FACTORS AFFECTING THE IMPLEMENTATION OF SOLAR TECHNOLOGY IN KENYA: THE CASE OF NYAMIRA COUNTY

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DECLARATION

Declaration by the student

This thesis is my original work and has not been submitted for any academic award in any institution; and shall not be reproduced in part or full, or in any format without prior written permission from the author/ or University of Eldoret.

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Declaration by the supervisors

This thesis has been submitted with our approval as the university supervisors.

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DEDICATION

This Thesis is dedicated to my lovely daughter Vellbridgitte Nyaboke Mandera for the great support and prayers during the research process.

ABSTRACT

Solar energy is an important source of energy in Kenya due to its renewable nature. The study endeavored to find factors affecting the implementation of solar technology in Kenya: the case of Nyamira county. The purpose of the study was to explore the factors affecting the implementation of solar technology in Nyamira County, Kenya. The study objectives were: to established how the influence of stakeholders' engagement affected the implementation solar technology, to find out how resource allocation affected the implementation solar technology, to assess how the use of technology affected the implementation solar technology, and to determine how the level of expertise affected the implementation of solar technology in Nyamira County, Kenya. The study employed purposive, stratified, and simple random sampling techniques to come up with a manageable study sample. Primary data was collected by use of questionnaires and interview schedules. Secondary data for the study was sourced from print media, journals, books, internet sources and online repositories. The study adopted the Resource Based Theory which states that the possession of resource is valuable, difficult to imitate and cannot be substituted. The collected data was analyzed using both descriptive and correlation analyzes. Correlation analysis was conducted to show the direction and strength of the variables in order to determine the relationship existing within the variables. Inferential statistics through regression analysis and ANOVA informed the hypothetical conclusions of the study. Data was analyzed using SPSS version 22. The results of the study were presented using tables, graphs, and charts. The study findings revealed that the: (1) engagement of stakeholders such as project teams, residents and government agencies were not fully involved; (2) resource allocation in project funding, implementation funds and security funds not inadequate; (3) technology was not adequately adopted; and (4) level of expertise with technical, human relation, and conceptual skills was inadequate in the implementation of solar technology. The study concluded that: for successful implementation of solar technology ought to involve stakeholders at every stage; adequate allocation of resources is required throughout the implementation process; adequate adoption of technology in solar installation, darkness sensing and automatic on/off sensors; and expert skills on technical, human relations and conceptual skills are key in the implementation of solar technology in Nyamira County, Kenya. The study recommends a further study to be conducted on the implementation of solar powered streetlights as a technology adoption mechanism in order to enhance building of the body of knowledge.

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LIST OF ABBREVIATIONS AND ACRONYMS

ANOVA	Analysis of Variance
CBET	Competency-Based Education Training
CECMs	County Executive Committee Members
ESP	Economic Stimulus Programmes
ICT	Information and Communication Technology
IoT	Internet of Things
LED	Light Emitting Diode
PV	Photovoltaic
SPSS	Statistical Package for Social Sciences
TVET	Technical and Vocational Education and Training
UNEP	United Nations Environment Programme

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

This chapter lays the foundation of the study by providing the background to the study, statement of the problem, purposes of the study, study objectives, research questions, and assumptions, scope, delimitation, limitations, justification and significance of the study. It also highlights the study's theoretical framework and conceptual framework. The study as well gave the operational definitions of some key terms used in the study.

1.2 Background of the Study

Solar technology remains one of the most credible mechanisms of harvesting the sun's rays and converting them into light energy. In addition, Gumbo (2013) indicated that the technology behind producing solar energy purely lies on the technical skills acquired by the technicians, funds allocated to such projects and the right involvement of all quarters of stakeholders.

Approximately 80% of all energy consumed in the world is utilized by the first twenty large economies commonly referred as G20 in 2010 (Schmidt & Haifly, 2012). About 16% of world energy consumption comes from renewables; with 10% from traditional biogas, used majorly for heating and about 3.4% from hydroelectricity. New renewable energy sources including small hydro, modern biogas, solar, wind, geothermal, and bio-fuels contribute about 2.8%. However, Gitone (2014) laments that solar technology has not been fully utilized to its optimal level due to insufficient solar technology training programs in the learning institutions.

Massachusetts Institute of Technology (2015) established that, in the global context, massive expansion of solar generation worldwide by mid-century is likely a necessary component of any serious strategy to enhance implementation of solar technology. In recent years, solar costs have fallen substantially and installed capacity has grown very rapidly.

In China, a study by Katyara *et al.* (2018) revealed that, the use of solar energy for both domestic and commercial through streetlights is a common feature. Solar technology has been seen as a major contributor that promotes security, safety, and comfort. Solar powered streetlights make it easy for crime to be detected and prevented in time. Under such circumstances, commercial prosperity is inevitable as a result of extension of marketplace time and increased productivity (Katyara *et al*., 2018).

Huang *et al.* (2007) investigated the design of solar powered LED lighting system on the highways and found out that the cost estimation of installing the project is high and there are few solar technicians to implement such projects. In addition, the researcher found that solar powered LED systems save 75% of the energy as compared to the mercury lamps. Lina *et al.* (2015) studied the uses of light emitting diodes (LED) in the public sector lighting system in Jordan. They analyzed the economic feasibility of roadway lighting system stretched out to 2 Km length with LED rated at 110W. It was established that power generation and transmission cost can be reduced significantly since LED helps to save around 75% of the green energy.

In Africa, implementation of solar technology projects street lighting remains a challenge since most of the street lights are powered by electricity (Hafner, Tagliapietra & De, 2018). A study carried out in Ghana established that despite the being a country that experiences high intensity of sunshine in West Africa, solar harvesting remains a challenge because of inadequate resource allocation that enable procurement and installations of solar panels (Asumadu-Sarkodie & Owusu, 2016). A similar study in Uganda showed that in Kampala, the capital of the country, it is only 8% of the city's roads and streets that are illuminated by solar energy (Meyer, Eberhard & Gratwick, 2018). The situation is mainly due to lack of political will and budgetary constraints. Ondieki (2016) notes that training based on solar technology implementation in TVET institutions is taken with low magnitude in many African countries.

Tsado *et al.* (2012) proposed a comparative analysis of street lighting powered by public electricity utility and through solar energy in Nigeria. They calculated the payback time of 20 years for suggested project in order to become economically feasible. It was found that although the cost of installing the solar powered LED lighting system is higher than that of the traditional lighting system, the new system helps to save about 60% of the energy. Xumei *et al.* (2007) investigated the performance of the solar powered city of Rizhao in China. They found that the use of solar energy in the city helps to save up to 3.8 billion KWh of electric energy every year. The solar street lighting system uses solar panels to convert light energy into electrical form, which is then stored into batteries. The batteries get charged during the day time and are discharged at night time to light up the street lamps when the sun is unavailable. Sensors are being installed to make the operation automatic. These sensors detect the sunlight and turn off the lamps. During the night time, they turn them on accordingly.

