International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2019): 7.583

An Examination of Project Planning towards Success of Electricity Access Rollout Project

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Abstract: ***The general aim of this study is to assess the impact of project planning towards success of electricity projects in Electricity Access Rollout Project (EARP) during the period from 2015 up to 2019. The specific objectives are:«to assess the effects of leading activities towards success of electricity projects in EARP; to analyze the effects of time management towards success of electricity projects in EARP and to determine the effects of financial facilities towards success of electricity projects in EARP». The researcher states the problems that the majority of developing countries do not have long term policies on the development and support of electricity projects, which proceed to be undertaken without the necessary electricity planning and policy. As consequence, electricity projects development follows an unplanned route, with no clear association to national power master plans. The researcher develops related theory of Resource Based Project Planning Theory. The sample size of 180 respondents as employees of EDCL selected from total population as 327 employees of EDCL, where research tools are questionnaire, interview and documentation techniques. Therefore, the data were tested through SPSS. The regression squared-R2 = 0.969 and regression squared adjusted-R2 = 0.975, show the goodness of fit of the estimated model. Up to 96.9% of long-run appreciation in success of Electricity Access Rollout Project is influenced by changes in leading activities; time management; and financial facilities. Therefore, the researcher can conclude by saying that the research hypotheses were tested; verified and then they are confirmed referring to the statistical (regression analysis) findings.***

Keywords: Project Planning; Leading Activities; Time Management; Financial Facilities and Success of Electricity Projects

1. Introduction

As the cornerstone of modern society, access to electricity has been linked to improvements in health, education, and social welfare. It is also acknowledged by the Sustainable Development Goals set by the United Nations that the provision of affordable and clean electricity is interconnected with other milestones in poverty elimination, environmental protection, and peace. However, there are still over a billion people worldwide, 87% of which are in rural areas, without electricity. Many are still dependent on traditional biomass and imported fossil fuels for their electricity needs. While there have been great efforts in addressing this gap, the electrification projects remain being one among solutions (Flanagan, 2017).

The electrification projects have been rapid growth in new renewables because of increased uptake of the relevant technologies. The share of renewables in electricity is about 19%, and it is estimated that about 16% of global electricity comes from hydroelectricity and 3% from new renewable. Solutions to provide electricity in rural and urban areas may be classified as large scale of electrical grid extension or small scale (localized) distributed generation. Furthermore, electricity projects can be classified based on the number of supply and demand connections. For the governments of developing nations, an immediate answer to improving electrification rates is the extension of the electrical grid. However, technical or economic constraints may prove electrical grid extension, in this case, electricity installations are deployed. More recently, with greater environmental awareness as well as concerns over electricity security, policy makers and other stakeholders have shown a growing interest in alternative electricity sources (Phillip, 2019).

Electricity projects are recognized as a significant part of electrification plans with the significant potential of electricity sources and the global shift towards cleaner electricity. However, given the variety of technology options and system architectures available commercially, it is not clear which types of electricity projects are feasible and sustainable for remote communities. The electrical technologies considered for both home and community scale systems comprise electricity; by quantifying the impacts of these technologies integrated within differing system designs and operating at different scales. For developing countries, the electrical grid connection, micro-electricity systems generate electricity locally and facilitate decentralized electricity generation. In the transition from traditional to modern electricity sources based micro systems, such as solar systems, play a key role as they offer cost efficient alternatives to electrical grid extension and an environmentally friendly source of modern electricity. Most importantly, electricity provides clean electricity for lighting and depending on the size also for modern communication, information and entertainment, such as TV, radio and cell phone (Agbemabiese, 2018).

The financing and implementation of various electrification project activities have been an integral part of public planning and management. The Government of Rwanda in its vision of 2020; given the importance of the electricity sector, procedures have evolved to help keep watch so that such electrification projects are now managed to facilitate their performance success. Electrification projects are among the most deliberated upon electricity issues in areas of Rwanda. It has been at the centre of national and regional electricity policy agenda and different actors both state and non-state have taken steps to resolve the electricity deficiency, especially in rural areas.

