also do concur with the work done by Smith (1995); Mardiana, Puji and Ayuu (2018); Lyambiko (2015); Nimalathasan and Pratheepkanth (2012) who postulated additional consideration by demonstrating the positive relationship between effective risk management practices with effective financial performance. the researchers indicated that companies need to improve risk management to obtain better company's financial performance as reflected in risk management.

Table 13.12: Relationship between risk management practices and energy project time performance

Dependent Variable	**TIME**			
Estimation method	OLS MODEL			
Independent Variable	**Estimate**	**Std. Error**	**t-statistic**	**P-value**
(Constant)	-0.319	0.56	-0.569	0.581
RI4	0.538	0.304	1.770*	0.104
RA7	0.549	0.358	1.533	0.153
RM4	0.803	0.299	2.682***	0.02
RA6	-0.529	0.178	-2.969***	0.12
R Square	0.491			
Adjusted R Square	0.399			
Observations	14			
df	8			
F-value	5.308***			
Prob (F-statistic)/ Sig.	.024[a]			

Source: SPSS

Notes: * denotes significant as 10% confidence level (1.645); ** denotes significant as 5% confidence level (1.96); *** denotes significant as 1% confidence level (2.576).

The results from Table 4.12 show that RM4 (prepare regularly mitigation plan content) with an estimate of 0.803, t-statistic 2.682, the p-value of .02 is significant at 99% of confidence level.
For the estimated coefficient, RM4 has a positive coefficient of 0.803, this means an increase in RM4 (prepare regularly mitigation plan content) by one unit leads to an increase in better project time performance by 80.3%. this infers that RM4 has a positive impact on energy project time performance and when the company has effective risk management practices, the energy project has a higher chance to be successful through a better time performance.
The obtained estimated coefficients for RM4 is also high, this mean higher coefficients the higher the probability of a project to be successful (Roque and Marly, 2013).

The regression analysis from table above also indicates the significant relationship between risk management practices and energy project time performance for 39.9 % of variance (R square adjusted = 0.399). It means that 39.9% of variation in energy project time performance were explained by the variation in risk management practices. The more risk management is effective the more project time schedule is followed or reduced. While the remaining 60.1% can be attributed to the other variables not considered by this study model.
The obtained significant positive relationship between RM4 and project cost performance implies that the utilities in energy sector should prepare regularly mitigation plan content in in order to enhance project time performance, this will contribute to complete the energy project within the estimated time. The findings agreed with the study done by Mervat (2017) who found that the risk management components (risk planning and definition, risk analysis, risk response, risk assessment and review) have impact on the success of projects in terms of the time dimension of the project.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

The discussions on the obtained results from this study are presented in this chapter, it includes the conclusions and recommendations within the line with the research's objectives. The objective of the study was to assess the usage extent of risk management practices in energy projects performance, mainly in cost and time performance. This study has also investigated how risk management practices are related to the energy projects performance

5.2. Discussion

The findings from this study are in the same line with the research's objectives.

5.2.1. Analysis of the effectiveness of the risk management practices in energy projects

Results from chapter four indicated different numerous risk identification tools and techniques are not used regularly (unused rate= 71.4%). This indicates the threat of using risk management tools in energy sector is high.

To use risk management tools during project management is very important, it allows the project managers to emphasize on the particular parts which need to be taken more into consideration rather than the whole project. For this reason, it helps the project managers to get better visibility of potential risks associated to the project and concentrate on them (Michael, 2009).

The findings reveal at the rate of 71.45% that there is no risk manager assigned in utilities for a specialized professional to deal with risk management activities. However, for better risk management, skilled personnel in charge of risk management is needed as Roque and Marly (2013) indicated that the existence of project risk manager can bring positive effect on project performance. Most of the project managers are engineers and they do not get sufficient regular trainings about risk management. However, the trained engineers and skilled consultants have better performance regarding cost, time, functionality, communication, cost and time management (Laurence, 2016). Therefore, it is very important to have a risk manager assigned in utilities for a specialized professional to deal with risk management activities.

Based on the results, 78.6% of the respondents indicated that there is no consistent format used to identify risks, this indicates also non-effective risk management. However, having risk

management format followed by project managers has a better performance on project in terms of communication, functionality, cost and time (Lawrence, 2015)

Finally, due to the findings, 50% of respondents confirmed that identified risks are not regularly well assessed by using risks level, this also indicates the threat of risk management in energy sector. However, having criteria to define high impact risks can help the project managers to emphasize more on few critical risks that need fast mitigation (Adrienne, 2019).

