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DETERMINANTS OF IMPLEMENTATION OF PHOTOVOLTAIC POWER PROJECTS IN NAIROBI COUNTY, KENYA

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ABSTRACT

This study sought to examine the challenges facing the implementation of photovoltaic power plants in Nairobi County. This study used a descriptive research design. The target population of this study was 123 project managers in photovoltaic power plants' projects in Nairobi County. The sample size was determined using Slovin's Formula. This study used of both primary and secondary data. Quantitative data was analyzed by use of both inferential and descriptive statistics with the help of statistical software known as Statistical Package for Social Sciences (SPSS version 22). The study found that project planning has positive and significant effect on implementation of photovoltaic power plants in Nairobi County. The study also established that project funding has positive and significant effect on implementation of photovoltaic power plants in Nairobi County. Moreover, the results revealed that project management skills have positive and significant effect on the implementation of photovoltaic power plants in Nairobi County. Further, the study found out that project leadership has positive and significant effect on implementation of photovoltaic power plants in Nairobi County. The study recommended that project managers should avail all work related items, develop necessary task procedure and set time to review work progress so as to implement photovoltaic projects on schedule. In addition, the study recommended that the projects managers should seek for financial resources through application of grants, donations and enhance their venture capital so as to ensure adequate financial resources available for purchase materials and cater for miscellaneous expenses. Further, the study recommends that the management of photovoltaic projects in Nairobi County should come up with appropriate training, career development and talent attraction programmes so as to enhance project managers' competency skills. Furthermore, the study recommends that the project managers in Nairobi County should tie bonuses to projects, reward staffs that meet their goals and provide heartfelt appreciation as a way of improving on photovoltaic projects' rewarding schemes.

Key Words: *Project Planning, Project Funding, Project Management Skills, Project Leadership, Photovoltaic Power Plants*

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INTRODUCTION

Energy has a major impact on every aspect of our socio-economic life. It plays a vital role in the economic social and political development of any nation (Forsyth, 2016). Over the years, the national power grid system has proven to be unreliable to frequent blackouts and high cost of electricity. Inadequate energy supply leads to a restriction in socio-economic activities, economic growth limitations and the quality of life is adversely affected. This has led to a global emphasis on the use of renewable energy including solar energy (Kabeyi, 2012).

Although it currently represents a small percentage of global power generation, installations of solar photovoltaic (PV) power plants are growing rapidly for both utility-scale and distributed power generation applications. Reductions in costs driven by technological advances, economies of scale in manufacturing, and innovations in financing have brought solar power within reach of grid parity in an increasing number of markets (Ludovique, Szklo & Schaeffer, 2017). Continued advancements and further cost reductions tend to expand these opportunities, including in developing countries where favorable solar conditions exist. Policy environments for renewable energy in the developing world are being refined, drawing on the lessons learned from the successes and failures of policies adopted in first-mover markets (Rachit & Vinod, 2016). Several regulatory models are being successfully deployed in the developing world with consequent increase in investment and installations. Solar is proving to be viable in more places and for more applications than many industry experts predicted even a few years ago.

International Finance Corporation (2017) indicates that the rapid market growth, globally, has been accompanied by an observed uneven expertise and know-how demonstrated by new market entrants. Building capacity and knowledge on the practical aspects of solar power project development, particularly for smaller developers, is necessary to ensure that new PV projects are well-designed, well-executed, and built to last. The International Finance Corporation also pointed out that project financing was also affecting the implementation of PV projects significantly. Project financing ranged from equity financing, corporate financing and borrowing. The terms of financing for a solar power project evolve over the course of its development because initially, the project is not well defined as there are risks and uncertainties with regards to many aspects of the project, including solar resource, expected yield, grid connection, and land lease and development rights with the landowner.

In Nigeria, Adeyemo (2013) found that 60 per cent of all PV projects experienced time overrun, 38 per cent experienced cost overrun and 13 per cent were stagnant. In addition, the implementation of solar Energy Powered Project including PV projects was facing such as technological, economic, social, legal, political and environmental challenges. In addition, Abdullahi, Suresh and Oloke (2017) indicate that inadequate technological skill, short-term adoption of policies, political instability and lack of awareness are the major factors affecting implementation of photovoltaic projects in Nigeria.

According to Oirere (2017), lack of access to financing and the current regulatory framework governing renewable energy development in Kenya has hampered generation of electricity from clean sources by different institutions in the country despite their increasing student enrolment and high carbon footprint. However, the Government has taken a positive step towards making the technology more attractive by putting in place the PV and Solar Water Heater regulations through the energy regulatory commission. These regulations were opened for public comment and review in 2011.

Kabeyi (2012) points out that power projects in Kenya were experiencing delays in completion and their completion cost exceeded the estimated cost. The time overrun and cost overrun were attributed to challenges in human resource planning, funding and cost effective long term financing, as well as operations and maintenance challenges. In addition, Tigabu, Kingiri and Odongo (2017) indicates that the main issues affecting solar resource exploitation in the rural areas include high up-front system costs, high import taxes, lack of adequate skilled personnel, lack of reliable knowledge about the technology and capital constraints.