In Kenya, there is a limited use of renewable energy resources such as solar, wind, biomass, bio-fuel, geothermal and hydropower. Expansion of the sector is being catalyzed by the growing demand and cost of electricity, increasing global oil and gas prices and environmental pressure. In Kenya, biomass accounts to over 70% of total energy consumption. The other sources are petroleum and electricity, which account to about 22% and 9% respectively (Mwakubo *et al.*, 2007). Renewable energy is, therefore, an important means to meet the challenges of growing demand and addressing the related environmental concerns (Mwakubo *et al*., 2007; Keriri, 2013).

According to Gumbo (2013), the solar harvesting technology-based training is an important aspect that TVET institutions should teach. The life of solar PV systems may be short if they are not properly designed or installed. Many improper solar PV systems have been installed in many places in the world and they have stopped working within a very short time due to poor designs and installations.

Many parts of Kenya are also experiencing the same situations especially the rural areas where the on-grid electricity line is far from their homes. The solar renewable energy field especially in Kenya suffers a deficiency of skilled personnel qualified to design, install and effectively maintain modern energy systems. This problem can be solved by training many engineers and technicians to have the right knowledge and skills on solar PV systems technology (Keriri, 2013).

Solar technology related training offers the greatest formal source of congruent skills to technicians not only in Kenya, but also in the whole world (Keriri, 2013). Ondieki (2016) points out that technicians' level of expertise is beneficial in project implementation. He further notes that for proper implementation of any project and for realization of the project objectives, training is of paramount importance. However, Okeke (2014) disputes this opinion by stating that most of the technical institutes and vocational educational centers do not provide proper training offered to the technicians because of ineffective structures, lack of adequate finances, and lack of committed tutors in realizing the achievement of the universal role of the training.

According to Silva (2016), Kenyan solar photovoltaic (PV) market is often considered as a successful commercially driven market. Market spoilage due to poor quality service has significantly hindered market growth. For instance, solar PV systems are poorly designed and installed. There are about 800-1,000 solar PV technicians working in the Kenyan market currently. However, the majority have not undergone competency-based education training (Silva, (2016). These practitioners are meant to provide the necessary service to end-users as the demand for solar PV systems is high especially in rural areas of this country. The regulations have been developed with the intention of improving the delivery of design, installation and maintenance services within the solar PV sector in Kenya. The regulations require that only licensed technicians are allowed to design and install solar PV systems, and to be licensed, technicians must have undertaken a solar training course. Solar PV system training is important in skill acquisition thus promoting installation of street lights and their solar panels (Silva, 2016).

Nyamira is one of the Kenyan counties that have made a remarkable effort in the implementation of solar technology in line with the United Nations' policy on sustainable energy, and Kenya's Vision 2030 on elimination of energy poverty and enhancement of prosperity (Nyamira County ADP 2019/2020, 2018). The county has put in place a solar powered street lighting project in all its major towns and market centers. The project has led to the installation of 402 solar lights. Solar street lighting has helped to promote security, and it has driven the county into a 24-hour economy since it facilitates long business hours. Besides, remarkable efforts of implementation of solar technology, the uptake of solar technology remains below 5% (Nyamira County ADP 2019/2020, 2018). In addition, Ondieki (2016) retaliates in his study that inadequate training of personnel more often results to poor implementation of projects. Ondieki further alludes that, counties in Kenya such as Nyamira, Homa Bay and Migori have suffered a blow of implementation of projects due to poor training of her personnel.

The installation of solar powered street lights in Nyamira is done by technicians and engineers hired by the county government. Some of these experts are graduates of the county's many TVET institutions, including Ekerubo Gietai Technical Training Institute (TTI), Gitwebe TTI, Gesima Vocational Training Centre, and Nyamira Engineering and Commercial Training College (Nyamira County ADP 2019/2020, 2018). Previous studies by (Gumbo, 2013; Gitone, 2014; Silva, 2016 & Ondieki, 2016) show that both TVET institutions and universities play a vital role in the implementation of solar technology by providing hands-on skills to the students, thus increasing their capabilities of solar installation for solar energy projects. Therefore, this study sought to find out the factors affecting the implementation of solar technology in Nyamira County, Kenya.

1.3 Statement of the Problem

Nyamira County is experiencing increasing demand for solar energy due to energy demand. The demand for utilization of solar energy in streets, homes, institutions and commercial places has continued to pose pressure on the implementation of solar technology projects. Many technicians graduate from various colleges in Kenya every year. Besides, a study by Gitone (2014) espouses that, most of them are incompetent due to the ineffectual tertiary education system in the country that is largely based on theory rather than practical aspects of knowledge, which creates a huge gap in the implementation of solar technology. In addition, technicians with relevant skills and technical competencies in the areas of design, installation, and maintenance undergo challenges due to lack of adequate resources, inaccessibility of physical infrastructure, and lack of political goodwill, this is anticipated to yield to poorly implemented solar technology projects.

Despite the government resorting to heavy investment in TVET institutions, these institutions have not yet reached the threshold of equipping learners with important technical skills that are required in the current job market and efficient implementation of solar technology projects. This study sought to analyze how stakeholders' engagement; resource allocation; use of technology and level of expertise affects the implementation of solar technology in Nyamira County, Kenya.

1.4 Purpose of the Study

The purpose of this study was to explore the factors affecting the implementation of solar technology in Nyamira County, Kenya.

1.5 Main objective

The main objective of the study was to investigate the factors affecting the implementation of solar technology in Nyamira County, Kenya.

1.5.1 Specific objectives

The following specific objectives were used in this study:

1. To establish how stakeholders' engagement affect the implementation solar technology in Nyamira County, Kenya;
2. To find out how resource allocation affects the implementation solar technology in Nyamira County, Kenya;
3. To assess how the use of technology affects the implementation solar projects in Nyamira County, Kenya;
4. To determine how the level of expertise affects the implementation of solar technology in Nyamira County, Kenya.

1.6 Research Questions

This study sought to provide answers to the following questions:

1. How does stakeholders' engagement affect the implementation of solar technology in Nyamira County, Kenya?

2. How does resource allocation affect implementation of solar technology in Nyamira County, Kenya?
3. How does the use of technology affect implementation solar projects in Nyamira County, Kenya
4. How does the level of expertise influence the implementation of solar technology in Nyamira county, Kenya?

