RISK MANAGEMENT STRATEGIES AND SUSTAINABILITY OF GREEN ENERGY HARNESSING PROJECTS IN KENYA: A CASE OF OLKARIA ONE UNIT SIX, NAKURU KENYA

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ABSTRACT

As a result of this ever-changing external pressure, businesses are rapidly adopting new management strategies in order to maintain their economic viability. The primary purpose of this research was to analyze how the management practices of one Kenyan power company, Olkaria Kenya, affected the sustainability of green energy harnessing in the country over the long term. The resource-based approach and the stakeholder theory provided the framework for this investigation. This study used a descriptive research strategy. In all, 180 workers from the Olkaria branch of the Kenya Electricity Generating Company were included in the analysis. A statistical technique known as simple random sampling was used to establish the size of the sample to be used. To gather information, a questionnaire was sent. Cronbach's alpha was used to determine the degree of reliability. Research relied on both content and facial validity. Descriptive and inferential statistics were used to examine the information. With a significance level of 0.000, which is less than 0.05, the model was statistically significant in predicting how the components (Risk management) affect the sustainability of green energy harvesting in Kenya. At a significance level of 5%, the F-value threshold was 3.123. The entire model was noteworthy as the computed F is larger than the F critical (value = 8.781). The8 study8 found8 that8 to8 a8 great8 extent8 that there is a channel for communication in case of any green energy harnessing emergencies. The study also found that mitigation plans have been put in place by the organization in case of the occurrence of any problems during production of green energy, a checklist of the risks identified in relation to the green energy harnessing is normally prepared in line with the organization's priorities.

Key words: Management Strategies, Risk Management, Green Energy and Sustainability

INTRODUCTION

Sustainability, according to Kanie and Biermann (2017), is a quantitative relationship in the process of communication between the demography and the ecological footprint of its surrounding in which the inhabitants generates to its highest capacity without causing irreversible negative effects on the environment on which it depends. Simply put, sustainability is ensuring the greatest possible outcomes for individuals and the planet today and in the future (Spenceley, 2016). According to Wario (2020), durability may also be characterized by the three pillars of sustainable development, which are: environmental protection, economic benefits, and environment progress; hence, real sustainability is attained when all three components are in proportion.

Although energy is not considered a fundamental requirement, it is an essential component in the effective fulfillment of practically all basic human requirements (Gitone, 2014). The amount and intensity of energy consumption is a key indication of a country's economic

development. The primary energy sources are classified into two categories: hybrid energy and convectional energy. Conventional energy sources, such as nonrenewable energy, face various issues, including fossil fuel emissions; as a result, nations have changed policy to encourage the development of cleaner renewable energy technology. Green energy is defined as the deployment of solar and non-polluting power and energy sources that are not harmful to the environment (Kosgey, 2017).

Global economic expansion has been fueled by fossil fuels such as coal, oil, and natural gas, but this feeds the emission of carbon dioxide (CO2) into the atmosphere, which is recognized as the primary cause of global warming and climate change (Gitone, 2014). The rising worry about the impacts of energy usage and global warming suggests that green energy sources such as wind, solar, geothermal, hydro, biogas, wave, and tidal will be used more in the future. In addition, as energy prices rise, greater emphasis is being placed on the discovery of renewable energy sources as a viable alternative to fossil fuels. As a result, scientists and businesses from all over the world have begun to envisage a future powered by renewable energy in the search of a more sustainable energy system.

The International Institute for Sustainable Development (2010) defines sustainability as "adopting business strategies and activities that meet the needs of the enterprise and its stakeholders today while protecting, sustaining, and enhancing the human and natural resources that will be needed in the future," as defined by the International Institute for Sustainable Development (Winnie, 2018). This concept recognizes that every development initiative, whether supported by a donor or locally, must be profitable in order to continue to care for mankind and the environment in the future.

The resource-based vision theory and the sustainable development theory are the foundations of the research. The idea helped people comprehend why they need to employ special management resources to generate green energy in order to stay competitive in the global market. Sustainable development theory, as defined by Malthus (1766-1834) and David Recardo (1772-1823) (Baariu, 2015), refers to companies' ability to maintain and sustain project or program outcomes using only their own assets or resources while not jeopardizing future generations' requirements. Because they advocate for sustainability through the utilization of available resources, the two theories were critical in the research.