Statement of the Problem

Climate change is one of the greatest challenges facing humanity in the 21st century. In Kenya like many other African countries, climate change is intensifying at an alarming rate as is evident from the current drought that is ravaging many parts of the country (Kiara, 2016). In addition, the electric power sector, mainly from hydro, accounts for 9% of the total energy consumption. This sector is constrained by high cost, insufficient supply and increasingly by adverse effects of climate change in cases of power produced from hydroelectric dams (Masud, Wirba & Alshammari, 2018). Adoption of Solar Technology provide the solution to the climate change and the evident energy gap but this tends to be negligible in most developing countries, and in Kenya representative data on solar energy use at house hold level is virtually nonexistent.

Despite the many benefits of the adoption of solar PV, reduction in the cost buying solar panels and the increase in the types of solar PV, the adoption of solar energy in Kenya is still low. Carbon Africa Limited (2016) reports that 34% of the solar PV projects experience cost overrun and 54% experience time overrun. Kenya Climate Innovation (2017) reports that about 50% of solar products entering the market, have not been approved by lighting Global. In addition, 57% of the solar PV systems that get in the market develop complications on the charging systems, damages on the bulbs account for 22% and other unknown defects accounted for 14%. Most of these challenges emanate from poor implementation of PV panels. It is therefore important to identify the challenges facing the implementation of solar PV projects.

Various studies have been conducted on challenges facing energy projects in Kenya. Keriri (2013) conducted a study on the factors influencing adoption of solar technology in Lakipia North Constituency; Kabeyi (2012) examined the challenges of implementing thermal power-plant projects in Mombasa County; and Kiara (2016) examined the determinants of the implementation of infrastructure development projects in renewable energy sector in Kenya Power Limited. However, these studies have been limited to specific regions and institutions like Kenya Power Limited. This study therefore sought to examine the determinants of implementation of photovoltaic power projects in Nairobi County, Kenya.

Objectives of the Study

The general objective of the study was to examine the determinants of implementation of photovoltaic power plants in Nairobi County. The specific objectives were:-

- To establish the effect of project planning on the implementation of photovoltaic power projects in Nairobi County, Kenya.
- To determine the effect of project funding on the implementation of photovoltaic power projects in Nairobi County, Kenya.
- To establish the effect of project management skills on the implementation of photovoltaic power projects in Nairobi County, Kenya
- To find out the effect of project leadership on the implementation of photovoltaic power projects in Nairobi County, Kenya.

LITERATURE REVIEW

Theoretical Review

Systems Theory

This theory was originally developed by Hungarian biologist Ludwig von Bertalanffy in 1972.From a biological viewpoint, it considers a creature as an integrated system of functions and interdependent structures. From a sociological perspective, system theory is the trans-disciplinary approach of an organization. A sociological system contains four main components including attributes, objects, interrelationships among various objects and the environment. Renger and Granillo (2018) refer objects as being parts, variables, or elements that exist in a system. Attributes refer to features of qualities of a system and its objects. Every organization has internal relations that exist among its various objects. Further, a system occurs in an environment.

Resource Based View Theory

Resource based view theory was developed by Birger Wernerfelt in 1984. The resource-based view (RBV) as a basis for the competitive advantage of a firm lies primarily in the application of a bundle of valuable capabilities as well as tangible or intangible resources at the firm's disposal. Colbert (2014) emphasize the distinction between capabilities and resources by defining capabilities as a special type of resource, specifically an organizationally embedded non-transferable firm-specific resource whose purpose is to improve the productivity of the other resources possessed by the firm. Resources are stocks of available items that are owned or controlled by the organization, and capabilities are an organization's capacity to deploy resources. Essentially, it is the bundling of the resources that builds capabilities. An organization is likely to succeed and excel if it has the best and most appropriate stock of the resources relevant for its business and strategy (Sedera & Sarker, 2016). In the RBV, the firm is characterized primarily in terms of the resources or knowledge it embodies or commands. It is a means of adding an appreciation of the role of the firm to our understanding of the market (Rashidirad, Soltani & Salimian, 2015).

Competency theory

Competency theory was established by McClelland and McBer in the 1980s. Competency Theory is linked to managerial skills variable. The theory states that competency is the primary attributes of a person who is causally related to criterion referenced effectiveness or superior performance in allocated or assigned task (Büker & Schell-Straub, 2017). Project managerial skills include technical skills, interpersonal skills, and conceptual skills. The ability to communicate, responsive behavior, and tactics of negotiation are what competence is made off. The theory of competency is of much relevance to this study based on the fact that it expounds on the importance of having project managers that have the required management skills (technical, interpersonal and conceptual) in handling projects in their constituency (Feng & Richards, 2018).

Trait Theory of Leadership

The emergence of the concept of trait leadership looks back to Thomas Carlyle's "great man" theory, which stated that the history of the world was the biography of great men. Subsequent commentators interpreted this view to conclude that the forces of extraordinary leadership shape history (Kumah-Abiwu, 2016). This trait perspective of leadership was widely accepted until the late 1940s and early 1950s, when researchers began to deem personality traits insufficient in predicting leader effectiveness. In 1948, Stogdill stated that leadership exists between persons in a social situation, and that persons who are leaders in one situation may not necessarily be leaders in other situations. Subsequently, leadership stopped being characterized by individual differences, and behavioural and situational analyses of leadership

took over and began to dominate the field of leadership research.