1.7 Assumptions of the Study

The study was based on the assumption that all the target respondents would be readily available during the study period, and would be easily accessed whenever needed. It also be assumed that all items designed for the study and the research instruments be understood with ease by the target population in order to prompt the right response.

1.8 Scope and Delimitations of the Study

This study was confined to the Nyamira County Government boundaries. Nyamira County government is one of the forty-seven counties of the republic of Kenya provided in the Constitution of Kenya 2010. The study was carried across the 5 sub-counties that include: Nyamira North, Nyamira South, Manga, Borabu and Masaba North in Nyamira County.

1.9 Limitations of the study

This study had some limitations as follows:

i. Time constraint was likely to limit data collection.
ii. Due to their busy schedules, some respondents returned partially completed or unfilled questionnaires.

iii. The researcher was not be able to come up with a comprehensive study as a result of lack of financial resources.

iv. Since the study specifically deals with the implementation of solar energy, its findings would not be applicable in the implementation of other forms of technology.

1.10 Justification of the Study

The implementation of solar technology has not been well embraced in most of the county governments in Kenya. The completion of this study therefore contributed to the already body of knowledge in Kenya. A few County governments, Nyamira County being among them, have embraced the concept of solar technology training in an attempt to boost skill acquisition and technical competency for technicians thus promoting implementation of solar technology using solar as an alternative source of energy. This study therefore is timely as the findings provide relevant facts to the policymakers both in the national and counties to help in formulation of effective strategies and policies that could enhance implementation of solar technology in order to improve security, source of alternative energy and boost a good 24 hours business economy in Nyamira County, Kenya. Findings of this study were documented to provide future reference to researchers and scholars.

1.11 Significance of the Study

The study is important because it informed the county management, scholars and other researchers about the factors affecting implementation of solar technology not only in Nyamira but also in Kenya as a whole. This study also anticipated to boost the business communities to engage their business throughout a 24 hours economy. Moreover, the study was significant to various stakeholders like investors, leaders of the county and national government can be able to appreciate the contribution of stakeholders' engagement, resource allocation, use of appropriate technology and technicians' level of expertise on implementation of solar technology in not only the county government system but also in the national level of government.

1.12 Theoretical Framework

According to Thomas (2007), a theory is a contemplative and rational type of abstract or generalized thinking or the results of such thinking. Theories guide individuals in findings facts rather than reaching goals and are neutral concerning alternatives among values. This study was guided by the Resource Based Theory. Resource Based Theory was developed by Philip Selznick in 1980. The resource-based model is based on the understanding that organizational resources and capabilities can vary significantly. For successful implementation of projects, resources are key in any intervention. Resources entail: human resource, financial resources, materials and most important time as a resource. Effective utilization of resources in the implementation of projects leads to project success (Ondieki, 2016).

Resource Based Theory espouses that although resources are insufficient, optimal utilization to avoid wastages is a success factor of competitive advantage. Examining the Resource Based Theory in detail, Wanyonyi and Muturi (2017) affirmed that, having a higher competitive advantage in firms tend to create a sense of confidence in organizations regardless of the financial support available. The resource-based view in outsourcing builds from a proposition that an organization that lacks important, uncommon, unique and organized resources and capabilities tends to seek external providers in order to overcome that weakness (Atoni, 2018). Stakeholders desire to be involved in projects that have the resources available well managed. Outsourced resources increase the cost of the entire project. Thus, stakeholders can only be convinced that the project managers are working towards the achievement of the project goals at minimum costs for maximum utility and benefit.

The technicians are important human resources for successful implementation of the project. In order to avoid the outsourcing of external experts which may end up being costly to the organization, there is need to establish more TVET institutions in the county to dispense the right knowledge regarding solar technology. These organizations can probably help to equip technicians with relevant competence-based education and training for successful design, installation, and implementation of the solar technology projects. Resource Based Theory was applied in this study to assist the researcher emphasize on the importance of ensuring that technicians as human resources are well trained to become competent in the implementation of solar technology.

The competence can be measured by the performance and success of the solar powered technology projects.

1.13 Conceptual framework

The researcher adopted a conceptual framework in order to come up with a comprehensive overall idea of the factors affecting the implementation of solar technology in Nyamira County, Kenya. The framework in figure 1 shows the interrelationship between different variables in a diagrammatic expression.

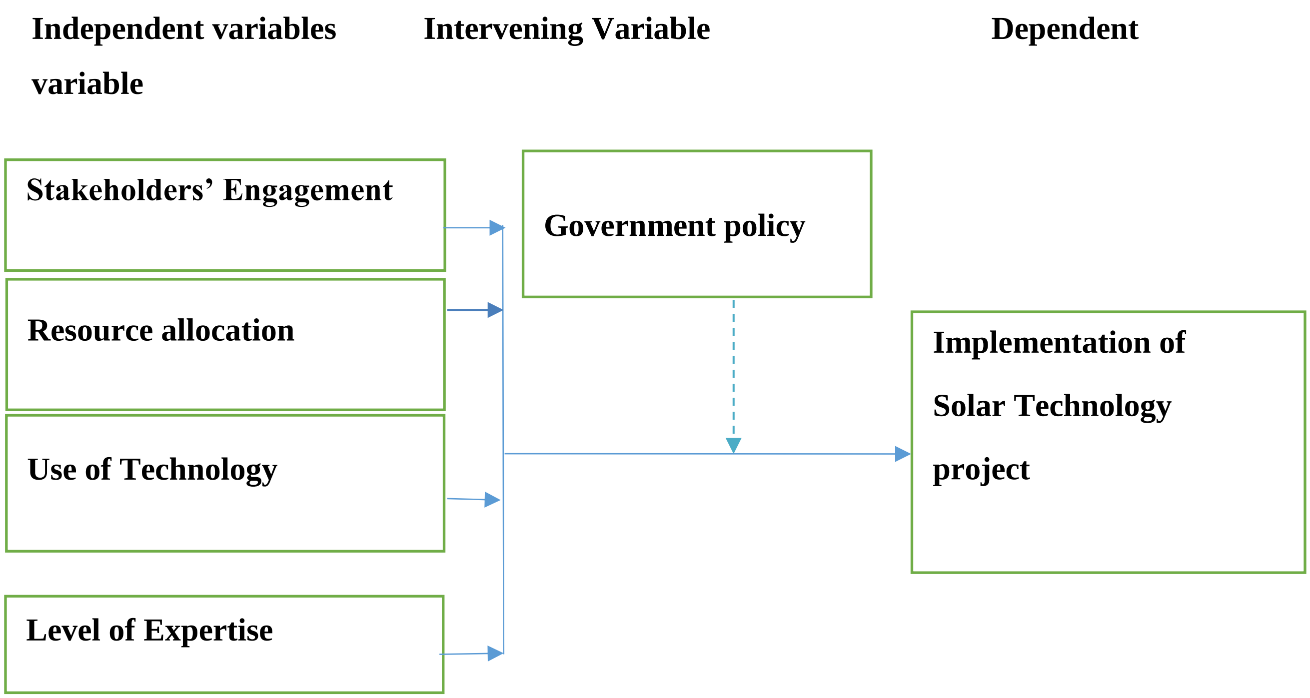

Figure 1: Conceptual framework

Stakeholder engagement including project team, residents and government agencies needs to be involved throughout project process. Project implementation therefore should not leave out the involvement of such essential organs if successful implementation was to happen.

