Internal and external factors and sustainability of renewable energy projects

A case of Gigawatt Global solar power plant

Judith Mutoni[1], Hakizimana Jean de Dieu Khan[2]

[1]Masters students Mount Kenya University Rwanda, Rwanda
[2] Lecturer ,Mount Kenya University Rwanda, Rwanda

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Abstract- Renewable energy in the past has been considered a costly venture and not until recently has the idea of exploiting natural resources been fully embraced. This has become a staple for most developing countries that are depending mostly on solar energy for electrification of rural areas. Rwanda is not an exception in this case and with this in mind the government in partnership with Gigawatt global embarked on a project to build the first-ever solar park of its size in the region (Gigawatt solar power plant) to further boost the energy sector. The study examined the various factors that influence renewable energy projects sustainability. This study included explanatory survey with the help of various respondents who included contractors, plant employees, and technicians. The study employed simple random sampling technique whereby different materials were applied for data collection and a statistical tool known as IBM SPSS version 21.0 was used for data analysis. The research findings indicated that the various factors studied on the sustainability of renewable energy were correlative with a high positive correlation as shown by the Pearson Correlation coefficient which was produced with p-value of 000 of a 2-tailed. Therefore, different factors affect sustainability of renewable energy projects significantly. The findings also revealed that government policies were significantly important to the sustainability of renewable energy projects, as they showed a strong linear positive and were statistically significant with the realization from regression analysis (R2) of 0.868. The study recommends that the government creates policies related with renewable energy projects which follow to the satisfaction of customers and investors as well so as to further boost the energy sector.

Index Terms- Solar energy, project sustainability, internal factors, external factors, Technological awareness

I. INTRODUCTION

Solar energy results from sun radiations. With 486 GW (gigawatts) of installed capacity, solar is the 3rd most utilized renewable energy source worldwide, coming behind hydro and wind (Farmer 2020). Over 100 GW of solar Photovoltaic are installed globally and these panels have the capability of producing over 110Twh of electricity annually (Bennett, 2012). According to World Energy council, solar radiation is available in most locations with a concentration in the desert areas (Clarke**,** 2014). However the current energy consumption level is less 15000 times in comparison with the potential that can be produced (Clarke**,** 2014). The distribution of solar energy amongst countries portrays the government settings in place that may encourage or discourage its use (Clarke**,** 2014). With the introduction of new technologies like low solar thermal systems which are used to heat any form of media and PV solar energy which converts sunlight into electricity, it is anticipated that this will increase by 2030 (Bennett, 2012)**.**

Solar energy in Germany currently contributes between 6.2-6.9 % of the total renewable energy consumed (Federal Ministry of economy and energy, 2019). The country is ranked as the 3rd in the world right behind China and the U.S.A (Federal Ministry of economy and energy, 2019). As indicated in PV resources (2019), Germany had the biggest photovoltaic power plants by 2014 and by 2016 the country had over 1.5million Photovoltaic installed and producing over 41.3GW (Federal Ministry of economy and energy, 2019).

Further developments in the sector are being researched and currently practical tests are being carried out in Germany with collaboration with the Institute for solar energy system in Freiburg (Federal Ministry of economy and energy, 2019).

Other developed economies like in the US, solar energy has been ranked as the first or second source of energy. Wood Mackenzie power and renewable and SEIA report (2019) indicates that there are over 9500 solar power plant projects with more than 150 GW of capacity. The department of energy has embarked on a program to reduce soft costs to curb any barriers to going solar**.** This has led to an incredible growth in the sector by 7% between 2017-2018 according to SEIA report (2019).

Energy poverty is a common problem in developing countries. It causes the human health, economic development and environmental sustainability problems. In Sub-Sahan Africa, about 80% depend on traditional energy to meet their energy demand (The International Energy Agency, 2016). Developing countries have potential to receive enough solar radiation considering their geographical location (Solar GIS, 2016) ……..

Rwanda as a country did not remain aloof to the idea of going green. The GR(Government of Rwanda) advocats for the use of clean energy with the likes of solar energy, bio fuel just to mention but a few. With this in mind, the GR together with Giga watt global embarked on the biggest project to set up a solar plant in Rwamagana district. Rwanda is strategically located in the heart of Africa a continent which is blissfully blessed by having the sun shining all year around. This means that the country can take advantage of this readily available resource to supplement the already existing supply from hydro-electricity.