Conceptual Framework

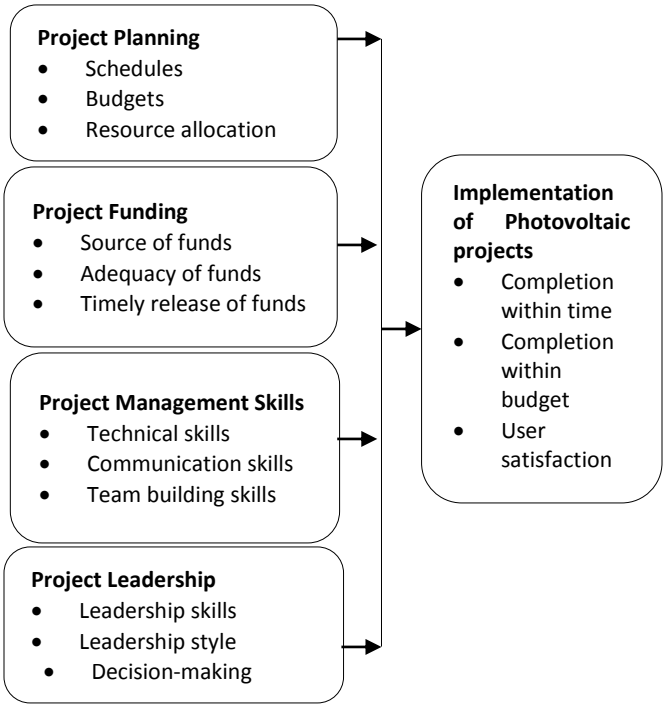

Figure 1: Conceptual Framework

Source: Author (2019)

Empirical Review

Project Planning

Ikejemba et al (2017) researched on factors affecting Implementation of PV projects in Africa and found that despite the differences in culture and understanding, the reasons for failure of the projects are found to be similar across the different countries poor project planning lead to project failure followed by poor maintenance and lack of public acceptance and inclusion.Sambo et al (2014) conducted research on the effect of project planning on Implementation of solar PV projects in Nigeria. The researchers adopted in-depth analysis of performances of existing systems during their studies. The study found that Implementation plan of standard solar PV projects in the country has a lot of advantages to the country's economic and industrial growth- the greatest advantage being increased energy access. The study also established that poor planning lead to failure of several solar PV projects being installed in various parts of this country as the PV projects fail to meet the minimum life-span due to a number of limiting factors such as poor or improper fundamental design, use of sub-standard components, adoption of poor installation procedure by inexperienced personnel, bad construction/civil works among other factors.

Project Funding

In Canada, Claire (2008) conducted a study on the effect of project funding on implementation of PV projects. Five funding models for school-based solar PV projects were evaluated by respondents to determine the effect of project funding models on overall project social acceptance. The results show that the project funding model does affect social acceptance, with 78.1% of respondents reporting that at least one of the five models cause their support for the project to either increase or decrease. Respondents indicated a strong preference for the government/utility model, while the corporate funding model was shown to be the most controversial.

Xiarchos and Lazarus (2013) conducted a study on factors which influence adoption of solar power generation systems in United State. The researcher used descriptive research method during the study. The study found that find the State financial instruments, such as rebates, grants, investment tax credits, and production incentives has no significant effect on adoption of power generation systems. Shrimali and Kniefel (2011) researched on the effect of project funding on implementation of solar energy projects in India. The study used a fixed-effects model with State-specific time-trends for State-level data from 1991-2007 and found that clean energy funds have a significant impact on implementation of renewable energy. Similarly, Rehman and Hussain (2017) researched on factors which affect implementation of photovoltaic projects in India. The

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study adopted descriptive research design and found that inadequate funding affected successful implementation photovoltaic projects.

Project Management Skills and Implementation of Photovoltaic Power Plants

In USA, Chandra (2017) researched on the effect of project management competencies skills on the KPIs of project performance. The researcher adopted exploratory research design. The study revealed significant relationship between hard skill-scope management and soft skill-negotiation. The results also showed a significant relationship between hard skill-human resource management and soft skill-team building. However, there was no significant relationship between both hard and soft skills and the KPIs based on cost, time and quality. Regression analysis was also conducted with KPIs based on cost, time and quality as the dependent variables and hard and soft skills as the independent variables. The results showed that the regression model for this relationship was not significant due to soft and hard skill showing high multicollinearity due to significant correlation between the hard and soft skill.

Project Leadership

In Brazil, Marco et al (2012) researched on the influence of leadership style and factors associated with organization agility on project performance. Upon analysis, a proposed characterization of the relationship between leadership, agility and project performance is presented. A Bayesian Network (BN) model is employed as a modeling tool, enabling both inferences and sensitivity analysis and also visualization and quantification of the propagation of effects between variables. The study found that leadership style, agility and organizational factors influenced the performance of projects.

Nawaz (2016) researched on the influence of project leadership on implementation of solar projects in Pakistan. The study used descriptive research design and found that project leadership has a positive and significant influence on implementation of solar projects. Similarly Muhammad et al (2012) researched on the effect of project leadership on implementation of projects. The study adopted descriptive research design. The data was collected from includes 70 employees from four main consultancies companies working together on a project, located in Lahore, Pakistan. Responses were gone through EFA and Cronbach's alpha test to assure consistency and reliability. Finally, path analysis in SEM using Amos was run to explore the nature and strength of the links. Results suggest that leadership has positive links with project performance.