2. Problem Statement

Majority of developing countries do not have long term policies on the development and support of electricity projects, which proceed to be undertaken without the necessary electricity planning and policy. As consequence, electricity projects development follows an unplanned route, with no clear association to national power master plans. The lack of policy meant that the majority of electricity projects diffusion efforts have not only been unplanned by Government, but have been practiced mostly as informal sector operations beyond the government framework, therefore unable to mobilize the financial supports from the government and its great donors. In Rwanda, for instance, there is inadequate general expertise of electricity in the applicable areas. At one time, only electricity projects and private engineers are responsible for organizing all renewable electricity operations. The electrification projects are not successful because of lack of sufficiency resources; this problem is large extent to blame for the usually inadequate rules and regulations of renewable electricity plans (Vleuten et al., 2017).

Most important economic and financial barriers in the context of electricity projects are high initial capital costs providing less installed capacity per invested dollar compared to conventional electricity sources, subsidies for fossil fuels and other non-renewables, high transaction costs due to unfamiliarity and lack of information, and environmental externalities of fossil fuel-based technologies distorting costs to society. The electrification often is a loss-making venture. People living in remote areas are usually poorer than those living in urban areas and technological electricity solutions require higher initial investments. In most cases, subsidies are required to cover initial investment or even operating costs (Beck & Martinot, 2014).

The ultimate importance of project performance is achieved through avoiding the project's failure to keep within cost budget, failure to keep within time stipulated for approvals, design, occupancy and failure to meet the required technical standards for quality, functionality, fitness forpurpose, safety and environment protection. Project performance ensures that companies maximize on profitability, minimize the consequences of risky and uncertain events in terms of achieving the project's objectives and seizes the chances of the risky events from arising.

3. Literature Review

Project planning is part of project management, which relates to the use of schedules such as Gantt charts to plan and subsequently report progress within the project environment. Project planning can be done manually or by the use o f project management software. Initially, the project scope is defined and the appropriate methods for completing the project are determined. Following this step, the durations for the various tasks necessary to complete the work are listed and grouped into a work breakdown structure. Project planning is often used to organize different areas of a project, including project plans, work loads and the management of teams and individuals. Project planning is inherently uncertain as it must be done before the project is actually started. Project planning is a discipline for stating how to complete a project within a certain timeframe, usually with defined stages, and with designated resources. One view of project planning divides the activity into setting objectives; identifying deliverables; planning the schedule and making supporting plans. Supporting plans may include those related to human resources, communication methods and risk management (Harold Kerzner, 2018).

Resource Based Project Planning Theory

The resource based project planning theory states that the basis for competitive advantage of a firm lies primarily in the application of the bundle of valuable resources at the firms disposal (Wernerfelt, 1984), including technology such as solar technology. According to Manoney and Pandian (1992) firm`s ability to reach competitive advantage when different resources are employed and these resources cannot be imitated by competitors. This relates to access to solar technology resources, tools and funds. From this theory when households have enough resources of funds and access to solar tools they can easily adopt solar technology in their homes. The resource based view has been a common interest for project management. A resource-based view of a firm explains its ability to deliver sustainable competitive advantage when resources are managed such that their outcomes cannot be imitated by competitors, which ultimately creates competitive barriers.

The firm's sustainable competitive advantage is reached by virtue of unique resources being rare, valuable, achievable, non-tradable, and non-substitutable, as well as firm-specific (Makadok, 2011). These authors write about the fact that a firm may reach a sustainable competitive advantage through unique resources which it holds, and these resources cannot be easily bought, transferred, or copied, and simultaneously, they add value to a firm while being rare. It also highlights the fact that not all resources of a firm may contribute to a firm's sustainable competitive advantage. Varying performance between firms is a result of heterogeneity of assets and focused on the factors that cause these differences to prevail (Helfat and Peteraf, 2013).

Fundamental similarity in these writings is that unique value-creating resources generate the sustainable competitive advantage to the extent that no competitor has the ability to use the same type of resources, either through acquisition or imitation. Major concern is focused on the ability of the firm to maintain a combination of resources that cannot be possessed or built up in a similar manner by competitors. Further such writings provide us with the base to understand that the sustainability strength of competitive advantage depends on the ability of competitors to use identical or similar resources that make the same implications on a firm's performance. This ability of a firm to avoid imitation of their resources should be analyzed in depth to understand the sustainability strength of a competitive advantage (Helfat and Peteraf, 2013).