Kenya hopes to achieve energy independence through using renewable sources. Electricity for KPLC comes mostly from the national grid, which is maintained by the Electricity Generating Company Limited (KenGen) (Kosgey, 2017). The growth of green energy projects like the Olkaria power field show that Kenya has increased its production of renewable energy. In the Olkaria sub-location of the Naivasha Central Division in the Naivasha District in Nakuru County is where the Olkaria Geothermal Project may be found. It is owned by KenGen Ltd, the Kenya Electricity Generating Company. There are now six operational Olkaria geothermal power facilities: Olkaria I, II, III, IV, V, and well heads. As of October 2020 (Takouleu, 2019), Olkaria V was fully operating. Olkaria was chosen for exploratory drilling after a study was

completed there in 1970 by the United Nations Development Programme (UNDP) and the Kenya Power and Lighting Company (KPLC).

With the completion of Olkaria, it has become one of the largest single renewable new investments in the world. Geothermal energy has now surpassed hydro as Kenya's primary source of energy, which had previously significantly dictated the country's economic power supply. Only 13% of Kengen's total power mix came from geothermal in 2010. (In light of the World Bank's data from 2015). The European Investment Bank, the Agency for French Development, the German KFW, and the Japanese International Cooperation Agency are all partners in the Olkaria project. Through its diverse Country Partnership Strategy for Kenya, the World Bank Group is helping the government of Kenya improve geothermal power output, expanding energy access for all consumers and opening up new avenues for growth and shared prosperity (Renkens, 2019).

The government's dedication to bettering people's lives and reducing the cost of doing business is shown by its determination to expand renewable energy supplies, offer dependable electricity, and cut costs for residential and industrial consumers (World Bank, 2015). Kenya has made great strides in extending access to dependable and low-cost green energy thanks to cooperation within the World Bank Group and partnerships with other development partners. Both commercial and residential power users have been quite persuasive in encouraging the development. KenGen has diversified away from non-green energy sources and toward green energy since it is more financially viable, reliable, long-lasting, and environmentally beneficial. When compared to non-green power, consumer devices are safer against power surges. This thesis was driven by these advances, as well as a paucity of research on how management practices might affect green-energy sustainability.

Statement of the Problem

To stay relevant economically, organizations are fast developing new management practices to respond to this dynamic external pressure. To ensure long-term success in the marketplace, progressive firms are adopting a new management paradigm that places a premium on environmental protection (Opilli, 2019). Power plants throughout the globe have ramped up their green energy operations to meet customer demand for a more sustainable supply. There has been a good change in the acceptability and execution of management plans as a result of the transition to green energy (Kosgey, 2017). Notably, this change to green energy is attributed to the challenge of climate change that is affecting the world. Therefore, management has a leading role to ensure that green energy generation is effective and adequate.

Geerdink (2016) assessed the factors influencing sustainable strategy implementation in Netherlands. Results showed that many of the companies under study failed in their implementation of strategies as a result of a lack of a clearly defined vision, a role of the management. In Tanzania, Hackee (2015) evaluated how community participation facilitates project sustainability and indicated that there was poor community participation in project implementation negatively influencing the sustainability of the projects. According to the

findings, the management play an essential role of bring the community members together during project implementation. Although both studies indicated that the different strategies by management influence sustainability, the studies did not focus on the sustainability of green energy harnessing, the focus of this study.

Kiara (2013) investigated the determinants of renewable energy infrastructure development: a case study of Kenya Electricity Generating Company Limited (KenGen). The research found that KenGen's green energy improvement was helped along by the company's culture, which encouraged the implementation of projects to generate renewable energy. Kosgey (2017), who studied the effects of green energy strategies on Kenya's progress toward clean energy, found that these policies significantly impacted the cost-effectiveness of renewable energy. None of the papers analyzed looked at the part played by management techniques such as risk management in green energy harvesting, despite attempts to look into the green energy issue in Kenya. It was clear that further investigation was required to answer the following question: How do risk management affect the sustainability of green energy harvesting at Olkaria Kenya?

Objective of the Study

The purpose of the study is to assess the influence of risk management on sustainability of green energy harnessing in Kenya.