METHODOLOGY

This study used a descriptive research design. This design refers to a set of methods and procedures that describe variables. It involves gathering data that describe events and then organizes, tabulates, depicts, and describes the data (Creswell, 2014). The target population of this study was 128 photovoltaic power plants' projects in Nairobi County. The unit of analysis was photovoltaic power plants' projects and unit of observation was project managers of photovoltaic power plants' projects in Nairobi County. The study adopted census and according to Brymann (2016) a census yields more reliable results than a sample, and whenever it is possible it should be undertaken. This study used of both primary and secondary data. Qualitative data was coded thematically and then analyzed by use of thematic content analysis. The results were then presented in form of a prose. Quantitative data was analyzed by use of both inferential and descriptive statistics with the help of statistical software known as Statistical Package for Social Sciences (SPSS version 22). The regression equation was;

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

Whereby; Y = implementation of photovoltaic power plants

X_1 = Project planning

X_2 = Project funding

X_3 = Project management skills
X_4 = Project leadership
ε = Error Term
β_0 = Constant Term
β_1, β_2, β_3, $\beta_{4=}$ Beta Co-efficient

FINDINGS

Project Planning

The first specific objective of this study was to determine the effect of project planning on the implementation of photovoltaic power plants in Nairobi County. The project managers were requested to point out their agreement level on various statements relating to the effect of project planning on implementation of photovoltaic power plants in Nairobi County. A five point Likert scale was used during the study where 5 symbolizes Strongly agree, 4 symbolizes Agree, 3 symbolizes Moderately agree, 2 symbolizes Disagree and 1 symbolized Strongly disagree. The results were presented in Table 1.

With a mean of 4.034 (std. dv= 0.392) the project managers working in photovoltaic power plants' projects in Nairobi County agreed that each activity during implementation of photovoltaic project start and end within the stipulated timeframe. They also agreed that their organization ensured that every project stakeholder is informed and accountable by ensuring that they are aware of current budget status as shown by a mean of 3.991 (std. dv = 0.278). In addition, they agreed that project managers adhered to project budget when allocating resources as shown by a mean of 3.965 (std. dv = 0.507).

Besides that, they agreed that in case project resources fail to materialized as planned, the project manager approximate the impact and communicate this to the management as shown by a mean of 3.940 (std. dv = 0.529). With a mean of 3.931 (std. dv = 0.468) they agreed that when allocating project resources, project managers ensured project dependencies by ensuring tasks were done systematically as a way of preventing hogging of resources. The staff also agreed that project managers assigned resources among team members and monitored their workload throughout project implementation and reassign resources if needed as shown by a mean of 3.923 (std. dv = 0.438).

The findings were in agreement with the findings of Sambo *et al* (2014) that effective communication, allocation of resources and monitoring has significant effect on implementation of photovoltaic projects in developing nations. They agreed that project managers set thresholds for behind and a head schedule so as to trigger the attention of staffs as shown by a mean of 3.897 (std. dv = 0.498). However, they moderately agreed that project managers catered for things outside their control when preparing budget as shown by a mean of 3.136 (std. dv = 0.413). Further, they moderately agreed that project managers were aware of resources which were available in the organization before assigning the resources among project team members as shown by a mean of 2.991 (std. dv = 0.464). The findings are in line with the findings of Ocharo and Kimutai (2018) that that project monitoring, assessment; follow up, evaluation and feedback provision play a significant role in implementation and implementation of photovoltaic projects in Kenya.

Table 1: Project Planning

	1	2	3	4	5	Mean	Std. Deviation
Each activity during implementation of photovoltaic project start and end within the stipulated timeframe	0.0	0.0	6.0	84.6	9.4	4.034	.392

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In case project resources fail to materialized as planned, the project manager approximate the impact and communicate this to the management	0.0	4.3	4.3	84.6	6.8	3.940	.529
Project managers set thresholds for behind and a head schedule so as to trigger the attention of staffs to improve on their efficiency.	0.0	3.4	7.7	84.6	4.3	3.897	.498
Project managers adhere to project budget when allocating resources	0.9	1.7	4.3	86.3	6.8	3.965	.507
Project managers cater for things outside their control when preparing budget	0.0	0.0	88.9	8.5	2.6	3.136	.413
Our organization ensures that every project stakeholder is informed and accountable by ensuring that they are aware of current budget status.	0.0	0.0	4.3	92.3	3.4	3.991	.278
When allocating project resources, project managers ensure project dependencies by ensuring tasks are done systematically and prevent hogging of resources.	0.0	3.4	4.3	88.0	4.3	3.931	.468
Project managers are aware of resources which are available in the organization before assigning the resources among project team members	2.6	3.4	86.3	7.7	0.0	2.991	.464
Project managers assign resources among team members and monitor their workload throughout project implementation and reassign resources if needed	0.0	2.6	6.0	88.0	3.4	3.923	.438

Project Funding

The second objective of the study was to determine the effect of project funding on the implementation of photovoltaic power plants in Nairobi County. The project managers were asked to indicate their agreement level on various statements relating to the effect of project funding on implementation of photovoltaic projects in Nairobi County. With a mean of 4.017 (std. dv = 0.262) the project managers agreed that project donors were always committed in funding photovoltaic projects. The also agreed that project managers ensured that information on the cost of projects is reasonable and is not questionable when presented to financing as shown by a mean of 3.991 (std. dv = 0.307). Moreover, they agreed that project managers seek for funding form government through the ministry of energy as shown by a mean of 3.982 (std. dv = 0.414).