4. Empirical Review

Rebane and Barham (2011) analyze the factors that determine the performance of electricity systems awareness and adoption in Nicaragua. They identify the determinants of four measures of electricity systems knowledge. Knowledge is predicted most strongly by the presence of other installed electricity systems, being male, being young and having a high-quality residence, Income, having learned about electricity systems from a business or NGOs and not living in the Caribbean lowlands are all positive determinants of electricity systems adoption, while living near a dealer reduces the likelihood of adoption. The study was limited to how various factors of perception influences adoption of electricity projects and thus does not explain how it influences performance and as such performance is more critical than adoption from the researcher's point of view. The study addressed how community perception influences the performance of electricity projects.

Caird et al (2018) in his study on electricity project performance concluded that the performance is influenced by various factors such as the socio-economic context, consumer variables, communication sources, and product and system properties to determine whether to adapt electricity. The research was found not to substantially single out and exhaust on the various factors that influence performance of electricity projects. This research particularly focused on projects in Nicaragua and provides a deep insight of how the various factors influence performance of electricity projects. From the reviewed literature, it is evident that much research has not been carried on the study topic. Also, the studies in the literature review have limited information on the extent to which various factors influence performance of electricity projects.

Nguyen et al (2017), while undertaking a study of large scale electricity contracts in Vietnam identified from among 20 factors of project performance. These are competent project manager, provision of sufficient financial and non-financial resources to see the project to completion, dedicated and technically knowledgeable project team that has access to needed resources. In Vietnam, little research has been done on project performance in electricity sector in Asia and the enabling factors, there is little to indicate that factual contribution of other scholars and / or researchers has been made in the target area.

The study of Sampa in (2014), provided the experience in the developing countries, points that the establishment and success of any renewable electricity technology is dependent to a great extent, on the government existing policy. These policies are significant factorsin conditions of their power to create an enabling environment for electricity projectspublic exposure and mobilizing resources, in addition to supporting private sector investment. Early policy initiatives on renewables in the country were as a result by the oil crisis of the 1970s. As a result to the crisis, governments launched either an autonomous Ministry of Electricity or a department committed to the advancement of good electricity policies, including the development of electricity projects. For instance, Zambia reacted by drafting policy proposals in its Third National Development Plan (1979-83) to develop alternative kinds of electricity as partial substitutes for conventional electricity sources. Regrettably, when the electricity crisis lessened, government funding for electricity development and electricity projectspractices decreased significantly. A research on wind electricity done in Kenya established that Dutch aid officials would have been interested in funding wind projects if there was an official policy on wind electricity powerfully supported by the Kenyan government.

Policy support for renewables is limited as shown by the low budgetary allotment to renewables in most economies. Majority of the countries laid more significance on the petroleum and power sectors, which supply a low percentage share of the population, than on renewables which provide electricity or has potential to supply to a large percentage of the population. Very small expenditure is allotted to small and medium scale electricity projects in comparison to the conventional electricity sector. For instance, Ethiopia's investment trends in electricity sector show huge investments in the electricity and petroleum sub-sectors. Investments in petroleum quadrupled between 1990 and 2000, whereas investments in electricity nearly tripled in the same period. In direct contrast, expenditure on traditional and alternative electricity (which includes electricity) has steadily reduced from around 1% of entire expenditure in 1990, to about 0.1% of full expenditure in the year 2000.About 2.9% of entire anticipated expenditure for the electricity sector in Kenya was allotted to renewable electricity. Additionally, the public investment program shows that only about 1% of the priority project investment for the electricity sector was allotted to small and medium Renewable Electricity Technologies in 1999/2000 (Kiplagat, 2015).

Findings in the study of Kapur et al., (2016), play a great role in the performance of projects, where researchers have shown that one of the primary obstacles to carrying out electricity projects is frequently not the technical feasibility of these projects instead it is the absence of low cost, long term funding. This situation is complicated more by competition for limited financing by the various projects and gets critical if the nation is running under unfavorable macro-economic circumstances. Therefore, the governments and private firms must find creative means of funding electricity projects. The main challenge of funding electricity projects is to come up with models that can give these electricity sources to consumers at affordable costs while securing that the industry stays sustainable. There is limited policy support for electricity projects as shown by minimum budget allotment to renewable at government level. As a result, the private sector is left to bear the weight of funding electricity projects.