Implementation of projects comes with a cost. Project Funding, Implementation Funds, Security Funds anticipates to play a critical role in the implementation of solar technology.

Technology used, serves as a cornerstone of any project implementation process. The effective use of technology through; Installation technology; Automatic On/Off technology; and Darkness Sensing technology served as good avenue toward fostering the implementation of solar technology projects

The level of education of the project implementors is anticipated to have an influence on the implementation of solar technology projects. Implementors' of any projects needs to have technical, human relations, and conceptual competencies remains key in realization of project outcomes.

1.14 Operational definition of terms

Competence-Based Education Training: Refers to an approach of inputting skills to the learners so as to boost their ability to execute tasks in order to promote performance and effective implementation of projects (Anane, 2013).

Implementation: Refers to execution of tasks with regard to the project requirement (Silva, 2016).

Solar Technology: Refers to innovation to the process of using solar panels to harvest sun rays and convert them to energy (Keriri, 2013)

Project: Is a temporal endeavor that has specific time to start and time to end (Ondieki, 2016).

Use of Technology: Refers to the application of scientific knowledge, tools, techniques, and systems to create, innovate, improve, or enhance various aspects of human life, industry, communication, and problem-solving (Ondieki, 2016).

Resource allocation: Resource allocation in the context of solar technology refers to the strategic distribution and utilization of various resources, including financial, human, technological, and material resources, to effectively plan, develop, and implement solar energy projects and initiatives (Ayuka, 2017).

Stakeholder engagement: Stakeholder engagement is the process of involving and interacting with individuals, groups, organizations, or entities that have a vested interest or are affected by a particular project, decision, policy, or initiative. It aims to foster communication, collaboration, and the exchange of information, feedback, and perspectives between the stakeholders and the party responsible for the project or decision (Gitone, 2014).

Level of expertise: Refers to the depth and breadth of knowledge, skills, and experience possessed by an individual or a group in a particular field, subject, or domain. It indicates how proficient and capable someone is in understanding, analyzing, and solving problems related to that area (Atoni, 2018).

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter covers the review of various studies containing relevant information on implementation of solar technology projects. It also tries to examine the factors such as stakeholder engagement, resource allocation, use of technology and technicians' level of expertise affect the implementation of solar technology. The chapter reviews empirical studies undertaken on the subject for the purpose of comparisons with the current study.

2.2 Overview of Implementation of Solar Technology

Implementation of any project requires adequate funding, involvement of stakeholders to be either directly or indirectly in the projects, adopt best technology and use of best gained skills in order to ensure that the project is delivered (Nyamu, 2015). According to Ngeny and Moses (2015), it is widely accepted that the active Solar Energy Systems (photovoltaics, solar thermal, solar power) provide significant environmental benefits in comparison to the conventional energy sources, contributing to the implementation of the human activities. Electricity production in Kenya today highly depends on imported energy, namely natural gas and fuel oil, while the country operates below 1350MW instead of the required 15,000MW as at today. In the period of between 2008 to 2020, annual electricity demand growth is expected to be (5.5%). This further increased the burden on Kenya's economy as well as the dependence on international fuel prices.

Statistics projections show that as of the year 2019, solar energy contributed to only 1.77% in the generation of electric power (Mwakubo *et al*., 2007). This figure demonstrates that the implementation of solar energy in Kenya is still at its infancy. Studies also reveal that implementation of solar technology is not an easy path (Keriri, 2013). Keriri further points out that, implementation of solar technology needs proper allocation of resources such as finances, human resource, effective technology and effective scheduling of activities within the project intervention.

Solar technology gives rise to solar energy which may be used for lighting or heating. In the implementation of solar technology projects, the solar street light does not need to set up the transmission line or route cable, and no special management and control are required. It can be installed in the entire public place such as the square, the parking lot, the campus, the street or the highway etc. The street lighting is closely related to people's daily life. Following quick development in process of the global urbanization, the green, efficient, and long-life LED light gradually enters into our lives (Shiquan, 2012). The design and installation of solar technology for street lights requires well qualified technicians.

2.3 Stakeholder Engagement and Implementation of Solar Technology

Stakeholders play a crucial role in the implementation process of projects. A study carried out by Nyamu (2015) shed light that, generally projects attract quite a big number of stakeholders, for instance: project managers, technicians, contractors, and residents who come from that particular area where the project was be implemented. At times, progress is delayed waiting clearance from stakeholders thus their involvement does affect implementation of the projects. Kamotho (2014), connotes that there are many stakeholders involved in property development with each having different interests. The ultimate goal in project development is the successful implementation of these projects. Stakeholders include the government, developers, financiers, buyers, lessees, consultants, labourers, amongst others. Each party is affected by project failure in different ways. Property development as discussed earlier plays a pivotal role in a country's economy hence its importance.

Lack of stakeholder involvement frustrates the overall implementation process (Ondieki, 2016). In addition to related studies based on stakeholder engagement by Osedo (2017) established that the majority (26%) of the respondents enjoyed a very good relationship with project stakeholders. 18% of the respondents indicated that they had a good relationship with project stakeholders. 24% of the respondents indicated that they had a relatively good relationship with project stakeholders. 20% of the respondents indicated that they had a bad relationship with the project stakeholders while 12% of the respondents indicated that they had a very bad relationship with project stakeholders. The study results showed organizations still need to work on improving the stakeholder relationship. He further concluded that stakeholders' engagement is a crucial aspect in project implementation interventions.

Nyaguthii and Oyugi (2013) had established that participation of stakeholders in project implementation influenced success of the project implementation process. The challenges stated by the study are imperfect project design, poor stakeholder management, delays between project identification and start-up, delays during project implementation, cost overruns and coordination failures. The research established a positive relationship between stakeholder participation in project planning, project implementation and participation in project monitoring, evaluation and success of the ESPs. Nyaguthii and Oyugi (2013) recommended that project facilitators clearly identify and train project stakeholders before initiation of similar programmes to aid in the success of the overall programme. Gituthu (2015) established a need to involve project stakeholders in the development of ICT solutions in the construction industry. (Osedo, 2017). Maina (2013) noted in his study, that stakeholders' engagement in implementation of Economic Stimulus Programmes (ESP) influenced the success of education projects in Nakuru County.