The findings were in line with the findings of Coughlin and Kandt (2011) that the main source of photovoltaic funding are solar development fund, government grants and donations. With a mean of 3.974 (std. dv = 0.306) they agreed that employees in their organization were paid on within the stipulated payment terms. Besides that, they agreed that investors who are passionate on photovoltaic projects donate adequate funds for implementation of the project as shown by a mean of 3.923 (std. dv = 0.457). The findings were in agreement with the findings of Xiarchos and Lazarus (2013) that project financing through grants and donations have significant effect on successful implementation of photovoltaic projects in Africa. However, they moderately agreed that the management in their organization has put procedures which ensure timely release of financial resources for implementation of photovoltaic projects as shown by a mean of 3.008 (std. dv = 0.334). They also moderately agreed that project managers accessed funds from credit facilities such as banks as shown by a mean of 2.974 (std. dv = 0.358). Further, they disagreed that there was enough money in the organization to buy material and resources which were used in implementation of photovoltaic projects as shown by a mean of 2.025 (std. dv =

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0.403). Furthermore, they disagreed that there was adequate financial resources to cater for miscellaneous expenses when implementing photovoltaic projects as shown by a mean of 1.974 (std. dv = 0.277). The findings are in line with the findings of Wamalwa and James (2018) that most project managers seek for funding from financial institutions to cater for miscellaneous expenses and purchasing of materials used in implementation of photovoltaic projects.

Table 2: Project Funding

	1	2	3	4	5	Mean	Std. Deviation
Project managers seek for funding from government through the ministry of energy.	0.0	0.0	9.4	82.9	7.7	3.982	.414
Investors who are passionate on photovoltaic projects donate adequate funds for implementation of the project	0.0	2.6	6.8	86.3	4.3	3.923	.457
Project managers access funds from credit facilities such as banks	0.0	7.7	87.2	5.1	0.0	2.974	.358
There is enough money in our organization to buy material and resources which are used in implementation of photovoltaic projects	4.3	91.5	1.7	2.6	0.0	2.025	.403
Employees in our organization are paid on within the stipulate payment terms.	0.0	0.0	6.0	90.6	3.4	3.974	.306
There are adequate financial resources to cater for miscellaneous expenses when implementing projects	5.1	92.3	2.6	0.0	0.0	1.974	.277
The management in our organization has put procedures which ensure timely release of financial resources for implementation of photovoltaic projects	0.0	5.1	88.9	6.0	0.0	3.008	.334
Project manager ensures that information on the cost of projects is reasonable and is not questionable when presented to financing agency thus preventing delay of funds.	0.0	0.0	5.1	90.6	4.3	3.991	.307
Project donors are always committed in funding photovoltaic projects	0.0	0.0	2.6	93.2	4.3	4.017	.262

Project Management Skills

The third specific objective of the study was to determine the effect of project management skills on the implementation of photovoltaic power plants in Nairobi County. The projects managers were asked to specify their agreement level on various statements relating to the effect project management skills on implementation of photovoltaic power projects in Nairobi County. The results were as shown in Table 3. With a mean of 4.017 (std. dv = 0.435) the project managers working in photovoltaic power plants' projects in Nairobi County agreed that team members were allocated tasks based on their capabilities and experience levels. Moreover, they also agreed that project managers ensured that the team members received timely feedback on progress of project as shown by a mean of 3.923 (std. dv = 0.438).

In addition, they agreed that project managers ensured there is good working relationship among project team members even when the staffs are working under pressure as shown by a mean of 3.914 (std. dv = 0.501). However, they moderately agreed that the management in the organization recognized the value of each team member from the subordinate to top senior staffs as shown by a mean of 3.094 (std. dv = 0.643). They also moderately agreed that project managers kept the staff informed on project performance by having complete access to information pertaining to project, needs of customers

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or stakeholders, objectives constraints and progress as shown by a mean of 3.034 (std. dv = 0.369).

With a mean of 3.008 (std. dv = 0.359) they moderately agreed that project managers build trust among the employees that they were capable of conducting their assigned task within the stipulated time. Further, they moderately agreed that employees in the organization were trained regularly to improve on their competency skills as shown by a mean of 3.008 (std. dv = 0.482). Besides that they moderately agreed that project managers effectively communicate on how task need to be done among employees as shown by a mean of 3.000 (std. dv = 0.293). The findings were in agreement with the findings of Abdullahi, *et al* (2017) that staff schedule management, training, timely provision of feedback have positive and significant effect on implementation of solar panel projects. Nonetheless, they disagreed that project managers have relevant competency skills and knowledge on technological requirement for implementation of photovoltaic projects as shown by a mean of 2.000 (std. dv = 0.321). The findings were in agreement with the findings of Brooks and Urmee (2014) that lack of project management competency skills such as capacity building skills impede beneficiary of solar projects from gaining technical knowledge on effective implementation of the projects.