Empirical Review

The practice of risk management is often thought of as a means to an end. It is often used to symbolize the possible complexity of a task. In the interim, it's more likely to be some kind of task or plan of action. Risk management, as defined by McNamara and Stark (2014), is the process of identifying, evaluating, and responding to prospective project hazards and appropriate actions, as well as verifying their plausibility.

For the smallest investment, businesses may protect themselves from potential danger by taking precautions like locking up important data and scaling down on projects before any more damage is done. When properly implemented, project risk management may ensure that projects are completed on schedule, within budget, and to the satisfaction of all stakeholders. The inability to meet predetermined objectives and assure the project's success is one of the main reasons why risk management has always been linked to project management.

Risk management was studied by Gitau (2015) to see how it affected the outcome of Rwandan building projects. The research focused on the construction industry in Rwanda, including architects, engineers, project managers, quantity surveyors, contractors, regulatory authorities, and high-profile clients who spent much on building projects. Both qualitative and quantitative approaches were used to acquire information for this investigation. The survey found that choosing consultant engineers and architects occurs before the design phase of most projects. Thus, many initiatives lacked proper direction from specialists throughout their first stages of development. The quality and cost based selection technique was the most popular when

looking to hire consultants. Poor performance in terms of both time and budget was found in 45.2% and 35.7% of the projects, respectively, that were analyzed. The majority of the investigated projects had site selection and needs assessment occur during the planning stage, typically without the involvement of construction specialists. Nearly half of the projects analyzed had site works contribution modifications that were more than 10% of the original estimate.

A research on the effect of risk management on project success: an empirical evaluation was conducted by Al Mhirat and Irtemeh (2017) for the Jordanian Ministry of Environment. Finding out how the Jordanian Ministry of Environment deals with risk and how it impacts project performance was the driving force behind this study. Sixty-two projects in Northern, Central, and Southern Jordan that are overseen by the Ministry of Environment were included in the analysis. The goals of the research were achieved by using a descriptive analytic strategy. A questionnaire consisting of 42 items was developed, 500 were sent, 430 were returned for a return rate of 86%, and 100% of the responses were valid and reliable for further research. Among the many interesting findings, the correlation between the many aspects of risk management and project performance is particularly strong. These aspects include risk planning and definition, risk analysis, reaction to danger, risk assessment, and review. Given these findings, many suggestions were offered.

Research on the topic of risk management in environmentally responsible building projects was undertaken by Apine and Escobar Valdés (2017). The results highlighted the different methods of corporate risk management and how they relate to the potential dangers of green building construction. The results proved the importance of tools used in managing sustainable construction projects that companies have built and incorporated to their processes to reduce potential hazards. More companies might be added to increase generalizability, and further research could imply that the companies have matured, leading to more reliable results.

Ondara (2017) investigated the relationship between risk management strategies and the success of construction companies in several areas throughout Kenya. An explanatory research strategy was used, and positivism served as the guiding research ideology. This study's sample included all 2,414 construction businesses registered with the Republic of Kenya between July 2011 and June 2012 to do public and private construction in certain counties in Kenya. In the three counties of Nairobi, Nakuru, and Machakos, enterprises were selected at random to participate in the study. Companies in Nairobi County, Nakuru County, and Machakos County (a total of 97) were selected at random to participate in the survey.

A self-administered, semi-structured questionnaire was used to compile the data. Statistics, both descriptive and inferential, were used to examine the data. Data analysis revealed that resource risk, people risk, and project control risk management strategies all significantly influenced company performance. There was no statistically significant correlation between the use of litigation risk management or insurance risk management and improved financial outcomes for the organization. The statistical correlation between risk management strategies

and business results in the construction sector was significantly influenced by government policy and regulation.

Theoretical Framework

The study will be guided by the following theories; resource-based view and stakeholder's theory

Resource-based View

Wernerfelt proposed the resource-based perspective (RBV) (1984). It claims that the only way to achieve competitiveness is to provide high value to customers in a novel way. The belief that all companies are a collection of unique skills and resources is referred to as RBV. The core of any organization's strategy and capacity to generate above-average results is the exclusivity of its competencies and resources. The term "resources" refers to the materials used in a company's manufacturing process (Hitt, 2013).

