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RISK MANAGEMENT PRACTICES AND IMPLEMENTATION OF LAST MILE CONNECTIVITY PROJECTS IN MACHAKOS COUNTY

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ABSTRACT

The key objective of this study was to determine the influence of project risk management practices on implementation of Last mile connectivity projects in Machakos County. The specific objectives included examining the influence of risk analysis and risk monitoring and control on implementation of Last mile connectivity projects in Machakos County by Rural Electrification and Renewable Energy Corporation (REREC), Kenya. The researcher did select each of the transformers randomly from four sub-counties of Machakos County, that is, Mavoko, Kathiani, Machakos town and Kangundo sub-counties. The study employed descriptive research design. Simple random sampling was used to select a representative sample from the target population for this research. The research data was gathered by use of structured questionnaires. The investigator analysed data using SPSS version 25. Descriptive statistics, which included means, standard deviation, percentages and frequency tables, and inferential statistics with multiple regression analysis was applied. Findings established that: there is a positive significant relationship between risk analysis and project implementation and project risk monitoring and control influence project implementation. This study intended to offer valuable pieces of information to power beneficiary communities, power utility firms, the Government of Kenya, students and academicians on the need to apply formal risk management practices for risk minimization and successful project implementation. There is need for further venture into risk control systems to make certain that they are effective enough to guarantee project success. Thus, there is a necessity to involve all stakeholders in determining the risks or costs of the risk impact within and outside the performing firm in cases of risks to ensure project success.

Key Words: *Risk Analysis, Risk Monitoring and Control, Last Mile Connectivity*

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INTRODUCTION

Rural electrification projects are obstructed by risks of diverse natures (Vanita *et al.,* 2018). For investors, return on capital invested is of paramount consideration, and a project that performs well brings long-standing returns to investors (Cohen, 2017). In order to reap performance paybacks, business organizations require capability for all their operations to minimize costly risks (Teece, et al., 2016). The ability of these organizations to handle uncertainties and maximize performance by proper management of risks is essential. Moreover, key rural electrification projects the world over have been shrouded in snags. Multiple missed deadlines, budget overruns, botched procurement, and/or inaccessibility of private funding are a common phenomenon. These projects suffer from substantial under-estimation and poor management of risks in nearly all stages of the project life cycle (Sithta & Gupta, 2017). Electricity infrastructure projects such as the last mile connectivity projects in Kenya are not immune to these challenges and risks.

Demand for electricity is growing powerfully all over the world, and it is anticipated that in the near-term decades over 90% of this growth in demand will arise from developing countries. In these countries, rapid rise in incomes, rural to urban migration, increase in industrialization and mobility will end in many years of great growth in consumption of electricity (Dong & Hao, 2018). Therefore, electrification projects such as last mile connectivity projects are necessary in the rural areas to cope with this fast increasing demand for electricity, especially in Africa.

A rural electrification project is usually recognized as fruitful once it is finalized on schedule, within reasonable cost, and in agreement with stipulations that are satisfactory to stakeholders (Musyoka, 2016). Alias et al., (2018) state that functionality; cost-effectiveness to suppliers, nonexistence of prolonged litigations and suitability-for-use for occupants may be considered as elements of success in implementation of projects. Alinaitwe, Apolot and Tindiwensi, (2019) concentrated on results in which schedule overruns, budget overruns and project condition or ability to provide anticipated outcomes are the main performance indicators.

Rural Electrification and Renewable Energy Corporation (REREC) is an organization put in place under the Energy Act, 2019. Its obligation is to boost delivery of electricity to rural areas in Kenya and to accomplish and support development of renewable electrical energy in the country. The corporation commenced its operations in the 2008/2009 financial year, known as REA under the Energy Act of 2006 then, and since then it has ensured that 70% of public facilities have been connected to electricity (Kenya Power, 2019). Rural Electrification and Renewable Energy Corporation (REREC) has participated in implementation of a number of power projects including Last Mile Connectivity project (AfDB, 2016), Garissa solar power project, Kenya Electricity Expansion Project (World Bank, 2019) and Turkwel-Lokichar grid extension. The initial phase of the Last Mile Connectivity project was set to start in October 2015 and be completed by April 2017(AfDB, 2016). However, the deadlines as well as significant targets were missed hence completion of this phase was delayed as some project contractors had not completed their tasks as at April 2017.