Solar Plaza-Facts (2012) published a report showing that the total output of renewable energy is at 43.3% with a consumption level of 86.8%.These figures indicate that the demand is quite high but the purchasing power is strained by the high tariffs that are a result of high sustainability costs. This is also the main challenge in Rwanda as the country is ranked as one with the highest electricity tariff of 212 rwf/Unit in the region as published recently by the new times (Bizimungu, 2017).

This in turn has prompted the government of Rwanda to take advantage of the existing inexhaustible resources to supplement its already existing energy levels.

renewable energy sources are considered to be the main drivers for global energy transformation. Recent reports by IEA (Birol, 2018) indicate that solar photovoltaics and wind are the most promising resources.

Growing interest in the energy field has seen an increase in funds being injected in the sector for the past couple of years which has led to an increase in power generation. Overall, renewable energies are contributing two thirds of the total energy generated as cited by International renewable agency (Parnell, 2019). This is mainly due to investor interest rates being reduced considerably, improved technology as well as having favourable regulatory frameworks that encourage competition among developers.

Rwanda envisions to move from a developing country to a middle-income economy by 2024 and one of the ways to achieve that is by targeting 100% electrification in the country. Several projects have been birthed across the country to boost the renewable energy sector in order to realize the full potential and meet the objective of this initiative.

Gigawatt global solar power plant was set up with an anticipated production capacity of 8.5MW and this helped increase the amount generated in the country by 6% as indicated by a report published by IndustryABout.com(2019).A report published by REG(2020) indicates that the plant is still producing at full capacity and with the introduction of new entrants like the plant being set up by Mara corporation it is anticipated that the government will be able to attain its electrification goal of 100% by 2024.The conception of Gigawatt solar power plant project is part of the government initiative to encourage the use of clean energy in Rwanda. As mention by Bimenyimana (2018), the government is concentrating on exploitation of local natural energy resource in order to optimize the power capacity. One of the factors that has led to the successful completion of this project is the readily available finances provided by FMO-Netherlands Development finance company, EAIF, Norwegian investment fund for developing countries just to mention but a few(Timilsina, 2011).This is coupled by government involvement which has seen the provision of free land to set up the project.

This research intends to investigate the effect of internal and external factors and government policy on sustainability of renewable energy projects by taking a closer look at the sustainability of Gigawatt global Solar Power plant which can facilitate in similar projects in the future.

Our research will use below hypothesis based on the available data that was collected

H01-There is no relationship between internal factors and sustainability of renewable energy projects.

H02-There is no relationship between external factors and sustainability of renewable energy projects.

H03-There is no relationship between government policy and sustainability of renewable energy projects

II. Literature review

There is a very thin line between exhaustible resources and renewable resources. Recent discoveries show that exhaustible resources can be renewed by taking advantage of new deposits and existing low-grade materials. Solar energy for instance can be useful for a number of things like home construction, light provision, cooking (Solanki, 2011).Another source of renewable energy is geothermal energy which is produced due to the facilitation of earth heat provision (Gleason, 2016).In order for society to improve the quality of their livelihood, there is a need to have an abundant source of energy and with the available renewable energy technologies, provision of clean energy has been made possible.Recent studies show that there are great developments in renewable energy and this is bound to affect their cost (Toklu,2013) and henceforth providing benefits that go well beyond energy alone.

Renewable energy remains an underutilized resource worldwide therefore projects in this sector are vital to create a clean and sustainable environment. As such, countries worldwide and policy makers are working towards doubling the contribution of renewable energies to 18.5% by 2030.In response to this several projects have been setup (Maqbool, 2018).These projects however are not set up without facing any problems. The heavy financial burdens and the requirement for specialized technologies and infrastructure lead to real and perceived risks regarding renewable energy systems. It is very crucial to manage the risks and incentives of stakeholders so as to promote and enhance the viability of renewable energy projects (Karunathilake, Hirushie & Hewage, Kasun & Sadiq, Rehan, 2020).

As suggested by Mitchel (2017) an organization has to strike a balanced correlation of its internal factors, by dwelling on its strengths and opportunities while at the same time limiting the external factors that arise from external risks. Businesses usually gain competitive advantage in the markets they serve based solely on this strategy.