Based on the case of REG/EUCL, most of the time various delays and cost overruns are due to: First, is the long procedures of availing plots where the availability of construction plot used to take long time and delay the whole project. This factor generally is related to unmanaged risks associated to the site selection. Second is the delay of equipment supply, this factor also is related to unmanaged risks associated to the supplier especially in terms of competence and experience. Lastly, is due to the contractor's financial crisis and contractor with no competence. This factor also is related to unmanaged risks associated to the contractor especially in terms of competence and experience.

The findings do concur with the work done by Lawrence (2015) where he indicated that the main risk project management challenges are related to the budget estimation, time schedule estimation process, site selection. Therefore, when risks associated to the site selection when are not well managed, this can lead to project delay or cost overrun. Bennett (2003) also indicated that qualification of the stakeholders is one of the most criteria that need more attention during the project management.

When all above highlighted risks associated to the site selection, suppliers and contractors are identified, assessed and treated effectively at the planning stage, they should be avoided before their occurrence.

5.2.2. Energy project performance

In project management, completing project within planned time, cost, quality, safety and environmental sustainability objectives indicates project success (Zhou, Zhang & Wang 2007). This study has considered only cost and time as they are the greatest important indicators used to measure the project performance as the indicators for energy projects performance. Ade (2012) showed that Time and cost performance is the fundamental criteria for success of any project.

Within the same line Bubashait and Almohawis (1994) also indicated that cost and time are one of the greatest important indicators used to measure the project performance.

However, most of the energy projects are facing the problem of time and cost overrun in developing countries. The cost and time overrun on a project is usually as a result of interplay of different factors and varies from one place to the other (Lekan, Dosunmu and Opetemi, 2017). Some of the factors have varying impact depending on the nature of the project.

This study has identified and considered different energy projects which indicated time and cost overruns, those projects have been conducted under REG/EUCL between 2015 and 2018.

Table 14.13: Some projects implemented under REG/EUCL (source: REG/EUCL)

Project	Estimated cost	Total cost	Cost variation	Estimated time schedule	Time of project completion	Time delay	The cause of delay
Project 1	7,067,455.8 USD	7,420,827.8 USD	353,372 USD	11 months	21 months	10 months	Availability of the plot
							Delay of equipment supply
Project 2	947,809.83 USD	750,243 USD	197,566.83 USD	7 months	18 months	11 months	Financial crisis of the contractor
							Breach of contract
Project 3	13,617,861.5 Euros	16,495,172 Euros	2,877,310.47 Euros	15 months	31 months	16 months	Availability of the plot
							Change of scope

Table 4.13 indicating considered 3 projects that have been conducted under REG/EUCL, they have not been completed within the planned time or cost. Chan and Chan (2004) noted that in order to check if there is a mismatch whether there is a cost saving or over cost, the project cost performance is measured through the comparison of estimated cost from the contract and the total project cost. By considering also the obtained results of survey during this research, 51.7% of respondents showed that they usually spend extra cost and time on their projects, it is supporting what the table 4.13 is showing. This means various energy projects do not complete within planned time and planned cost.

The findings do concur with the work of Laurence (2016) who has showed that for the project with inefficient cost and time performance, this affect negatively the whole project performance.

Some factors have severe impact on project than the others while others may not, and therefore it is always necessary to identify the source of occurrence of the factors for better mitigation.

Based on the case of REG/EUCL, most of the time various delays and cost overruns are due to:

First, is the long procedures of availing plots where the availability of construction plot used to take long time and delay the whole project. Second is the delay of equipment supply. Third is due to the contractor's financial crisis and contractor with no competence. Lastly is related to change of scope of the project during implementation.

The findings do concur with the work done by Lawrence (2015) where he indicated that the main risk project management challenges are related to the budget estimation, time schedule estimation process, site selection. Therefore, when risks associated to the site selection when are not well managed, this can lead to project delay or cost overrun. Bennett (2003) also indicated that qualification of the stakeholders is one of the most criteria that need more attention during the project management.