Machakos County is one of the 47 counties of Kenya. According to Machakos County Annual progressive report (2017-2018), Machakos has eight constituencies including Machakos Town, Mavoko, Masinga, Yatta, Kangundo, Kathiani, Matungulu, and Mwala. The county had a population of 1,421,932 as of 2019. It borders Nairobi and Kiambu counties to the West, Embu to the North, Kitui to the East, Makueni to the South, Kajiado to the South West, and Murang'a and Kirinyaga to the North West.

The Last Mile Connectivity Project is a project that aims at extending low voltage systems throughout the country so as to reach counties with low

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penetration rates. It is believed that this project will accelerate economic growth at the microeconomic level in line with the Government's vision 2030 (African Development Bank, 2016). The project entails supply of distribution material to reach 300,000 new connections; construction of low voltage (LV) distribution lines; supervision and management; and capacity building activities in targeted areas of expertise. The population located in rural areas, low income groups as well as small businesses will particularly benefit from this project. Indeed, by providing increased electricity access, the project will contribute to improvement in standards of living of the targeted households in terms of education, health and access to information. As for small businesses, the project will help increase their competitiveness and expansion of activities (African Development Bank, 2016).

KP is undertaking the last mile project whose main objective is extending power supply connectivity to over 1.2 million customers countrywide and within the vicinity of 45,000 distribution transformers. The last mile project is financed by African Development Bank (ADB) and the Government of Kenya to the tune of Ksh 13.5 billion. The project is in three phases, the 1st phase is the extension of electricity to customers within 600 meters of transformers, 2nd phase is the installation of a half a million transformers, and the 3rd phase is the extension of electricity supply within the installed transformers (KP, 2016).

Statement of the Problem

Rural electrification projects in Kenya and the world are affected by many risks and uncertainties just like those in other sectors. Kenya has an eye-catching market for investing in rural electrification projects to achieve the objective of complete access to electricity by the year 2022 as per the vision of the Government of Kenya. Foreign exchange and off-taker risks are among the biggest risks affecting foreign and domestic investment in rural electrification projects such as the Last Mile connectivity projects in Kenya (Shrimali & Reicher, 2017). Additionally, a number of recent rural electrification projects such as Last mile connectivity projects were delayed due to community opposition in relation to impacts of the projects, land acquisition, lack of agreement on sharing benefits and other associated issues (Power Africa, 2018). Besides, implementation of last mile connectivity projects in Kenya has been affected by unpredictable weather patterns, and this places such projects at a risk of delays and cost overruns, especially where storms and floods erode erected power lines during their construction (KenGen Annual Report, 2016).

Kenya has registered a national electricity access rate of 73.4% (Kenya Power Annual Report, 2018). However, actual connectivity and access to electricity in rural areas remain very stumpy hence the need for more rural electrification projects. Notwithstanding these observations, most Last Mile connectivity projects in Machakos County still suffer cost overruns, delays, and even failure (Sovacool, Proudlove & Green, 2017). Currently due to unbalanced levels of higher likelihood and higher consequence of risks for these projects, the significance of risk management in project implementation should be emphasized. This is because research has demonstrated that project implementation could be upgraded significantly through risk management, for the reason that 70% to 90% of risks that come upon projects are foreseeable and preventable (Chihuri & Pretorius, 2018).

Nevertheless, none of the previous studies was conducted to reveal the influence of risk management practices on implementation of Last Mile Connectivity projects by REREC in Machakos County in Kenya, hence a knowledge gap. This lacuna, therefore, necessitated this study in order to answer the question: What influence does risk management practices have on implementation of Last mile connectivity projects in Machakos County, Kenya?

Objectives of the Study

The general objective of this study was to establish the influence of project risk management practices

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on implementation of Last mile connectivity projects in Machakos County, Kenya. The specific objectives were;

- To analyse influence of risk analysis on implementation of last mile connectivity projects by REREC in Machakos County
- To determine influence of risk monitoring and control on implementation of last mile connectivity projects by REREC in Machakos County

LITERATURE REVIEW

Prospect Theory

This theory that deals with decision-making under risk conditions as proposed by Tversky and Kahneman, (1979). Internal conflict over value trade-offs informs decisions. It explains options that a classic person takes when they are in situations of uncertainty. This theory outlines how the options are made and appraised in the process of decision-making. The theory promotes the view that utility curves vary in spheres of profit compared to those in spheres of loss. It is both descriptive and empirical. It regards risk as an exposure to commercial loss or profits, bodily harm or interruption because of vagueness related to pursuing a course (Bikker & Vervliet, 2018).