Table 3: Project Management Skills

	1	2	3	4	5	Mean	Std. Deviation
Project managers have relevant competency skills and knowledge on technological requirement for implementation of photovoltaic projects.	5.1	89.7	5.1	0.0	0.0	2.000	.321
Team members are allocated tasks based on their capabilities and experience levels.	0.0	1.7	3.4	86.3	8.5	4.017	.435
Employees in our organization are trained regularly to improve on their competency skills	2.6	3.4	84.6	9.4	0.0	3.008	.482
Project managers effectively communicate on how to task need to be done among employees	0.0	4.3	91.5	4.3	0.0	3.000	.293
Project managers keep the staff informed on project performance by having complete access to information pertaining to project, needs of customers or stakeholders, objectives constraints and progress.	0.0	5.1	86.3	8.5	0.0	3.034	.369
Project managers ensure that the team members receive timely feedback on progress of project.	0.0	0.0	13.7	80.3	6.0	3.923	.438
Project managers ensure there is good working relationship among project team members even when the staffs are working under pressure.	0.9	2.6	4.3	88.9	3.4	3.914	.501
The management in our organization recognizes the value of each team member from the subordinate to top senior staffs.	2.6	2.6	83.8	5.1	6.0	3.094	.643
Project managers build trust among the employees that they are capable of conducting their assigned task with the stipulated time	0.0	6.0	87.2	6.8	0.0	3.008	.359

Project Leadership

The fourth specific objective of this study was to find out the effect of project leadership on the implementation of photovoltaic power plants in Nairobi County. The project managers were requested to specify their agreement level on various statements relating to the effect of project leadership

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on implementation of photovoltaic power plants in Nairobi County. The results were as shown in Table 4. With a mean of 4.017 (std. dv = 0.321) the project managers agreed that they tracked the mistake of each staff and penalized when they reach a certain threshold. In addition, they agreed that project managers came up with different opinions on how to ensure effective implementation projects and allowed the employees to select the most preferred decision as shown by a mean of 3.991 (std. dv = 0.278). Moreover, they agreed that project managers were always available when required to attend to project matters as shown by a mean of 3.982 (std. dv = 0.556). They also agreed that leaders in their organization made decisions on which project initiatives should be implemented first as shown by a mean of 3.940 (std. dv = 0.354).

The findings were in line with the findings of Musembi *et al* (2018) that leadership commitment and critical decision-making have significant effect on implementation of photovoltaic projects in Kenya. Besides that they agreed that leaders inspired and motivated team members so as to achieve the set project goals as shown by a mean of 3.914 (std. dv =0.465). With a mean of 3.914 (std. dv = 0.465) they agreed that project managers often came up with decision which enabled team members to achieve project goals. Further, they agreed that project managers in the organization were active listeners, understand and consider the team members perspective before makings final decision as shown by a mean of 3.880 (std. dv = 0.527). The findings are in agreement with the findings of Marco *et al* (2012) that effective communication skills, critical thinking and motivational skills among leaders have positive and significant effect implementation of solar projects. However, they moderately agreed that project managers in their organization provided clear reward scheme for every task completed on schedule as shown by a mean of 3.068 (std. dv = 0.468). Furthermore, they moderately agreed that project managers assessed whether their decisions were effective in terms of resources implementation during development of photovoltaic projects as shown by a mean of 3.059 (std. dv = 0.354). The findings are in line with the findings of Muhammad *et al* (2012) that motivation of staff through rewarding and effective allocations of resources have positive and significant effect on implementation of photovoltaic projects.

Table 4: Project Leadership

	1	2	3	4	5	Mean	Std. Deviation
Project managers in our organization are active listeners, understand and consider the team members perspective before makings final decision.	0.0	5.1	5.1	86.3	3.4	3.880	.527
Leaders inspire and motivate team members so as to achieve the set project goals	0.0	3.4	5.1	88.0	3.4	3.914	.465
Leaders in our organization make decisions on which project initiatives should be implemented first.	0.0	0.0	9.4	87.2	3.4	3.940	.354
Project managers track the mistake of each staff and penalizes when they reach a certain threshold.	0.0	0.0	4.3	89.7	6.0	4.017	.321
Project manager is always available when required to attend to project matters	0.0	3.4	6.0	79.5	11.1	3.982	.556
Project manager in our organization provide clear reward scheme for every task completed on schedule	0.0	4.3	88.0	4.3	3.4	3.068	.468

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Project manager come up with different opinions on how to ensure effective implementation project and allow the employee to select the most preferred decision	0.0	0.0	4.3	92.3	3.4	3.991	.278
Project manager often come up with decision which enable team members to achieve project goals.	0.0	3.4	5.1	88.0	3.4	3.914	.465
Project managers assess whether their decisions are effective in terms of making a difference in time and resources implementation within the organization	0.0	3.4	87.2	9.4	0.0	3.059	.354

Implementation of Photovoltaic Projects

The projects managers were requested to specify the duration of time it took to complete photovoltaic projects their organization. The results were as shown in Table 5. As shown, in the year 2014, 63.4% of the projects managers specified that photovoltaic projects took more than six months to be accomplished, 21.4% indicated between 1 to 3 months and 15.2% specified between 4 and 6 months. With respect to the year 2015, 63.4% specified above six months, 23.5% specified between 1 to 3 months while 13.1% pointed out between 4 and 6 months. In the year 2016, 83.7% of the participants specified above 6 months, 15.3% pointed out between 4 and 6 months while 1% indicated between 1 and 3 months. Regarding the year 2017, 68% pointed out above 6 months, 21.3% specified between 1 and 3 months and 10.7% specified between four and six months. In 2018, 78.6% of project managers pointed out above six months, 16.4% specified between 4 and six months while 5% indicated between 1 and 3 months.