According to Abdallah (2017), thought that even though, minor decisions and emergency situations are generally not appropriate for stakeholder participation, a complex situation with far-reaching impacts warrant stakeholder involvement and when done proactively, rather than in response to a problem, helps to avoid problems in the future (Maina, 2013). The focus of public participation is usually to share information with, and gather input from, members of the public who may have an interest in a project. The Constitution of Kenya 2010 gives citizen the right to take part in activities that have a direct bearing on their lives (Mbaabu, 2012). In the context of development, community participation refers to an active process whereby beneficiaries influence the direction and execution of development projects rather than merely receive a share of benefits. Stakeholders' involvement is paramount in development projects. Becerik (2007), extrapolates that if the project meets practical performance and achieves high level of contentment among key players and various stakeholders, then the project is considered as overall success.

In addition, he further adds that, to overcome the risk associated with non-involvement of stakeholders during the implementation process, the public infrastructure project should have a mechanism in place that ensures that a participatory planning process is in place and involves all those that the project affects directly and indirectly. Perceived non-involvement of stakeholders creates anxiety among the stakeholders and especially those directly affected by the project and may lead to total rejection of the project. It was of high importance to involve the stakeholders early in the project stages to ensure that they own and defend the project (Onyango, 2017).

According to Ram (2014) in every stage of implementation of solar technology for lighting and heating require stakeholders' engagement. Ram indicates further that right from initiation of the project up to fully functioning street lighting projects stakeholders ought to be involved in order to enhance project integration and reduce resistance by the residents on the implementation of that project. Moreover, Solar Street Lighting Technology is a renewable energy solution used for illuminating road, pathway, parking place or other similar outdoor areas. A standalone SSL system is an outdoor lighting unit used for illuminating a street or an open area, and having no connection to the local electricity grid. Solar Panel or Solar Photovoltaic (PV) Modules convert solar energy into electricity, which is stored in the battery via a solar charge controller. The Solar Light (preferably an energy efficient LED) works during night times automatically by incorporating a light-sensor control, and provide light during evening and night hours only. Moreover, solar technology results to harvesting of sunrays through the use of solar panels. The harvested solar energy is then stored in the accumulators which are then connected to heaters and cookers (Ram, 2014). Successful implementation of any project requires divine involvement of the stakeholders (Ayuka, 2017).

2.4 Resource Allocation and Implementation of Solar Technology

Project implementation requires funds in order to ensure that activities are properly undertaken and coordinated. Funding is the backbone of any project implementation undertaking (Ondieki, 2016). In addition, a study conducted by Nyamu (2015) found out that project implementation can be greatly affected by delayed funding, stakeholder demands, expectations as they occasionally caused long delays, beyond the control of the implementing agencies. Other factors that influenced completion of the projects include inadequate funding, complicated government procurement procedures, lack of proper planning, contractor operations procedures and poor supervision. The projects are initiated, designed and planned and implemented. Project inputs that facilitate the execution of the county construction projects are in form of funds they get from the project financiers.

Project finances are supposed to be used effectively to enable successful implementation of the county construction projects (Osedo, 2017). In furtherance to the issue of funding of project and their implementation, Abdalla (2017) points out that, many infrastructure projects fail to be implemented due to factors like time in efficiency, financial constraints and lack of political will. It was against this background that the study sought to investigate how project managers' competency, community participation, project certification and project funding affects implementation of projects in Kilifi County. In addition, studies show that funding is the act of providing economic resources, usually in the form of money, or other values such as effort or time, to finance a need, program, and project, usually by an organization or government (Gyula, 2008; & Jackson, 2010). Usually, this word is used when a firm uses its internal treasury to satisfy its necessity for cash, while the term financing is used when the firms acquire funds from external sources (Gyula, 2008). Jackson (2010) added that project funds availability is an important factor that influences delivery of a project.

The county government plays a fundamental function in county development projects' funding, initiation, implementation and management. It provides the enabling policy and legal environment for the regulation of funds and the procurement of goods, works and services. The government may create the need to participate in information sharing platforms to discuss development progression in their counties. Studies show that most donors including the national government gives restrictions to their funding including, among others, sound financial management systems in place, good leadership with integrity, educated staff with experience and the strategic plans of the county governments. County Governments without the requirements cannot attract donors and national government for funding in some projects. Specific donors assess the capacity of the organization's systems and structures to handle funds before funding them. The delivery of project activities in terms of time taken, affected how allocation of funding influenced the rate of implementation of development projects. The allocation of funds in Kilifi County Government influences the rate of implementation of development projects. This is evidenced by the data collected and analysed regarding the allocation of funding. The allocation of funds affects the rate of implementation of development projects with neutral extent to a great extent (Ali, 2012; Abdalla, 2017).

Wanyonyi (2017) connotes that, in line with project management, undergo transformation. The projects inputs are in form of funds they get from the County Government Ministry of Finance and Planning. The funds are supposed to be implemented in order for the projects to be successfully completed. The outputs as illustrated by the project management theory are exemplified by the completed County Government projects. However, it is noted that there is minimal involvement of the community in the allocation of the county funds to selected projects, and that existing structural weaknesses could possibly help to explain the existence of otherwise of transparency in allocation and utilization of the county fund specifically those allocated to development activities. Thus Busiinge (2010) alludes that county assemblies need to demand for county governments' accountability. Proper accountability, timely and adequate funding greatly influences successful implementation of projects. Proper legislation on how counties should promote competence-based education training for technician should be instituted in order to promote skills that are relevant in return profitable in the implementation of solar technology.

2.5 Use of Technology and Implementation of Solar Technology

In day-to-day life, technology is taking center in the implementation of many projects (Ondieki, 2016). Solar technology is also not left out as an innovative measure in ensuring that there is an alternative source of energy commonly in form of home lighting, heating and street lighting (Ayuka, 2017). The advantage of solar technology in street lights lies within the fact that it helps to save energy compared to other conventional sources of energy. It is also important to note that unlike electric power, solar power is highly reliable (Smith, 2012). Photovoltaic technology offers an affordable solution for power supplying the light points, making it easy to obtain electricity in many developing countries and places (Primiceri & Visconti, 2017).