Contingency Theory

Helms, (2000) proposed the contingency theory by breaking it down into two categories: internal and environmental contingencies. He dwelt on possibility and likelihood as key features of project risks. The term likelihood demonstrates how the earth, the source of threats, is linked to the framework hence deciding the activities involved in a ranked framework (Longenecker & Pringle, 2017). Projects are volatile and difficult to gauge the level of risks associated with them, hence it is a tall order to relate risk likelihood management practices adequately (Panthi et al., 2019).

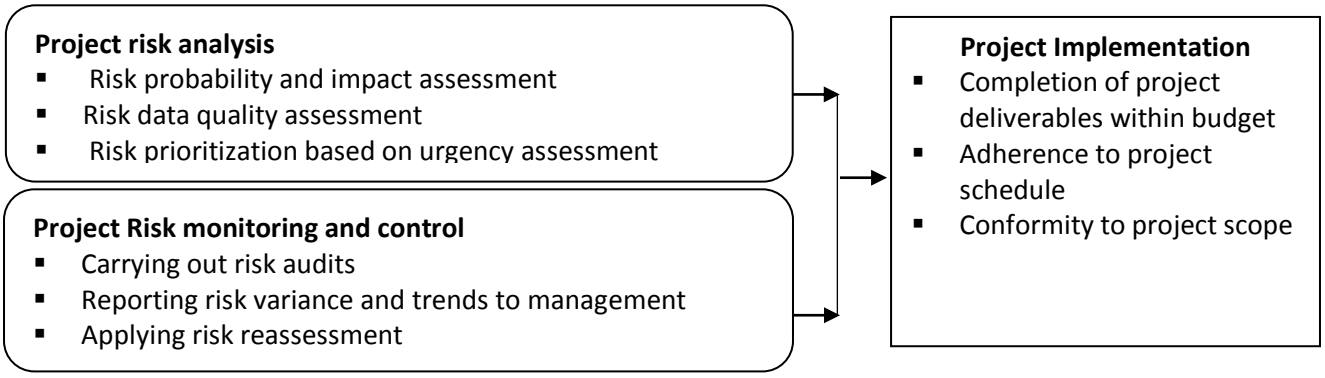

Figure 1: Conceptual Framework

Empirical Review

Liu et al. (2017) examined the notable potential risks in the planning phase of design-build power stations and other infrastructure projects, discovering that design risks have a significant impact on project performance. Through analysis of risks using a structural equation model (SEM) and bearing in mind the straight relationship between risks and project performance, they established that information inaccuracy, an incompetent design team, and delays are the most prominent risks affecting project performance basing on cost, time, safety, and quality.

Roque and de Carvalho, (2016) did a study on appreciating the effect of project risk management and valuation of risks on project performance in Vendor companies in Brazil. The aim of the study was to grasp the impact of risk analysis on performance of IT projects and to probe the degree of dispersion of project risk assessment in Brazilian companies' risk identification, risk reporting, risk registration, risk allocation, risk control and risk

checklist. The research procedure consisted of a survey of 415 projects at diverse firms in the Brazilian IT sector. The findings prove that espousing risk assessment and planning has a substantial positive impact on project success. Project staff were capable of identifying and taking measures to alleviate occurrence of risks largely. The study, further, concluded that evaluating uncertainties in the course of the project, applying risk management approaches and deeply understanding the business environment are critical project success factors ($P<0.05$, $r=0.002$, beta=0.413). The results established that the influence of project risk assessment on project success was positive.

Walke et al. (2018) documented that monitoring and control of risk is a practice of checking effectiveness of risk responses besides identification, and analysis of newly arising risks. It is a process of implementing risk response plans, keeping track of identified risks, monitoring residual risks, identifying fresh risks, and evaluating efficiency of the project risk management practices (Rezakhani, 2016).

Sibomana (2017) carried out a study on effects of risk management procedures on performance of projects in the construction industry of Rwanda. The researcher employed structured in-depth interviews and questionnaires to gather data from a sample of 169 people out of a population of 231. The researcher was content with 95 percent level of confidence having a margin error of 0.05. The target population of 291 formed the project team for the Multi-story buildings project. 50% of respondents strongly agreed the risk monitoring and control had a positive influence on the successful performance of construction projects in Rwanda.