5.2.3. Relationship between Risk management and energy projects performance

Results from chapter four addressed a significant linear relationship between risk management practices and energy project performance. As energy project performance is indicated by its performance in the achievement of project time and cost, in terms of energy project cost performance, the findings from this research indicated a significant relationship between risk management practices and energy project cost performance for 74.8 % of variance (R square adjusted = 0.748). The more risk management is effective the more project cost is effective.

The obtained significant positive relationship between risk management practices and project cost performance implies that the utilities in energy sector should involve the experts during risk mitigation, avail regularly resources for risk mitigation and regularly do risk monitoring on all projects in order to enhance project cost performance. The findings agreed with the work done by Berk (2005) who showed that the better risk awareness the better financial performance and effectiveness. The findings also do concur with the work done by Smith (1995), Mardiana, Puji and Ayuu (2018); Nimalathasan and Pratheepkanth (2012) who postulated additional consideration by linking effective risk management practices with effective financial performance.

For the project time performance, the findings also indicated the significant relationship between risk management practices and energy project time performance for 39.9 % of variance (R square adjusted = 0.399). It means that 39.9% of variation in energy project time performance were explained by the variation in risk management practices. This means in terms of energy project's time schedule; the more risk management is effective the more project time schedule is effective.

The findings do concur with previous findings of Mervat (2017) who found that the risk management the risk management components (risk planning and definition, risk analysis, risk response, risk assessment and review) have positive effect on the project performance in terms of the time dimension of the project.

Based on the positive impact that risk management practices have on both energy project time and cost performance, therefore risk management has a positive impact on energy project performance. The findings do concur with the work done by Mudau and Pretorius (2009) who showed that risk management and project controlling have a significant influence on performance of a project and therefore on the success of the company. They indicated that by strengthening and focusing more on project controlling and risk management methods and processes, the performance of projects should be improved. Tzvi, Aoron and Dov (2002) postulated an additional consideration, where they concluded that there is a positive correlation between risk management and project performance, this means that the greater risk management is practiced the greater is project objectives achieved. To achieve this necessitates the additional developed risk management tools and skills. Within the same line Kishk and Ukaga (2008) agreed with the findings by demonstrating the direct relationship which is between risk management and project performance. They showed how an uninterrupted effective risk management increases the chance of achieving the project goals successfully.

5.3. Conclusion

In general, this study aimed at assessing how risk management is practiced in energy projects performance mainly cost and time performance and investigating how risk management is related to projects performance.

The research targeted project managers and other staff related to energy project management. The study has used quantitative method. Questionnaires have been used to collect needed data and collected data was processed using SPSS. The correlation analysis and regression analysis were used to assess the relationship between risk management practices and energy projects performance.

The results from the study, first indicated that even if risk management is practiced in energy projects but it is practiced in informal way. The risk management is not being applied strategically by observing and assessing all risks associated to the project via a coordinated manner with formal and structured way at planning and implementation level. This means that risk management in energy utility needs a bit of improvement.

Second, it indicated a significant relationship between risk management practices and energy project performance. This means that an effective risk identification, effective risk assessment as well as effective risk treatment at planning and implementation stage have a large effect on energy project performance in terms of cost and time performance.

The thesis has both academic and policy implications. It provides a deep understanding of risk management in energy projects which has not been has not been given important attention in the academic literature as most studies have a bias on banks and construction industries. The thesis contributes to practice as well. Findings from this study can help the project managers to enhance existing risk mitigation strategy which will be beneficial to the various stakeholders in energy sector to streamline the project development process and reduce the risks attached to energy projects.

5.4. Suggestions

- This research recommends that the utilities should manage risks strategically by observing and assessing all risks associated to the project via a coordinated manner with formal and structured way at planning and implementation level.
- This research recommends that the risk manager should be assigned in utilities for a specialized professional to deal with risk management activities.
- This research suggests that all the concerned organizations should train regularly and specifically their project managers and other members related to project management how to manage risks methodologically.
- The skilled, experienced project managers and consultants should be involved in all energy projects especially during the stage of budget and schedule estimations, stage the of selecting site, stage of identifying risks, risk assessment and risk treatment.
- Finally, it recommends that the utilities should consider the opinion and advice of stakeholders on the identified risks and how they should be treated because to put effort together as one team is the best way to treat the risks of cost and time overruns.

5.4.1. Area for further research

Given that the variation of 74.8% and 39.9% of energy project cost and time performance are respectively due to risk management. This study further suggests a study on the factors that describe the remaining portion.