In their study on Solar-Powered Led-Based Lighting Facilities: An Overview on Recent Technologies and Embedded IoT Devices to Obtain Wireless Control, Energy Savings and Quick Maintenance, Primiceri and Visconti (2017) revealed that technology serves a critical role in implementation of solar technology street lighting projects. Moreover, LED lighting is projected to reduce related energy consumption of 15% in 2020 up to 40% in 2030; in this contest, solar-powered LED lighting facilities offer a significant contribution to obtain energy savings, together with substantial environmental and health benefits. Last innovations in nanotechnology and quantum physics have the potential to strongly increase the electrical power obtained from solar panels for feeding any portable device. Furthermore, the spread of Internet of Things (IoT) and the huge use of smartphones and related apps allow wirelessly to control and drive the LED based lighting systems, that also can be provided with integrated sensors thus realizing new functionalities, an improved management of energy and new services for smart cities (Primiceri & Visconti, 2017).

Solar technology in solar powered street lights have transformed from the manual way of lighting to automatic darkness sensing technology by adding wireless controls to monitor and drive lighting system integrated with sensors, LED street lights act as a wireless mesh communication network that would have a prohibitive cost if realized separately. Detected data are sent to a centralized control unit which can be used to provide to city staff useful information and to ensure appropriate site control for police officers activity. Thus, the street light poles could become the ideal platform for adding environmental sensors and security infrastructures, such as a cameras or acoustic sensors to detect, for example, gun shots cackles or cries of alarm in real time, and thus alerting the police staff (Priyanka *et al*., 2015; Saleem *et al*., 2015).

Solar street lights project ought to be grounded on technological innovations. Technological developments in the last two decades have allowed LEDs to be used first in signal devices, like traffic lights and exit signs, then in some limited illumination applications, such as flashlights, and now for many general illumination applications, from houses to commercial spaces up to outdoor lighting (Visconti *et al.,* 2016; Costantini *et al.*, 2011). However, still technological shortfalls for instance, use of inappropriate technology; vandalism of solar technology infrastructure and high cost of installation of such solar projects remains a challenge not only in the counties but also in the developing countries (Ayuka, 2017).

2.6 Level of Expertise and Implementation of Solar Technology

Implementation of solar technology project requires technical skills, human relation skills, and financial skills that are key in any project intervention. They execute tasks, coordinate activities through an overall guidance of a project manager. Project teams and project manager should have skills relevant to the project being undertaken, which are skill oriented (Ondieki, 2016). Kagendo (2013) adds that as project progresses, project team understands the steps to follow, deliverables and way of executing them much better. Based on this knowledge team members elaborate initial draft plans and execute next phase of the project based on these detailed plans. For major projects it is necessary sometimes to set up a special temporary organization, consisting of a project team and one or more work teams (Flaman & Gallagher, 2001). Major projects can be divided into sub-projects, and program denotes collection of related projects. Implementation is the stage where all the planned activities are put into action. Before the implementation of a project, the implementers which are spearheaded by the project committee or executive should identify their strength and weaknesses including internal forces, opportunities and threats which include external forces.

A study by Ng'eno (2014) established that, 84.7% of the household heads have seen solar power in use; Most of them 74% have seen solar lamps. Awareness of the existence of solar technology in lighting is high in the community although, 79.7% of the household heads indicated they have never received any formal or informal training on solar systems, 91.4% of the 20.3% who indicated they have been trained up to the certificate level on solar systems by the Service providers. The study concluded that knowledge and awareness of the availability of solar technology has positive effect on implementation on solar. This implies that the level of knowledge based on solar installation in the country is poor thus prompting for enhanced training by the technical institutions to provide training relevant to solar technology. A studies by Wambugu (2016) have shown that, the most important issue to take care of is to assign completed projects to staff members, preferably those with monitoring and evaluation skills. It is essential to instil skills and a sense of ownership among team members, especially of those projects which are completed.

According to Ondieki (2016) Level of expertise include: firstly, technical expert level which is the team that handles technical issues and implements the project to its entirety, this level is important in ensuring that solar panels are properly fixed to relevant accumulators, fix all technical aspects of the solar lighting and heating. Secondly, Human relations expertise refers to a type of expertise that ensures human resource is properly guided and human relation issues like workplace safety, salaries, and motivation is properly instated into the project in order to realize success. Lastly, conceptual expertise level refers to the team that brings out the concept about any particular project and it sets a framework or policy on how the project are implemented.

2.7 Knowledge Gap

The literature that was reviewed in this study is from different authors originating from different countries whose strategic approach and strategic footing is different from that of Kenya. A study by Ondieki (2016) based the arguments on the overall implementation pattens but it did not single out to solar technology. On the same note, Ng’eno (2014) centered his arguments on effectiveness of solar technology, little on implementation of solar technology was revealed by Ng’eno. Therefore, studies conducted in Kenya have not fully looked at the factors affecting the implementation of solar technology in Nyamira County. Thus, the researcher finds an enormous research gap on the same. Implementation of solar technology remain a great gap since literature from different authors have not clearly reviewed the implementation aspect with regard to solar technology. It is this particular knowledge gap that the current study seeks to fulfill.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter describes the methodology that was used to carry out the research to provide answers to the research questions. The chapter covered the research design, sampling procedure, data collection methods, validity and reliability of research instruments, methods of data analysis, operational definition of variables and ethical issues.

3.2 Research Design

Orodho (2003) defines research design as the scheme, outline or plan that is used to generate answers to research problems. It can be regarded as an arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance with the study purpose. It constitutes the blue print for the collection, measurement and analysis of data. According to Mugenda and Mugenda (2003), its objective is to know the characteristics of the population in terms of population frame, sample size, sample selection and estimation methods. This study employed a descriptive research design because it best describes the existing phenomena. The design is useful in obtaining an overall 'picture' as it stands at the time of the study.

3.3 Target Population

The target population in this study consisted of employees from the departments that are likely to be affected by the implementation of solar technology in Nyamira County, Kenya: Transport, Road and Public Works, Agriculture, Livestock and Fisheries, Education and ICT, Gender, Youth, Sports, Culture and Social Services, Environment, Energy and Natural Resources, Lands, Housing and Physical Planning, Health Services and contractors who have once worked with the county government. The Transport, Road and Public Works comprised of 70 employees, Agriculture, Livestock and Fisheries comprised of 90 employees, Education & ICT comprised of 120 employees, Gender, Youth, Sports, Culture and Social Services comprised of 80 employees, Environment, Energy and Natural Resources comprised of 30 employees, Lands, Housing and Physical Planning comprised of 60 employees, Health Services comprised of 100 employees. There were also 10 contractors who once worked with the County Government. Therefore, the target population of the study comprised of 550 employees and 10 contractors. The targeted population of this study is believed to have experience and knowledge in the area of study in the factors affecting the implementation of solar technology in Nyamira County.