METHODOLOGY

The researcher utilized the descriptive research design. Descriptive research designs frequently apply observational methods rather than quantitative methods; hence, one cannot replicate the results obtained. The study population was 110 individuals for purposes of meeting research objectives appropriately and the unit of analysis involved REREC project staff, line construction contractors and members of the power beneficiary community with regard to Last Mile Connectivity projects. The study was concentrated at the REREC headquarters in Nairobi as well as in randomly selected rural areas in Machakos County and it involved only four transformers affected by last mile connectivity projects. The study applied stratified, purposive and systematic random sampling techniques to obtain response from the targeted population. Out of 110, a sample size of 82 individuals consisting of project team members at REREC, line construction contractors under REREC and members of the power beneficiary community for the last mile connectivity project was considered as an adequate representation. The population was stratified into three subcategories and purposive sampling was employed to pick out 24 REREC project staff members, 15 line construction contractors and 43 members of the power beneficiary community or customers for the last mile connectivity project. The researcher used questionnaires for data gathering. The data-gathering instrument that was taken on entailed structured questionnaires to generate both quantitative and qualitative data for the study. The researcher tabularized the data on presentation sheets in SPSS version 25 to determine relationships between variables.

FINDINGS AND DISCUSSION

Risk Analysis and project implementation

The role of risk analysis in project risk management is an important aspect that can determine the level of success in project implementation. In order to evaluate the significance of the different risk categories identified in the reviewed literature, the participants were asked to rate them into Very Low, Low, Medium, High and Very High on the risk scale. Nearly half of the respondents (43%, n= 22) agreed that political and regulatory risks have the highest probability and impact on rural electrification projects. These results are consistent with prior research findings such as Gatzert and Kosub, (2016)

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as well as The Economist Group, (2011). The probability and impact of physical security risks to materials and people were considered medium with the consent of 53.8% of the respondents. 73.1% of respondents consented that likely conflicts due to involvement of multiple teams accounted for the lowest risk probability and impact on rural electrification projects. Table 1 below showed the outcome of the survey for this study.

Table 1: Awareness on Risk probability and impact

		Frequency	Percent
Political and Regulatory risks	L	14	26.9
	M	15	28.8
	H	23	44.2
	Total	52	100.0
Financial risks	L	6	11.5
	M	26	50.0
	H	20	38.5
	Total	52	100.0
Technical risks	L	25	48.1
	M	19	36.5
	H	8	15.4
	Total	52	100.0
Land and site acquisition risks	L	22	42.3
	M	20	38.5
	H	10	19.2
	Total	52	100.0
Environmental risks	L	33	63.5
	M	7	13.5
	H	12	23.1
	Total	52	100.0
Procurement delays	L	22	42.3
	M	20	38.5
	H	10	19.2
	Total	52	100.0
Physical security risks to materials and people	L	11	21.2
	M	28	53.8
	H	13	25.0
	Total	52	100.0
Likely conflicts due to multiple teams involved	L	38	73.1
	M	9	17.3
	H	5	9.6
	Total	52	100.0
Unexpected scope changes during project execution	L	35	67.3
	M	12	23.1
	H	5	9.6
	Total	52	100.0
Design error risks	L	23	44.2
	M	19	36.5
	H	10	19.2
	Total	52	100.0

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Aspects of risk analysis such as quantitative and qualitative risk analysis are critical at this stage. Thus, this study sought to establish the influence of risk analysis based on the views of the respondents and its impact on the level of success in project implementation.

From the findings in Table 2, it was revealed that 53.8% (n=13) agreed that their project teams execute risk probability and impact assessment before implementation of rural electrification projects, whereas 50% (n=13) of the respondents are faithfully involved in risk categorization based on severity of the likely risk. Furthermore, the findings show that 46.2% (n=12) of the participants in the study properly assesses quality of risk data before responding, whereas 44.2% (n=11) of the respondents agreed that their project teams assess risk urgency and prioritizes their responses.