Several external factors affect sustainability of renewable energy projects. These include financial resources and technical resources and technological innovations. Funds to finance projects can be raised from various sources which may include; internal accruals, securities, loans, working capital advances, miscellaneous sources, bonds and debentures etc. Project financing, is usually risky for the financers as this mostly depends on the successful completion of the project and should the project

fail then they stand to lose a lot of money (Wellace, 2010).This is the reason why financiers try their level best to ensure that any risks that can be associated with the project are eliminated or minimized.

A report published by SDG (2019) indicates that global investments are predicted to be over USD 2.6 trillion by the end of this decade. This is due to favourable investment policies that have been established by the different countries which will in turn encourage development of new renewable energy projects.

Stakeholders in the energy sector must be trust worthy to allow them to openly discuss concerns and advise regarding the various challenges that arise due to extensive use of energy resources. Any decisions made in the sector should be made based on available facts by providing correct information and in a timely manner so as to avoid concerns of wrong decision making.

In most cases differences in opinion by the stakeholders that require negotiation are related to a range of factors. At times these can be genuine differences of interest like how cost and benefits should be distributed (Phillips, 2017).

III. Methodology

Target population is the whole number of population that were investigated by the researcher (Sekaran and Bougie, 2011).

Mugenda (2013) recommended that a sample size of 10% to 30% would be appropriate for a population of less than 10,000 employees. Out of the 191 participants a sample size of 186 was obtained using census design. These included employees, technicians and contractors.

IV. Research Design

Research design by definition is the process that researcher uses to plan, conduct and apply different techniques to address research objective and the problems or questions (Sanders et al,.2017).This study used the descriptive design and it participated in the description and analysis of report findings(Kothari, 2018).This research design is therefore instrumental in drawing inferences about factors influencing the successful implementation of renewable energy projects in particular solar energy projects in Rwanda focusing on Gigawatt solar power plant. Descriptive survey is chosen due to its ability to fulfill the research objectives because it allows the researcher to use many approaches where both qualitative and quantitative data can be analyzed.Census design was employeed due to its ablity to give reliable results from a larger population instead of sampling out just a few of them as this has been and also due to its ability to handle different kinds of data Erhardt(2017)

V. Data Analysis and Results

The study used both inferential and descriptive statistics. For descriptive the study used measure of central tendency which is mean and measure of dispersion which was standard deviation.

For inferential statistic regression analysis was used to measure the relationship between the dependent and independent variable while Pearson correlation coefficient was used to measure the strength of their relationship.

Table 4. 1 Questionnaire turn rate

	Respondents	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Contractors	21	10.99	10.99	10.99
	Project beneficiaries	118	61.78	61.78	72.77
	Technicians	47	24.60	24.60	**97.37**
	Total	**186**	**97.37**	**97.37**	

Researcher, 2021

This part indicated the demographic characteristics of respondents. They were classified according to their age, level of education, gender and working experience while working on such projects. The total number of respondents for this case study was 186 which included 21 contractors, 118 project beneficiaries and 47 technicians. All participants were given the questionnaire to fill and the response rate was 97.3% as shown in table 4.1The above findings indicate that all distributed questionnaires were returned by the participants to the researcher thus the above mentioned rate was realized. All the information that was provided played a crucial role to this study.

Table 4. 2 Age of respondents

The researcher wanted to establish the age of respondents to be sure that all age ranges had been represented since the plant employed several people to play different roles during its construction and also the beneficiaries differed depending on the members of the households that are served by power from the plant. All the participants were in different age ranges and were able to provide clear and helpful information to the study as indicated in table 4.2.

	Statement	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	15-20 years	1	.5	.5	.5
	20-25 years	19	10.2	10.2	10.8
	25-30 years	90	48.4	48.4	59.1
	30-40 years	36	19.4	19.4	78.5
	40-50 years	16	8.6	8.6	87.1
	above 50 years	24	12.9	12.9	100.0
	Total	**186**	**100.0**	**100.0**	

Researcher, 2021

The findings above show that the age ranges were classified into categories where by 0.5% of respondents were in the range of 15-20 years, 10.2% of all respondents were in the range of 20-25 years, 48.4% of all respondents were in the range of 25-30 years, the 19.4% of respondents were in the range 30-40years, 8.6% of participated respondents were in the range of 40-50years and 12.9% of respondents were above the age of 50 years. Therefore, based on the above mentioned numbers, it should be noted that the majority of the respondents were in the range of 25years and above which means they are able to provide clear and helpful information about the operations of the power plant.