This research has adopted a non-probability sample and based on the respondents from only one utility. This study suggests for further studies and bases for cross country comparison.

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Appendices

QUESTIONNAIRE

Dear respondent,

My name is Bertrand NTWARI and I'm a Masters' student in Business Administration at University of Rwanda/CBE. I'm conducting a master's academic research (thesis) on the **Analysis of risk management practices in energy projects performance, case study 'REG/EUCL".**

Please be assured that all answers you provide will be kept in the strictest confidential, thank you.

SECTION I: GENERAL RESPOND INFORMATION

For this section, please tick the response category that applies to you,

1. Gender

Male ☐ Female ☐

2**. Age group**

Code	**1**	**2**	**3**	**4**	**5**
Years	21-35	26-30	31-35	36-40	Above 41
Tick					

3. Highest level of education attained

Code	**1**	**2**	**3**	**4**	**5**
Level	O'Level	A' level	Diploma	Degree	Post graduate qualification
Tick					

4. Education field attained

Code	**1**	**2**	**3**	**4**	**5**
major	Finance	Accounting	Project management	Engineering	others
Tick					

5. How long have you worked in project management?

Code	1	2	3	4	5
Level	Less than 1 year	1-3 years	4-6 years	7-9 years	Over 9 years
Tick					

6. Who is responsible for Risk management in energy projects?

Code	1	2	3	4	5
Status	Financial managers	Project managers	Risk managers	External experts	No one
Tick					

PART I: RISK AND RISK MANAGEMENT

Direction: Please indicate your level of agreement or disagreement with each of these statements

EVALUATION SCALE:

1 = Strongly agree
2 = Agree
3 = Disagree
4 = Strongly disagree

Risk identification	1	2	3	4
We most often clarify what we mean by project risk.				
We regularly use a variety of risk identification tools and techniques, not just one. (eg: PESTEL, SWAT,etc.)				
Due to the institution policy, there is a consistent format that we always use to identify risks.				
Project managers consider the rights and views of stakeholders during risk management.				
We always capture project risks in a central repository.				
Risk assessment:				
We regularly assess the nature and type of possible causes and effects of the identified risks;				
We most often assess the manner in which risks are defined in our project.				
We always assess the space and time horizon of the frequency and consequence of the risk				
We regularly define risk levels.				
We always define possible risk limits.				

We define the combined effect of recurring or parallel risks (we combine effects of similar risks).				
We consider the opinion and advice of stakeholders on the identified risk and how they should be treated.				

Risk mitigation	**1**	**2**	**3**	**4**
We always choose the best risk treatment option (accept, avoid, control, transfer or monitor risk				
We regularly design risk mitigation plans by assessing user needs				
We always seek out the help of experts on risk mitigation				
We regularly prepare mitigation plan content.				
We always select the appropriate and skilled risk manager.				
We always develop high-level mitigation strategies and identify steps and actions to implement them				
We regularly avail resources for risk mitigation.				
We regularly do risk monitoring on all projects.				

PART II: ENERGY PROJECT MANAGEMENT PERFORMANCE

Directions: Please indicate your level of agreement or disagreement with each of these statements

EVALUATION SCALE:

1 = Strongly agree
2 = Agree
4 = Disagree
5 = Strongly disagree

Based on the above rating, please select the correct answer according to the existing project Management.

a) Financial performance

cost	**1**	**2**	**3**	**4**
We usually spend a lot on the inputs				
We usually use the estimated total cost of the project				
We usually spend the extra cost on the project (overspend budget)				
We usually have contingency budget (budget for risk management)				
Our assets are put into their best use				

We continually review, evaluate, and improve processes in a quest for optimization				
Project completion:				
Effective risk management contributes to the project completion on time				
Risk associated with suppliers (late deliveries, unexperienced suppliers, etc.) affect the estimated project timely completion due to late deliveries, when they are not well managed.				
Risk associated with planning (improper planning) affect the estimated project timely completion.				
Delayed payment (financial risk) affects the project timely completion				
Resource allocation:				
Effective risk management leads to maximizing the effective use of limited resources to offer the best return on investment.				
Poor risk management increases the unplanned additional resources				
Poor risk management can cause over allocation of resources				
Poor risk management can cause under allocation of resources				