Moreover, the findings showed that 55.8% (n=14) the respondents agreed that their project teams collect and analyze information from experts on potential risk impacts on cost and schedule before responding to risks, as 51.9% (n=13) observed that relevant stakeholders are interviewed to provide data for quantifying probability and impact of risks on project objectives. On sensitivity analysis and other modeling techniques, 44.2% (n=11) of the respondents agreed that these techniques are used to decide which risks have potentially high impact on the project. The overall mean response was 3.7092, indicating agreement with the aspects of risk analysis by majority of the respondents. The findings regarding this were presented in Table 2.

Table 2: Project Risk Analysis

		Frequency	Percent
Our project team executes risk probability and impact assessment	D	2	8.0
	N	3	12.0
	A	13	52.0
	SA	7	28.0
	Total	25	100.0
Our project team is faithfully involved in risk categorization based on severity	SD	2	8.0
	D	1	4.0
	N	4	16.0
	A	13	52.0
	SA	5	20.0
	Total	25	100.0
Our project team properly assesses quality of risk data before responding	SD	1	4.0
	D	2	8.0
	N	8	32.0
	A	12	48.0
	SA	2	8.0
	Total	25	100.0
Our project team assesses risk urgency and prioritizes their responses	SD	1	4.0
	D	5	20.0
	N	7	28.0
	A	11	44.0
	SA	1	4.0
	Total	25	100.0

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Our project team collects and analyses data from experts before responding to risks	SD	1	4.0
	N	8	32.0
	A	14	56.0
	SA	2	8.0
	Total	25	100.0
Our project team collects and analyses data from experts on potential risk impacts of cost and schedule	D	2	8.0
	N	5	20.0
	A	12	48.0
	SA	6	24.0
	Total	25	100.0
Relevant stakeholders are interviewed to provide data for quantifying probability and impact of risks on project objectives	SD	1	4.0
	D	2	8.0
	N	6	24.0
	A	13	52.0
	SA	3	12.0
	Total	25	100.0
Sensitivity analysis and other modeling techniques are used to decide which risks have potentially high impact on the project	D	1	4.0
	N	7	28.0
	A	11	44.0
	SA	6	24.0
	Total	25	100.0

Risk Monitoring and control, and project implementation

Risk monitoring and control is viewed as the process of identifying and analysing newly arising risks, keeping track of the identified risks, reanalysing existing risks, checking trigger conditions for contingency plans and reviewing the execution of risk responses while evaluating their effectiveness. Thus, the study sought to assess the level of implementation of project risk monitoring and control in relation to successful implementation of rural electrification projects. A five-point Likert scale rated 1 for 'None at all', 2 for 'Small extent', 3 for 'Undecided', 4 for 'Moderate extent', and 5 for 'Great extent', was used.

The findings in Table 3 showed that, 38.4% (n=10) of the respondents agreed that, to a great extent, their project implementation teams carry out risk audits to examine the effectiveness of risk responses as 44.2% (n=11) of the participants observed that employees of their organizations report risk variance and trends to management for immediate action. In addition, the respondents whose companies practice risk reassessment of the identified risks accounted for 48.1% (n=12), whereas 42.3% (n=11) of the respondents approved of the fact that technical performance measurement is employed in the monitoring and control of risks that are inherent in a particular rural electrification project. Finally, 38.5% (n=10) represents the number of respondents who settled on contingency reserve analysis as a technique for risk control in their organizations.

The overall mean response for project monitoring and control was 3.6500, which showed that the majority of the respondents agree that, to a great extent, the various aspects of project risk monitoring and control are applied in the management of their rural electrification projects. The findings regarding this study were presented in Table 3.

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Table 3: Project Risk Monitoring and Control

		Frequency	Percent
Carrying out risk audits	None at all	1	4.0
	Small extent	1	4.0
	Undecided	6	24.0
	Moderate extent	10	40.0
	Great extent	7	28.0
	Total	25	100.0
Reporting risk variance and trends to management	Small extent	3	12.0
	Undecided	8	32.0
	Moderate extent	11	44.0
	Great extent	3	12.0
	Total	25	100.0
We practice risk reassessment of the identified risks	None at all	1	4.0
	Small extent	2	8.0
	Undecided	8	32.0
	Moderate extent	12	48.0
	Great extent	2	8.0
	Total	25	100.0
Technical performance measurement	Small extent	1	4.0
	Undecided	6	24.0
	Moderate extent	11	44.0
	Great extent	7	28.0
	Total	25	100.0
Contingency reserve analysis for risk control	Small extent	6	24.0
	Undecided	7	28.0
	Moderate extent	10	40.0
	Great extent	2	8.0
	Total	25	100.0

Project Implementation

Finally, the study sought to establish the level of success in project implementation given the extent of application of project risk management practices in the Last mile connectivity projects. The views of REREC project staff and power line construction contractors were sought regarding completion of the projects in time, within the set budget, ability of the project to serve its purpose as well as other aspects of project implementation. The project budget that results from the planning phase must be attainable, reasonable, and based on the statement of works and contractually negotiated costs.