Table 4. 3 Gender of respondents

Much as the researcher used random selection extra care had to be taken to ensure that all genders were represented to avoid any bias and also establish fairness in answers provided and the results are shown in table 4.3

	Statement	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	121	65.1	65.1	65.1
	Female	65	34.9	34.9	100.0
	Total	**186**	**100.0**	**100.0**	

Researcher, 2021

The findings revealed that 65.1% of the respondents were male and only 34.9% were female. The results are very typical since this is a technical field that requires a lot of manpower and this tends not to favour women due to the kind of tasks involved.

Table 4. 4 Education level of respondents

	Statement	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Masters	9	4.8	4.8	4.8
	Bachelor	95	51.1	51.1	55.9
	Diploma	56	30.1	30.1	86.0
	A ‘level	26	14.0	14.0	100.0
	Total	**186**	**100.0**	**100.0**	

Researcher, 2021

The results indicated in the table 4.4 show that the respondents have different qualification where 4.8% of respondents have a master’s degree, 51.1% of respondents had a bachelor’s degree, and 30.1% of respondents have diploma while 14.0% of respondents had an A ‘level certificate. Therefore, all respondents are fully qualified in the areas of

technology and are able to perform any duties assigned to them.

Table 4. 5 Main composition of client base

The major consumers of the power generated at the plant are the masses these include home owners, corporate companies etc. since the plant also contributes to the power supply provided by the power regulating body, REG. The other direct beneficiaries from the plant are a local hospital setup close to the power plant and Agahozo shalom youth village. The findings were summarized in the table 4.4

	Statement	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Home owners	171	91.9	91.9	91.9
	Corporate firms	7	3.8	3.8	95.7
	both	8	4.3	4.3	100.0
	Total	**186**	**100.0**	**100.0**	

Researcher, 2021

The researcher wanted to know the major consumers of the power generated by the plant and the findings indicated in table 4.5 show that the 91.9% of respondents own home solar systems based their electricity needs and 3.8% are corporate firms while the 4.3 % of respondents indicated that the supply received from the plant is used by firms and their own homes.

Table 4. 6 Internal factors affecting sustainability renewable energy

The first objective of this research was to examine the internal factors that influence sustainability of renewable energy projects. The findings indicated in table 4.6 are supported with the responses received from the participants. They were provided with statements to advise their level of agreement regarding the possible influence of internal factors that influence sustainability of renewable energy projects using a like rate scale of 1-5.The answers were written down and interpreted using means where 1.0-1.9 represented strongly disagree and 2.0 – 2.9 represented disagree. 3.0 – 3.9 represented neither agree nor disagree, 4.0 – 4.4 represented agree, and 4.5 – 5.0 represented strongly agree.

Statement	N	Mean	Std. Deviation
Capital costs or the upfront expense of building and installing solar energy and high cost of installation	186	4.5796	.92842
Lowly trained, qualified and competent technicians for solar system installation	186	4.7527	1.67755
Unequal playing field from energy system and low investment in the solar energy production	186	3.2581	1.42490
Sitting and transmission for solar energy system to the clients have challenged the service provision of the projects	186	4.3978	1.05666
Stake holder involvement in day to day operations of the projects	186	4.7527	1.67755

Source: Researcher 2021

The other factor also raised was the unequal playing field from energy system and low investment in the solar energy field. The respondents neither agreed or disagreed with the statement (mean of 3.2581) which indicated that the some respondents agreed that there is the unequal playing field from energy system and low investment in the solar energy production and others disagreed by saying that the field offers equal opportunities. Therefore, the solar energy system need more and high investment to improve the socio economic development of the country and the poverty reduction through rural electrification by using renewable energy.

The second factor identified were based on sitting and transmission for solar energy system to the household (mean of 4.3978).The findings also indicated that the respondents agreed with the statement that sitting and transmission for solar energy system was vital to the project. Which means that transmission and setting of solar energy system is one of the major factors that influence sustainability of the solar energy. This was validated with a mean of 4.3978.

Last but not least, the respondents agreed that stake holder involvement in the day to day running of these projects had an effect on sustainability of these projects. This was shown with a mean of 4.7527.