Table 5: Duration of Completing Photovoltaic Projects

	2014	2015	2016	2017	2018
1-3 months	21.4	23.5	1.0	21.3	5.0
4- 6months	15.2	13.1	15.3	10.7	16.4
Above 6 months	63.4	63.4	83.7	68.0	78.6
Total	100.0	100.0	100.0	100.0	100.0

Completion Cost of Photovoltaic Projects

Further, the project managers were asked to estimate the completion cost of the photovoltaic projects in their organization. The results were as depicted in Table 6. According to the results, in the year 2014 the estimated cost of completing photovolitatic projects was 15.4390 million while the completion cost was 17.0000 million. In 2015, the esitmated cost was 18.7154 million and the completion cost was 19.4530 million. With respect to the year 2016, the estimated cost was 21.0000 million while completion cost of photovolitaic projects was 22.0000 million. In the year 2017, the etimated cost was 23.0000 million while completion cost was 23.5000 million. In relation to the year 2018, the estimated cost was 25.0000 million and the completion cost was 26.17300 million.

Table 6: Completion Cost of Photovoltaic Projects

	2014	2015	2016	2017	2018
Estimated cost in millions	15.4390	18.7154	21.0000	23.0000	25.0000
Completion cost in millions	17.0000	19.4530	22.0000	23.5000	26.1730

Customers' Satisfaction Ratings

The project managers were requested to rate customer satisfaction level with respect to implementation of the photovoltaic projects in Nairobi County. The results were as presented in Figure 2. According to the results, 47.9% of project managers specified that customers were moderately

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satisfied with implementation of photovoltaic projects in Nairobi County, 23.9% indicated satisfied, 14.5% pointed out very satisfied, 7.7% specified dissatisfied while 6% pointed out very dissatisfied. This implied that most of the customers were moderately satisfied with implementation of photovoltaic projects in Nairobi County.

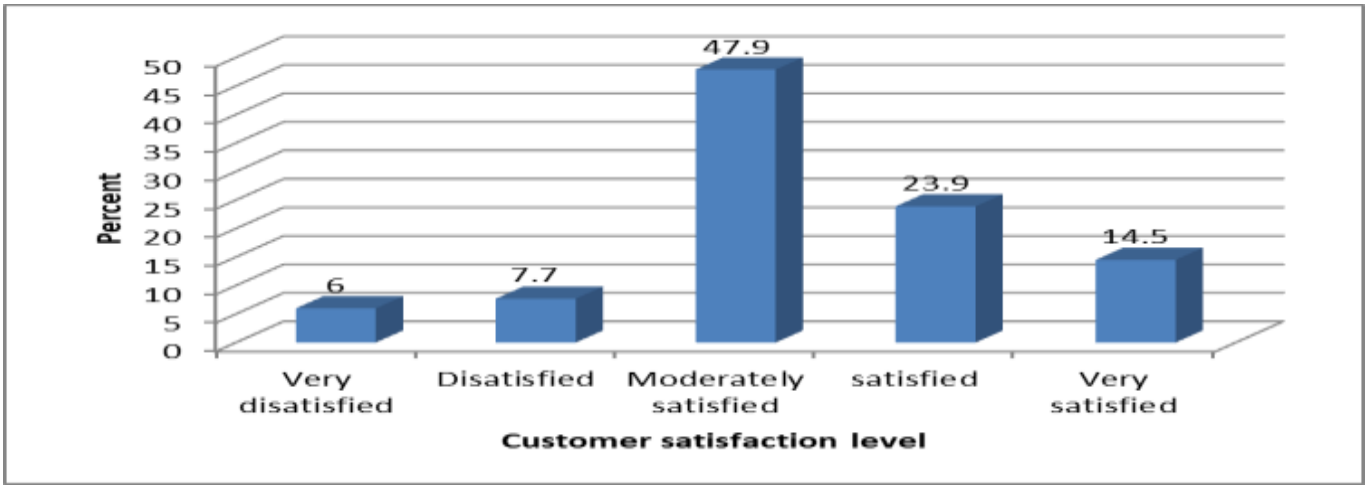

Figure 2: Customers' Satisfaction Ratings

Achievement of Photovoltaic Projects implementation Objectives

The projects managers were asked to rate the achievement of photovoltaic projects implementation objectives in Nairobi County. The results were as shown in Figure 3. With respect to achievement of implementation of photovoltaic project objectives, 70.1% of the project managers rated between 41% and 60%, 11.1% specified 61% and 80%, 7.7% pointed out between 81% and 100%, 6% specified below 20% while 5.1% indicated between 21% and 40%. This implied that the efficiency of project managers regarding achievement of implementation of photovoltaic project objectives was not excellent.