From the findings in Table 4, 38.5% (n=10) of the respondents agreed that the most significant risks that impact more on Last mile connectivity projects are related to cost, time and scope, while 40.0% (n=10) of them agreed that failure to enact risk management processes is what leads to major time and cost overruns in Last mile connectivity projects. Additionally, 42.3% (n=11) of the respondents agreed that completion of deliverables for ongoing LMC projects is within expected time, cost and scope. Furthermore, 51.9% (n=13) of the respondents agreed that despite having knowledge of their benefits, most organizations do not adopt formal risk management frameworks due to its addition cost to the overall project cost, however 44.2% (n=11) of the study respondents agreed that

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application of risk management practices leads to successful project implementation. The overall mean response was 3.3962 indicating agreement by majority of the respondents regarding various risk aspects in relation to project implementation. The findings were presented in Table 4.

Table 4: Project Implementation

		Frequency	Percent
The first phase of LMC project was completed within expected time	SD	1	4.0
	D	4	16.0
	N	8	32.0
	A	10	40.0
	SA	2	8.0
	Total	25	100.0
Completion of deliverables for ongoing LMC projects is within budget	SD	1	4.0
	D	5	20.0
	N	8	32.0
	A	9	36.0
	SA	2	8.0
	Total	25	100.0
Completion of deliverables for ongoing LMC projects is within time	SD	1	4.0
	D	4	16.0
	N	7	28.0
	A	12	48.0
	SA	1	4.0
	Total	25	100.0
Our employees did all the work, and only the work, that was required to deliver the product during implementation of first phase of LMC project	SD	1	4.0
	D	2	8.0
	N	8	32.0
	A	13	52.0
	SA	1	4.0
	Total	25	100.0
Application of risk management practices leads to project success	D	2	8.0
	N	6	24.0
	A	11	44.0
	SA	6	24.0
	Total	25	100.0

CONCLUSIONS AND RECOMMENDATIONS

The researcher was able to achieve the study objectives whereby it was established that project risk analysis and project risk monitoring and control influence implementation of Last mile connectivity projects by REREC in Kenya. Nonetheless, the extent to which these risk management practices influenced project implementation differed. The findings established that all the four risk management practices that were studied had a positive influence on implementation of Last mile connectivity projects by REREC in Machakos County. It is also confirmed that risk monitoring and control influenced the level of success in project implementation largely, followed by risk analysis.

Based on the findings of this study, it was recommended that there was a need for more investment in control systems and ensuring they are effective in decision making. This research project recommended a formal and structured risk management practice during project planning and with the involvement of construction professionals

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and end users. The researcher recommended that risk management be included in the curriculum as an examinable subject for all students undertaking construction related studies.

There was need to enhance the knowledge of project main risk operations, project risk competence, identification of the risks posed by entrants, new products and services as well as competitors, main operations of the project and ensuring the board exhibits diversity in terms of project risk would enhance project performance. To manage the project risks effectively and efficiently, the contractor must understand risk responsibilities, risk event conditions, risk preference and risk management capabilities. Adequate project management training or courses should be conducted, to increase the knowledge of practitioners about different project management tools and techniques available for appropriate choice at the early stage.

Areas for Further Study

The scope of this study only concentrated on Last mile connectivity projects in Machakos County. However, there is a need to increase the scope to cover other electrification projects in other regions in Kenya so as to confirm the findings of this study and also to add more knowledge. Furthermore, because of the difference in operations between sectors, there is a need to include the perspective of the external forces or factors as well as policies in order to widen the net of the factors that can have an influence on project risk management.

Moreover, while there are firm-inherent factors that determine the direction of project risk management; there are factors that are inherent from their customers and operational procedures that might have an influence on the practices in project risk management. Thus, there is a need to have a deeper look into the role of the customers, in terms of risk management practices and policies, so as to get an overview of the challenges with the view of addressing them from all angles.

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