5. Research Methodology

The entire population of the study who are supposed to provide information data related to the objectives of the study is based on 327 employees (staff) of EDCL. The sample size of the study is calculated using the following formula invented by YAMEN formula, invented in 1967; the used formula to calculate the sample size, is: $n = \frac{N}{1+N(e)^2}$

Where n is the sample size, N is the population size, and e is the marginal error of 5% through level of confidence of 95%. Thus, this formula is applied to the above sample. $n = \frac{327}{1+327\,(0.05)^2} = \frac{327}{1.8175} = 179.917 \cong 180$. Therefore, for the case of this study, the sample size is 180 respondents. Questionnaire, documentation research tools were used during data collection.

Data analysis and hypotheses testing

Leading Activities (or LA); Time Management (or TM) and Financial Facilities (or FF) all as independent variables then the Success of EARP (or SEARP) as dependent variable. **βo** is constant and **β_1; β_2 andβ_3**are parameters of equation model; **ε_t**is the error term of equation model. These are specifically stated as simple regression model that is evaluated and is represented as follows: Y(Success of EARP)=βo+β_1(Leading Activities)+β_2(Time Management)+ β_3 (Financial Facilities)+ε_t.

$$\mathbf{LogSEARP=\beta_o+\beta_1 LogLA_{t1}+\beta_2 LogTM_{t2}+\beta_3 LogFF_{t3}+\varepsilon_t;}$$

Therefore, the above equation model provided the findings in figures as statistical results which were interpreted by basing on the regression analysis, with these following important coefficients: **Sig(P-Value)** is significance probability value; **R^2** is Regression Squared; **AR^2** is Adjusted Regression Squared; **Mean** of findings among variables and**ANOVA** is Analysis of Variance.The following Analysis of Variance table that tests the regression of variables of the study:

Table 1: Evaluation of mean

Range	Interpretation of the mean
[1-1.8]	Very weak
[1.8-2.6]	Weak
[2.6-3.4]	Neutral
[3.4-4.2]	Strong
[4.3-5]	Very strong

Source: Researcher; Documentation, September 2020

Table 2: Evaluation of standard deviation and correlation

Scales	Interpretation of Scales
[-1.00 - 0.00]	Negative correlation
[0.00 - 0.25]	Positive and very low correlation
[0.25 - 0.50]	Positive and low correlation
[0.50 - 0.75]	Positive and high correlation
[0.75 - 1.00]	Positive and very high correlation

Source: Researcher; Documentation, September 2020

6. Research Findings

Project planning and success of Electricity Access Rollout Project

Table 3: The correlation among project planning and the success of Electricity Access Rollout Project

Main factors of project planning	Mean		Std Deviation	
	Statistical range	Results of the mean	Statistical Scales	Results of Std Deviation
Leading activities	4.71	Very strong	.951	Positive and very high correlation
Time management	4.72	Very strong	.956	Positive and very high correlation
Financial facilities	4.14	Strong	.734	Positive and high correlation
Overall of mean	4.286	Strong	--------	--------

Source: Researcher; Primary Data, SPSS, September 2020

The table number three shows the results about 3 items that were assessed about correlation among project planning and the success of Electricity Access Rollout Project. The results showed an overall strong mean of 4.286 meaning that project planning provided by Electricity Access Rollout Project, is effectively strong. The first item known as leading activities, and it proves that respondents are strongly agreed with mean of 4.71 and positive and very high correlation standard deviation of .951; the second item known as time management, and it proves that respondents are strongly agreed with mean of 4.72 and positive and very high correlation standard deviation of .956; the third item known as financial facilities, and it proves that respondents are only agreed with mean of 4.14 and positive and very correlation standard deviation of .734. Therefore, this means that the majority of respondents strongly agreed and in harmony that leading activities; time management and financial facilities are the main key components of project planning towards effective success of Electricity Access Rollout Project.

6.1 Hypotheses testing

Estimated research hypotheses

H_1: Leading activities has statistical effects towards success of Electricity Access Rollout Project.
H_2: Time management has statistical effects towards success of Electricity Access Rollout Project.
H_3: Financial facilities have statistical effects towards success of Electricity Access Rollout Project.