The theory is relevant to the research because it identifies economic resources that are expected to play a role in green energy capture. According to resource-based theory, resources are critical to the Kenyan power producing company's policy implementation success (Pfeffer & Salancik, 2003). By comparing outcomes across several levels of study, it expands on the idea that economic resource impacts will be more important drivers of management techniques than sector effects.

The resource-based view (RBV) is important in this study since it helps define the problem rather than the symptom of a problem. A thorough examination of the problem's condition is carried out, with the goal of identifying people who are impacted by it. This idea is significant because it recognizes intra- and inter-organizational information exchange, protocols, and close working relationships as resources for accelerating the creation of sustainable, low-cost power sources.

Stakeholders Theory

The concept of a stakeholder was first articulated by Edward Freeman in 1963. Stakeholders were first defined as "those people without whom a company could not continue to operate" (Donaldson, 1995). Stakeholder analysis, as defined by Mansell (2013), is a method for learning about the dynamics between project participants. Stakeholder analysis is a technique that helps project participants identify, understand, and value those individuals and groups that have a vested interest in the project's outcome.

Charles (2003), for example, critiqued this approach for assuming that the interests of many stakeholders are balanced. According to Charles (2003), this is due to the reliance on talks as the primary technique for resolving disputes between stakeholder interests. As a result, according to Charles (2003), policy analysts who are critical thinkers who can clearly explain

their views and ideas are required (Mansell 2013). He goes on to say that, although being utilitarian and descriptive, stakeholder theory is deeply normative. In this sector, stakeholders are defined by their interests, and it is generally agreed that everyone's stake is equally important. Management theory, such as stakeholder theory, may be used to argue for changes in the Kenyan power company's culture, policies, and procedures. It necessitates giving equal consideration to the concerns of all legally recognized parties.

RESEARCH METHODOLOGY

A descriptive research design was used in this study. As a consequence of its usefulness in obtaining data to meet the research objectives, a descriptive design provides a clear explanation of the variable features (Mugenda & Mugenda, 2003). As a result, the design is appropriate and justified for this thesis. The target population of the study was 180 staff of Kenya Electricity Generating Company Olkaria Kenya. The staff are suitable for the study since they provided information on how management strategies on sustainability of green energy harnessing in Kenya.

Managers, plant chief engineer, steam field team, project execution team, regulatory team, operation and maintenance team.

Table 1: Target population

Category	Population
Managers	5
Plant chief engineer	10
Steam field team	36
Project execution team	37
Regulatory team	42
Operation and maintenance team	50
Total	**180**

In this survey, we were able to collect data from 180 participants. The following recipe comes highly recommended by both Mugenda brothers:

$$nf = n/ [1 + n/N]$$

Where,

According to the above formula:

nf= desired sample size when the population is less than 10,000

n= desired sample when the population is more than 10,000

N= estimate of the population size.

N=180

Therefore, n will be

nf = 384/ [1 +384/180]

For the purpose of this study, a sample size of 122 respondents was used.

Data was gathered using questionnaire. Data from the staff was collected using a questionnaire guide which was made up of structured and unstructured questions. The structured questions were in form of a five-point Likert scale, whereby respondents will be required to show their perspectives on a scale of 1 to 5. For example, where (1= strongly disagree, 2= disagree, 3= moderately agree, 4= Agree and 5= strongly Agree).

The researcher made use of respondents whose information was not included in the final analysis of the study to pre-test the questionnaires and check the validity of the questions. Finally, the results of the pilot testing were accounted for, and any necessary changes were made. The pretest ensured that the questionnaire accurately measured the variables of interest. The study's cutoff criterion will be 0.7. Cronbach's alpha must be larger than 0.7 to be accepted, while it must be less than 0.7 to be rejected.

The data was analyzed using both descriptive and inferential methods. Summaries of the research variables were generated using descriptive statistics, while their connection was analyzed with inferential statistics. The average and the deviation were calculated. Graphs, tables, and charts illustrated the study's results. In addition, multiple linear regression would be utilized as an inferential method to demonstrate the interconnectedness of the variables under investigation. We resorted to the following statistical technique for our regression:

$$\mathbf{Y=\beta_0+\beta_1 X_1 + \varepsilon}$$

Y= Sustainability

β_0 = Constant

X_1= Risk management

B_0 = The regression co-efficient.