Table 4. 7 The effect of external factors on the sustainability of renewable energy projects

The second objective of this research was to assess the assess the effect of external factors on the sustainability of renewable energy projects.The findings indicated in table 4.7 are supported with the information provided by the respondents which shows their level of agreement regarding the possible influence of these factorson project sustainability using a like rate scale of 1-5. Responses were added and interpreted using means where 1.0-1.9 represented strongly disagree and 2.0-2.9 represented disagree, 3.0-3.9 represented neither agree nor disagree, 4.0-4.4 represented agree, and 4.5-5.0 represented strongly agree. Results were as documented in Table 4.9

Statement	N	Mean	Std. Deviation
Solar Energy Technology is a largely expensive energy option and it impacts the renewable energy installation activities	186	4.7817	.85075
Unawareness of local community towards solar systems is an obstacle to enhance the energy level use compared with the other source of energy	186	3.4839	1.67082
Reliability misconceptions and client mind change impact sustainability of renewable energy projects	186	1.9677	1.31068
Market availability and demand also is a big challenge for project sustainability of solar energy	186	4.8710	1.47576

Source Researcher, 2021

The findings revealed that there are many factors that impact sustainability of renewable energy projects and the results are shown in the table 4.7. The respondents were asked to show how each factor affects sustainability of renewables especially solar energy systems and the first statement were on solar energy technology which is a largely expensive energy option. This in turn affects renewable energy installation activities and the findings indicated that the respondents strongly agreed with the statement with a mean of 4.7817.This means that technology used in the renewable energy system are very expensive which

can be a big problem when implementing renewable projects compared.

The other concern that was raised was unawareness of local community towards the different solar systems that can be adopted and the results indicated that they are agreed with that the local population are not interested to used solar energy in their daily activities and mostly they need energy from the hydro power plant therefore there is a need of creating and innovating different strategies to increase the awareness and usage of solar system. This would potentially improve adoption of renewable energy especially solar not only in Rwanda but globally. This factor gave a mean of 3.4839 which shows that most of respondent agreed with the statement therefore marketing strategies should be improved to raise the level of consumptions of solar system. The findings shown in the table 4.7 revealed that reliability misconceptions and client mind set is another factor that cannot be ignored in the sustainability of the renewable energy especially solar energy and the respondents neither agreed nor disagreed that reliability misconceptions and client mind-set be considered as the factors that can affect the sustainability of renewable energy (mean of 1.9677). This in other words means that the general masses need to be educated of the benefits associated with embracing clean energy options like solar to have more clients adopt these other options to the already existing energy sources.

They also expressed their level of agreement with regards to market nature i.e. Market availability and demand is highly important to renewable energy and could potentially affect sustainability of such projects. This was represented with a mean of 4.0914 where the market and its availability required high mobilization, appreciation and more campaigns in order to change the people's mind-set towards use of renewable energy. Therefore, market availability and demand played a big role in the sustainability and performance of the renewable energy systems especially solar energy.

Table 4. 8 Correlation of factors and sustainability of renewable energy projects

Here the researcher used regression analysis to measure the relationship between the dependent and independent variables.To obtain our results, we assessed the relationship between the two variables and this is summarized in table 4.8.

Variable		**Sustainability of renewable energy Projects**
Internal factors	Pearson Correlation	.949**
	Sig. (2-tailed)	0.000
	N	186
External	Pearson Correlation	0.829**
	Sig.(2-taled)	0.000
	N	186
	Pearson Correlation	
Government policy		0.449**
	Sig. (2-tailed)	0.00
	N	186

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

Source: Primary Data, 2021

Findings in table 4.8 indicated that internal and external factors have a strong relationship with sustainability of renewable energy projects. The Pearson Correlation coefficient of r=0.949 for internal factor and r=0.829 for external factor was produced with p-value of 000 of a 2-tailed. The findings also show that there is a weak relationship of government policy with sustainability of

renewable energy projects with r=0.449 was produced with p-value of 000 of a 2-tailed.

Table 4. 9 Regression analysis model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.949[a]	.868	.869	.52062

a. Predictors: (Constant), External and internal factors

b. Dependent Variable: Sustainability of renewable energy Projects

Source: Researcher, 2021

The findings in table 4.9 revealed that external and internal factors were significantly important to sustainability of renewable energy projects hence the regression analysis (R^2) of 0.949. This means that the findings show a strong relationship between the factors under study and sustainability of the renewable energy projects.