3.4 Sample Size and Sampling Procedure

Mugenda and Mugenda (2003) suggest that for descriptive studies, a sample size of 10% to 30% is enough for accessible population that is less than 10,000. This study used the sample size of 10% of the 560 participants which results in the sample size of 56 respondents. The sampling design that was used for the study is purposive stratified and simple random sampling technique where the population was divided into homogenous strata of county staffs of various departments, and contractors as indicated in Table 3.1. Thereafter, simple random sampling method was used to select the required sample in order to give every member of the population an equal chance of being selected and therefore, avoiding selection bias.

Table 3. 1: Sample size

Categories	**No. of Employees**	**Sample Size**
Department of Transport, Road and Public Works	70	7
Department of Agriculture, Livestock and Fisheries	90	9
Department of Education & ICT	120	12
Department of Gender, Youth, Sports, Culture and Social Services	80	8
Department of Environment, Energy and Natural Resources	30	3
Department of Lands, Housing and Physical Planning	60	6
Department of Health Services	100	10
Contractors	10	1
TOTAL	**560**	**56**

3.5. Instruments of Data Collection

The choice of data collection instruments is crucial to success of a research. The researcher took into account the complexity of the topic, response rate, time and targeted population. Instruments of data collection were questionnaires and interview schedule

3.5.1 Questionnaire

According to Kothari (2004) a questionnaire is a document that consists of some questions printed in a definite order on a form or set of forms. There are three basic types of questionnaires; close-ended, open-ended or a combination of both. Close-ended questionnaire is used to generate statistics in quantitative research while open-ended questionnaire is used in qualitative research, although some researchers may quantify the answers during the analysis stage. This study used both closed-ended questionnaires and open questionnaires to collect data. The questionnaire–encompassed the Likert scale constructs with a scale range of 1-5 where each participant was required to rate each statement given in the description of a given variable. In the scale, the analysis represented was; 5=Strongly Agree, 4=Agree, 3=Neutral, 2= Disagree and 1=Strongly Disagree. At the end of each Likert scale questions, open-ended questions were included to allow respondents give additional information. Mugenda & Mugenda (2003) opine that questionnaires are easy to analyze, easy to administer and economical regarding time and finances hence the researcher's preference.

3.5.2 Interview Schedule

Kombo and Tromp (2009) define an interview schedule as questions asked orally and avails information which would otherwise not be availed by other data collection instruments. Semi- structured interview questions were administered to county CECMs (Education and ICT; Health services; and Agriculture, Livestock and Fisheries), county Directors (Environment, Energy and Natural Resources; Transport, Road and Public Works; and Lands, Housing and Physical Planning) who were the senior management staff in Nyamira County. The questions in the schedule were suitable to the researcher since precise information was given by the interviewees.

3.6 Methods of Data Collection

Data was collected from the identified respondents using questionnaires distributed by the researcher. The researcher asked the respondents the questions in the questionnaire in the order in which they were listed and recorded the replies in the spaces meant for the same. To avoid interviewer bias when administering and translating the questions to the respondents, the researcher first inducted the respondents on the data collection instrument and the questions, ensuring that they had common understanding.

The questionnaire that the researcher administered had 2 parts namely: Part I which entailed Demographics and Part II which contained specific objectives. The structured sections of the questionnaire contained a five-point Likert scale rating indicated thus: (1) Strongly agree (2) Agree (3) Neutral (4) Disagree (5) Strongly disagree respectively.

3.6.1 Pilot-testing of the Research Instrument

Pre-testing of the instrument was done in Kisii County with 6 respondents of which each stratum gave a single respondent. The subjects of the pretest encouraged to give suggestions concerning the instructions, clarity of the questions, and sensitivity of the questions and flow of the questionnaire. The pilot testing was done with 6 respondents who constituted 10% of the sample size which is within the range of 10% to 20% of the sample size as noted by Kothari (2006). Upon receiving pilot questionnaires together with the suggestions and comments by the respondents, the questionnaire was reviewed to find out the comprehension and suitability of the wordings used, the sequencing of the questions and the time taken to complete each questionnaire. The study of the completed pilot questionnaires was an indication of the reliability of the instrument through the responses received on factors affecting the implementation solar technology.

3.6.2 Validity of the Research Instrument

Validity of a questionnaire refers to the extent to which it measures what it claims to measure (Mugenda & Mugenda, 2009). It is the degree to which results obtained from the analysis of the data actually represent the phenomena under the study. To improve validity, the instrument was pilot-tested with 6 respondents from each stratum, namely the department of Transport, Road and Public Works, Agriculture, Livestock and Fisheries, and Education & ICT before wider distribution.

In this study, the researcher will typically employ a combination of these validation methods (content validity and construct validity). Validity will be achieved through continually assessment and refining of the research instruments to ensure that they are measuring the intended constructs accurately. Additionally, reporting the steps taken to establish validity will be essential in research publications to provide transparency and allow readers to evaluate the quality of the research.

3.6.3 Reliability of the Research Instrument

Mugenda and Mugenda (2009) define reliability as a measure of the degree to which a research instrument yields consistent results or reliability of a research instrument refers to the extent to which the instrument consistently measures what it is intended to measure. In addition, it assesses the consistency and stability of the measurements obtained using the instrument. High reliability is essential for valid research because it ensures that the instrument provides consistent results across multiple measurements or over time.

The researcher employed Test re-test method by issuing the questionnaire to the 6 piloted respondents on two occasions. After one week, the instruments will re-tested with the same group from Kisii County; in this case, respondents will be issued with the questionnaires that had been fine-tuned to ensure there was uniformity in responses as compared to earlier tests. The re-test feedbacks will be found to be the similar and the instruments will be readily used for the actual study.

Berg (1998) exemplary notes that the use of consistent and systematic line of questions for even unanticipated areas is particularly important for reliability, and for possible replication of a study. The researcher used consistent and systematic questions in the questionnaires. The questions were related to the subject of the study. Of key importance, instruments should be initially piloted to small numbers of respondents to verify whether the questions are easy to understand, appropriate to the research topic, and unambiguous (Fellows and Liu, 2003), and to gain some idea of the time required to administer the questionnaire. It is also important to get feedback and input on other important issues that may be worthy of consideration, that the initial instrument may have missed. This also gives the researcher an indication of whether the instrument is measuring the right concept, hence its validity and reliability (Ayuka 2017). The Cronbach's alpha (α) will be used to statistically measure internal reliability of the research instrument by quantifying the degree to which items within an instrument and correlating with each other. Internal consistency reliability is a measure used in research to assess the consistency or reliability of a research instrument, such as a survey or questionnaire, by evaluating how closely related a set of items or questions are to each other within that instrument. It indicates the extent to which the items in the instrument are measuring the same underlying construct or concept. Besides, it assesses whether the items in the instrument are internally consistent or whether they provide consistent responses. If the Cronbach's alpha (α) is greater than 0.7 it will indicate of good internal consistency, suggesting that the items in the instrument are measuring the same construct consistently.