ε= is the random error that accounts for the other variables not captured in this model but do influence sustainability.

One-way ANOVA significance testing was performed to see whether there was a statistically significant difference between the research variables.

RESEARCH FINDINGS AND DISCUSSION

The study intended to collect data from 122 respondents. From a total of the 122 respondents targeted for the study, 108 took part in the study, presenting an 88.5% response rate. Nonparticipation in the research was documented at an 11.5% response rate. According to Bryman and Bell (2014), a response rate of 50% is considered sufficient, 60% is excellent, and 70% is remarkable. This led to a high rate of involvement in the study.

Risk Management

It was asked of the respondents what percentage of risk management they agreed with. Table 2 displays the results.

Table 2. Risk Management

Risk Management		VSE	SE	M	LE	VLE	Mean	Std. Dev
A risk management system is put in place to identify any risks that may occur with regards to the production of green energy	108	0 (0%)	4 (3.7%)	10 (9.3%)	48 (44.4%)	46 (42.6%)	3.52	1.283
The risks identified in relation to green energy harnessing are communicated to the management of the organization	108	0 (0%)	6 (5.6%)	22 (20.4%)	56 (51.9%)	24 (22.2%)	3.55	1.140
A checklist of the risks identified in relation to the green energy harnessing is normally prepared in line with the organization's priorities	108	2 (1.8%)	0 (0%)	6 (5.5%)	61 (56.4%)	39 (36.4%)	3.70	0.755
Assessments of the green energy harnessing risks identified is normally conducted before settling on a solution	108	1 (1.3%)	1 (1.2%)	2 (1.6%)	48 (43.9%)	56 (52.0%)	3.61	1.206
Action to address a risk identified in relation to the green energy harnessing is taken following its assessment	108	0 (0%)	7 (6.7%)	28 (25.6%)	52 48.5%)	21 (19.2%)	3.65	1.356
Mitigation plans have been put in place by the organization in case of the occurrence of any problems during production of green energy	108	2 (1.8%)	3 (2.5%)	6 (5.9%)	55 (50.5%)	42 (39.3%)	3.75	1.304
There is a channel for communication in case of any green energy harnessing emergencies	108	2 (1.9%)	2 (1.8%)	20 (18.6%)	43 (40.2%)	41 (37.5%)	3.86	1.426

From the findings the respondents agreed to a great extent that there is a channel for communication in case of any green energy harnessing emergencies (mean=3.86, SD=1.426), followed by mitigation plans have been put in place by the organization in case of the occurrence of any problems during production of green energy (mean=3.75, SD=1.304), a checklist of the risks identified in relation to the green energy harnessing is normally prepared in line with the organization's priorities (mean=3.7, SD=0.755), action to address a risk identified in relation to the green energy harnessing is taken following its assessment (mean=3.65, SD=1.356), assessments of the green energy harnessing risks identified is normally conducted before settling on a solution (mean=3.61, SD=1.206), the risks identified in relation to green energy harnessing are communicated to the management of the organization (mean=3.55, SD=1.14), and that risk management system is put in place to identify any risks that may occur with regards to the production of green energy (mean=3.52, SD=1.283). This depicts that to a great extent that there is a channel for communication in case of any green energy harnessing emergencies.

Regression Analysis

In order to investigate the nature of the connection that exists between the predictor factors and the long-term viability of green energy harvesting in Kenya, the research applied multiple regression analysis. Following the cleaning and coding of data collected in the field, the research made use of the version 24 of SPSS to construct the output of the regression statistics. The coefficient of determination was used in order to demonstrate how the shift in the value of the dependent variable can be rationalized via consideration of the shift in the values of the independent variables. In this particular piece of research, the viability of green energy harvesting in Kenya served as the investigation's dependent variable, while risk management, served as the investigation's independent factors.

Model Summary

The table below summarizes the model's findings about the connection between the various predictor factors and the long-term viability of capturing green energy in Kenya. Table 3 displays the results.