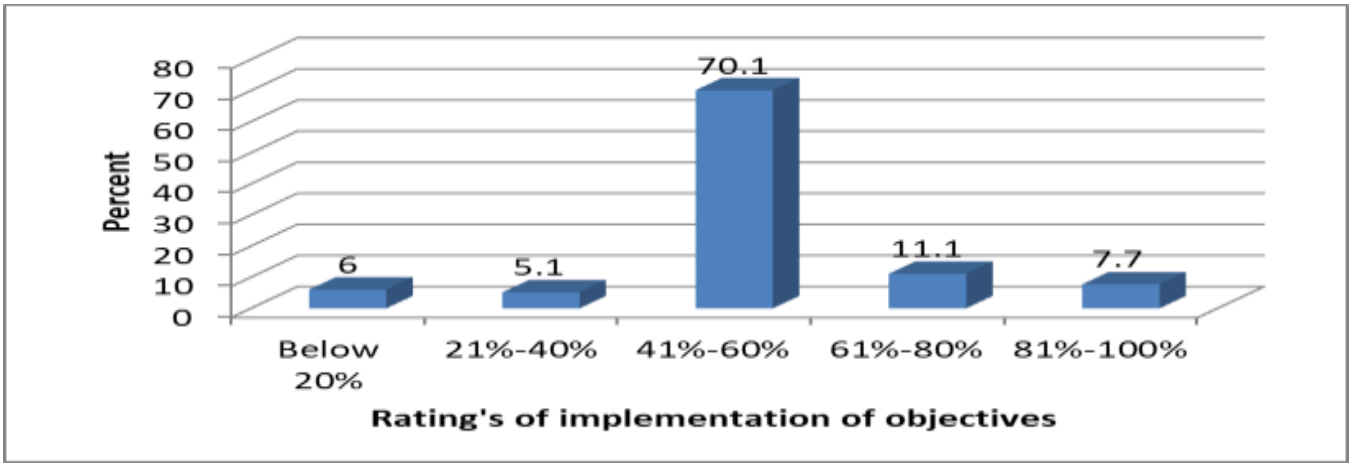

Figure 3: Achievement of Photovoltaic Projects implementation Objectives

Inferential Statistics

Table 7: Correlations Coefficients

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		Implementation of photovoltaic projects	Project planning	Project funding	Project management skills	Project leadership
Implementation of Photovoltaic projects	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	117				
Project Planning	Pearson Correlation	.856	1			
	Sig. (2-tailed)	.000				
	N	117	117			
Project Funding	Pearson Correlation	.848	.725	1		
	Sig. (2-tailed)	.000	.000			
	N	117	117	117		
Project Management Skills	Pearson Correlation	.805	.394	.442	1	
	Sig. (2-tailed)	.001	.003	.004		
	N	117	117	117	117	
Project Leadership	Pearson Correlation	.796	.776	.606	.500	1
	Sig. (2-tailed)	.002	.004	.013	.041	
	N	117	117	117	117	117

Regression Analysis

Table 7: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.887	.786	.752	.45513

Table 8: Analysis of Variance (ANOVA)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	38.134	4	9.533	102.505	.000
	Residual	10.383	112	0.093		
	Total	48.517	116			

Table 9: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.125	.546		7.554	.000
	Project planning	.853	.187	.844	4.561	.000
	Project funding	.817	.211	.810	3.872	.001
	Project management skills	.785	.203	.768	3.866	.003
	Project leadership	.752	.237	.737	3.172	.004

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CONCLUSIONS

The study concluded that project planning has positive and significant effect on implementation of photovoltaic power plants in Nairobi County. The study also established that project schedules, budgets and resource allocation have significant effect on implementation of photovoltaic projects. Further, the study established that each activity during implementation of photovoltaic project work completed on time.

The study also concluded that project funding has positive and significant effect on implementation of photovoltaic power plants in Nairobi County. The results also revealed that source of funds, adequacy of funds and timely releases of funds have positive and significant effect on implementation of photovoltaic projects. However, the study established that there was inadequate financial resource to buy material and resources which were used in implementation of photovoltaic projects.

Further, the study concluded that project management skills have positive and significant effect on the implementation of photovoltaic power plants in Nairobi County. The study also found out those technical skills, communication skills and team building skills have significant effect on implementation of photovoltaic projects. In addition, the study established that project managers did not have relevant competency skills and knowledge on technological requirement for implementation of photovoltaic projects.

Furthermore, the study concluded that project leadership has positive and significant effect on implementation of photovoltaic power plants in Nairobi County. The results also revealed that leadership skills, leadership style and decision making have significant effect on implementation of photovoltaic projects. The study also established that project managers provided clear reward scheme for every task completed on schedule.

RECOMMENDATIONS

The study established that each activity during implementation of photovoltaic project work completed on time. Therefore, the study recommends that project managers should avail all work related items, develop necessary task procedure and set time to review work progress so as to implement photovoltaic projects on schedule.

The study also found that there was inadequate financial resource to buy material and resources as well as to cater for miscellaneous expenses during implementation of photovoltaic projects. Therefore, the study recommends that the projects managers should seek for financial resources through application of grants, donations and enhance their venture capital so as to ensure adequate financial resources available for purchase materials and cater for miscellaneous expenses.

Further, the study found out that project managers did not have relevant competency skills and knowledge on technological requirement for implementation of photovoltaic projects. Hence, this study recommends that the management of photovoltaic projects in Nairobi County should come up with appropriate training, career development and talent attraction programmes so as to enhance project managers' competency skills.

Furthermore, the study found that project managers provided clear reward scheme for every task completed on schedule. Therefore, this study recommends that the project managers in Nairobi County should tie bonuses to projects, reward staffs that meet their goals and provide heartfelt appreciation as a way of improving on photovoltaic projects' rewarding schemes.

Recommendations for Further Studies

The current research focused on determinants of implementation of photovoltaic power plants in Nairobi County. Therefore, the study recommends that further studies on determinants of

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implementation of photovoltaic power plants should be conducted in other counties in Kenya. Moreover, the study established that 78.6% of the variation in the dependent variable (implementation of photovoltaic projects) could be explained by the independent variables (project planning, project funding, project management skills and project leadership), thus, the study recommends that further studies should be conducted to assess other factors affecting implementation of photovoltaic projects.

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