Table 4.10 Regression Coefficient

Model	Unstandardized coefficients		i. Standard coefficient	t	sig.
	B	Std error	ii.		
			iii. Beta		
Constant	2.321	0.433		5.36	0.03
Internal factors	1.613	0.063	0.164	2.563	0.04
External factors	0.963	0.036	1.408	0.035	0.000
Government policy	-0.149	0.008	-0.036	-1.385	0.016

Source: Researcher, 2021

Y=B0+B1X1+B2X2+B3X3+E
Y=2.321+1.613X1+0.963X2+0.149X3

Translating to:
Sustainability of renewable energy projects=2.321+1.613internal factor+0.963external factor -0.149 government policy.
If all variables are held constant sustainability of renewable energy projects is 2.321.
A unit in internal factors will lead to 1.613 increase in sustainability of renewable energy projects.
A unit increase in external factors will lead to 0.963 increase in sustainability of renewable energy projects.
A unit increase in government policy will lead to a decrease in sustainability of renewable energy projects.

VI. Summary and Conclusion

The findings indicated in table 4.6 are supported with the answers that the respondents provided indicating their level of agreement with the statements that were made regarding the possible influence of the external and internal factors on sustainability of renewable energy projects.

The statements were focusing on some of the crucial factors like capital costs or the upfront expense of building and installing solar energy and high cost of installation to which most respondents agreed with a mean of 4.5796. The second factor

identified was based on sitting and transmission for solar energy system to the consumers with a mean of 4.3333.The respondents agreed with the statement by appreciating that sitting and transmission of solar energy system is a main factor for the sustainability of the renewable energy. Also respondents agreed with the statements that market entry, availability and demand is highly important to the renewable energy sustainability with a mean of 4.0914. It was noted that market availability required high mobilization, appreciation and more campaigns in order for the clients to be enticed to adopt the new or alternative sources of energy. Therefore, this factor plays a big role in the sustainability and performance of the renewable energy especially solar energy systems.

The findings indicated in table 4.7 are supported with the response received from the participants showing their level of agreement regarding the possible influence of the external on sustainability of renewable energy projects in Rwanda. The findings revealed that there are many factors that impact the sustainability renewable energy.

Findings in table 4.8 indicated that government policies have a weak correlation with sustainability of renewable energy projects with a Pearson Correlation coefficient r=0.449 which was produced with p-value of 000 of a 2-tailed.Their influence is indicated with the regression analysis model in table 4.10.

The research presented a complete understanding of the various factors that affect sustainability of the renewable energies in particular solar based on the findings from Gigawatt solar power plant. The findings revealed that there are more factors which affect solar energy projects such as capital costs or upfront expense of building and installing solar energy and high cost of installation, high sitting and transmission for solar energy system to households, market entry , its availability and demand , Unequal playing field from energy system and low investment in the solar energy production, Reliability misconceptions and client mind change, unawareness of local community towards the solar system, lowly trained, qualified and competent technicians for solar system installation etc. These factors have a huge impact on the sustainability of such projects as highlighted in the second objective.

The study also indicated with objective three that there is a strong positive correlation between external and internal factors and sustainability of the renewable energy projects as this affected the outcome from these projects.

Take for example Gigawatt sustainability, if delayed would affect government initiative to increase electricity generation in the country which is also intended to reduce dependence on expensive imported hydroelectricity.

Furthermore, it was concluded that there are other factors which affect sustainability of renewable energy projects which have not been exhausted in this study and if studied would also give a strongly positive correlation.

VII. Limitations and Future Research

The main constraint encountered while doing this research is the luck of adequate information as most of it was considered confidential.

Also, the statistics given may not be up to date therefore one could not draw a final conclusion on the current status of activities. However, the researcher did their best to provide the most recent information based on the previous years' reports.

Therefore, it is suggested that a similar study be done in other fields like methane gas production and energy generated by wind turbines.

The study also suggested that further study be done on the strategies adopted in advanced countries that help them ensure effectiveness of solar energy provision so as to give uniform and reliable results.

It is suggested that further research on the role of the government and development partners in delivering renewable energy projects in Rwanda be done.

It is also suggested that further research be done on understanding of the impact of renewable energy projects on local community across diverse communities in Rwanda.

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AUTHORS

First Author – Judith Mutoni, Masters students Mount Kenya University Rwanda, Rwanda
Second Author – Hakizimana Jean de Dieu Khan, Lecturer ,Mount Kenya University Rwanda, Rwanda