Table 3. Model Summary

Model	R	R Square	Adjusted Square	RStd. Error of the Estimate	F	P-value
1	0.89	.792	.742	.312	31.341	.001

a. Predictors: (Constant), Risk Management, b. Dependent Variable: Sustainability of green energy harnessing in Kenya

R^2=0.792, which indicates that the independent variable accounts for 79.2% of the variance in the sustainability of green energy harnessing in Kenya. But the other unaccounted-for predictors in the regression model account for the remaining 20.8% of the variance in the sustainability of green energy harnessing in Kenya. The results shown in the preceding table support the conclusion that the model is reliable and may be used for forecasting. Results from the table reveal that there is a substantial association between the independent variables and the long-term viability of green energy harnessing in Kenya, with an R^2 value of 0.792 (or 79.2%).

ANOVA Results

The effects of the various predictor factors on the long-term viability of green energy harnessing in Kenya are listed in the table below, as calculated using an analysis of variance. A summary of the results is provided in table 4.

Table 4: ANOVA of the Regression

Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	23.015	4	5.754	8.781	.000[b]
	Residual	67.465	103	.655		
	Total	**90.48**	**107**			

a. Predictors: (Constant), strategy planning, leadership style, risk management, and monitoring and control.
b. Dependent Variable: Sustainability of green energy harnessing in Kenya
With a significance level of 0.000, which is less than 0.05, the model is statistically significant in predicting how the components (Risk management) affect the sustainability of green energy harvesting in Kenya. At a significance level of 5%, the F-value threshold was 3.123. The entire model was noteworthy as the computed F is larger than the F critical (value = 8.781).

Coefficient of Determination

The coefficient of determination for the association between the predictor factors and the viability of green energy harnessing in Kenya is shown in the following table. The results are detailed in table 5, which may be found here.

Table 5. Coefficient of Determination

	Unstandardized Coefficients		**Standardized Coefficients**		
	B	Std. Error	Beta	T	Sig.
Model 1(Constant)	0.289	0.116		2.491	0.005
Risk Management	0.245	0.106	0.413	2.31	0.001

a. **Dependent Variable:** Sustainability of green energy harnessing in Kenya

To ascertain whether or not the use of renewable energy sources can be maintained in Kenya, a simple regression analysis was performed. The following table presents the regression equation as obtained by SPSS.

($Y = \alpha + \beta_1 X_1 + ę$)

Becomes:

($Y = 0.289 + 0.319 + \varepsilon$)

By holding all other factors (risk management) constant, the regression revealed that the sustainability of green energy harvesting in Kenya was 0.289. Taking all other independent variables to be at their lowest possible values, the data also showed that an increase of one unit in risk management would result in a 0.319 increase in the sustainability of green energy harnessing in Kenya, This suggests that risk management contributes the most to the long-term viability of capturing green energy in Kenya, were relevant at the 5% level of significance and the 95% level of confidence on the long-term viability of green energy harnessing in Kenya.

Conclusion

The research found that no instances of theft or waste of green energy resources had occurred. The study concluded that to a great extent that the managers at Olkaria encourage and motivate the employees to be vocal about their opinions on how to improve green energy harnessing. The study concluded that to a great extent that there is a channel for communication in case of any green energy harnessing emergencies.

The study concluded that to a great extent that timely decisions about the future of the green energy harnessing project are taken. The study concluded that more green energy projects are

to be undertaken by the organization. The research also found that leadership style was the second most important factor in ensuring the long-term viability of Kenya's green energy harvesting initiatives. Strategy planning, leadership style, risk management, and monitoring and control were all important at the 5% level of significance and the 95% level of confidence on the sustainability of green energy harnessing in Kenya.

Recommendations

The research concluded with the following suggestions based on the data.

1. The organization should increase the investment in training employees on the green energy strategies for it is a good way to enhance the adoption of the green energy strategies and operationalization of these strategies.
2. In an era of more concern in the environment and increase demand on the green energy, it is essential for the organization to put all the stakeholders into consideration in their implementation of the green energy strategies.
3. Socio-economic consideration is paramount for does not remain constant and that adapting to these strategies will enable the organization to meet their objectives, mission and vision in the organization and society in general.
4. The strategic planning should also be incorporated in these strategies for it will ensure that the strategies are achieved and also will allow the innovation and creativity in the strategies hence facilitating the achievement of the affordability of clean green energy.

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