Table 4: Presentation of regression summary

Model		Unstandardized Coefficients		Standardized Coefficients	95% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta	Lower Bound	Upper Bound	Tolerance/ Sig.	F
1	Constant	-3.345	0	0.92018	-3.345	-3.345	-------	---------
	Leading activities	0.133	0	0.871927	0.133	0.133	0.183	5.46
	Time management	0.112	0	0.914291	12.38	12.38	0.197	5.064
	Financial facilities	0.113	0	0.854494	0.113	0.113	0.293	5.311

Dependent variable: Success of Electricity Access Rollout Project.
Based on the model coefficient result the model becomes:

$$\mathbf{LogSEARP=-.345+0.133LA_{t1}+0.112TM_{t2}+0.113FF_{t3}+\varepsilon_t;}$$

Considering other variables stay constant then, in short-run, The change of one percent (1%) of leading activities leads to 13.3% change of success of Electricity Access Rollout Project;

The change of one percent (1%) of time management leads to 11.2% change of success of Electricity Access Rollout Project;
The change of one percent (1%) of financial facilities leads to 11.3% change of success of Electricity Access Rollout Project;

Table 5: ANOVA table

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1.614	4	4.35025	0.1045274	0
	Residual	0	0	-------	-------	-------
	Total	1.614	4	-------	-------	-------

a. Predictors: (Constant), leading activities; time management and financial facilities
b. **Dependent Variable**: Success of Electricity Access Rollout Project

For testing whether variables are correlated or not; it's better to find the division and variation of Sum of Squares which is equal to 161.4%. Therefore, the variables are significantly correlated at regressive level.

LSEARPt = 0.920180 + 0.871927*LA$_{t1}$ + 0.914291*TM$_{t2}$ + 0.854494*FF$_{t3}$+µ$_t$
R-squared: R^2 =0.969
Adjusted R-squared: Adjusted R^2=0.965

$ß_1$=0.871927: This means that in the long run; leading activities are positively related to the success of Electricity Access Rollout Project as it is explained by expectation; therefore, this means that when leading activities are increased by 1%, the success of Electricity Access Rollout Project is appreciated by 87.1927% other things being constant (Ceteris Paribus); reasoning about the probabilities, success of Electricity Access Rollout Project is significantly explained by the leading activities, because it is statistically significant at 1% level of confidence.

$ß_2$= 0.914291: This means that in the long run, the time management is positively related to success of Electricity Access Rollout Project as expected; thus this means that when time management changes in increasing of 1%, the success of Electricity Access Rollout Project is appreciated by probability of 0.914291 respected by 91.4291% and then other things remain constant (Ceteris Paribus). Reasoning about the probability, in the long run the time management significantly explains success of Electricity Access Rollout Project, because it is statistically significant at between 1% and 10% as level of confidence.

$ß_3$=0.854494: This means that in the long run, the Financial facilities is positively related to success of Electricity Access Rollout Project as expected; thus this means that when Financial facilities changes by 1% positively, it automatically affect the success of Electricity Access Rollout Project and it is appreciated by probability of 0.854494 estimated by 85.4494% then other things being constant (Ceteris Paribus). Reasoning about the probabilities, in long run the financial facilities significantly explains the success of Electricity Access Rollout Project, because they are statistically significant at between 1% and 10% as level of confidence.

7. Conclusion

The regression squared-R^2 = 0.969 and regression squared adjusted-R^2 = 0.975, show the goodness of fit of the estimated model. Up to 96.9% of long-run appreciation in success of Electricity Access Rollout Project is influenced by changes in leading activities; time management; and financial facilities. Therefore, the researcher can conclude by saying that the research hypotheses including: "**H_1:** leading activities have statistical effects towards success of Electricity Access Rollout Project; **H_2:** time management has statistical effects towards success of Electricity Access Rollout Project and **H_3:** Financial facilities have statistical effects towards success of Electricity Access Rollout Project"; all are were tested; verified and then they are confirmed referring to the statistical (regression analysis) findings.

8. Acknowledgement

We would like to thankJomo Kenyatta University of Agriculture and Technology andDr. Patrick MULYUNGIfor supporting this project.

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