The results of the reliability test revealed is shown in the table 3.2

Table 3. 2: Reliability of Research Instrument

Variable	Cronbach's Alpha
Stakeholder's engagement	0.72
Resources allocation	0.71
Use of technology	0.78
Level of expertise	0.81

From the data in Table 3.2, the coefficient of alpha for all variables was above 0.7. It therefore meant that the instruments were strong and consistent in measuring the phenomenon under investigation.

3.7 Data Analysis and Interpretation

The study generated both quantitative and qualitative data. Data cleaning was done before analysis, which involved removing any cases that were outside the inclusion criteria and identifying responses that were improbable (outside the normally expected range) or impossible. During analysis, cross-tabulations was used to establish relationship between variables. Both descriptive and inferential statistics were utilized to address the objectives of the study.

Descriptive statistics helped to compute measures of central tendencies and measures of variability to determine how independent variables affect the dependent variable. While inferential statistics (correlation) was used in the study to establish the relationship between the dependent variable and the independent variables. Both descriptive and inferential statistics were utilized to address the objectives of the study. Qualitative data was transcribed and analyzed using Content analysis based on analysis of meanings and implications emanating from respondent's information. Content analysis entailed examining qualitative responses from individuals to establish cross cutting themes and attributes that are not dependent on absolute numbers. Responses with common themes were grouped together into coherent categories to establish a framework of thematic ideas. Thematic analysis was done by examining and recording themes/patterns across data sets that are important and associated to a specific research question. Finally, aggregation of the summary themes into major qualitative findings to corroborate quantitative findings was done.

3.8 Ethical Considerations

The researcher obtained permit to execute this study from the Ministry of Education, Science and Technology, Nyamira County education, after authorization from school of graduate studies in University of Eldoret. The researcher also sought for consent from the respondents before they participated in the study and participation in the study was voluntary. Objectives of the study was explained to the respondents with assurance that the data provided was to be treated with utmost confidentiality and privacy and would only be used for academic purposes.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, INTERPRETATION AND DISCUSSION

4.1 Introduction

This chapter details the questionnaire response rate, general information of the respondents, interpreted and discussed descriptive and inferential statistics on implementation of solar technology projects in Nyamira County, Kenya; stakeholders' engagement; resources allocation; use of technology and level of expertise.

4.2 Questionnaire Return Rate

A total of 56 questionnaires were administered to the target respondents, 50 were returned by the respondents. According to Mugenda and Mugenda (2009), a response rate of 50% is adequate for analysis and reporting, a rate of 60% is generally good while a response rate of above 70% is excellent (Ekal, 2016). Therefore 89.3 per cent return rate in this study was excellent for conclusive arguments. The findings are presented in Table 4.1

Table 4. 1: Questionnaire Return Rate

Questionnaires	Frequency	Percentage
Retained	6	10.7
Received	50	89.3
Total	56	100.00

The return rate of the questionnaires is 89.3 per cent. This was attained by having a clarity of questions in a logical manner that could be filled using a few minutes. This high return rate was helpful to the study as it confirmed reliable representation of the targeted population.

4.3 Demographic Information of the Respondents

This section covered the respondent's gender and age bracket. The information was useful in ensuring the study had relevant respondents.

4.3.1 Distribution of Respondents by Gender

The findings from the analysis of the respondent's gender are presented in Table 4.2

Table 4. 2: Distribution of Respondents by Gender

Demographic Information		Frequency	Percentage
Gender	Male	35	70.0
	Female	15	30.0
	Total	50	100

From the analysis, out of participants, (70 %) were male and (30%) were female thus meeting the two third gender rule.

4.3.2 Distribution of Respondents by Age

Respondents were asked to indicate their age to ascertain their maturity level in participating in the study. The results are illustrated in Table 4.3

Table 4. 3: Distribution of Respondents by Age

Demographic Information		Frequency	Percentage
Age	Below 25 years	10	20.0
	25-29 years	8	16.0
	30-34 years	11	22.0
	35-39 years	8	16.0
	40-44 years	6	12.0
	45-49 years	2	4.0
	50 and above	5	10.0
	Total	50	100

The respondents were also to provide their age. Out of participants, (20 percent) were aged below 25 years, (16 percent) between 25 and 29 years, (22 percent) from 30 to 34 years, (16 percent) range 35 and 39 years, (12 percent) range 40 and 44 years, (4 percent) range 45 and 49 years and (10 percent) above 50 years. Every other participant was regarded mature enough to provide information at free will. From the results all the respondents were mature enough to give informed opinions.

4.4 Implementation of solar technology in Kenya

This was the dependent variable in this study. The study sought to find out if the implementation of solar technology project is evident in Kenya; case of Nyamira county. The results were analyzed according to the indicators for this variable. The responses were given in a Likert of 1 - 5 scale where; 1= strongly agree, 2= agree, 3= neutral 4= disagree and 5= strongly disagree. The results from descriptive statistics are shown in Table 4.4

Table 4. 4: Implementation of solar technology in Kenya

Indicator	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	SD
Sustainability in the implementation of solar technology is evident	21(42%)	16(32%)	2(4%)	9(18%)	2(4%)	2.10	1.30
There is efficiency in implementation of solar technology	11(22%)	19(38%)	10(20%)	9(18%)	1(2%)	2.40	1.10
There is effectiveness in implementation of solar technology	13(26%)	17(34%)	7(14%)	9(18%)	4(8%)	2.50	1.30
Increase in number of Technicians who have sufficient technical knowledge on solar technology	17(34%)	25(50%)	1(2%)	5(10%)	2(4%)	2.00	1.10
There is an increase in number of users of solar technology in the county	20(40%)	19(38%)	3(6%)	7(14%)	1(2%)	2.00	1.10
There is an increase of skills in implementing solar technology projects	22(44%)	16(32%)	4(8%)	4(8%)	4(8%)	2.00	1.30
Composite Mean, Standard deviation						2.10	1.20

The first indicator of dependent variable sought to find out if sustainability is evident in the implementation of solar technology. From a total of 50 respondents (42 percent) agreed strongly, (32 percent) agreed, (4 percent) neutral, (18 percent) disagreed, whereas (4 percent) disagreed strongly. This indicator also had a mean of 2.10 and S.D of 1.30 against the study composite mean of 2.10 and S.D of 1.20. When the indicator values surpass the composite values, it suggests that this statement had a positive effect on the adoption of solar technology in Kenya.

The second indicator of dependent variable was to determine whether there is efficiency in implementation of solar technology. From a total of 50 respondents (22 percent) agreed strongly, (38 percent) agreed, (20 percent) neutral, (18 percent) disagreed, whereas (2 percent) disagreed strongly. This indicator also had a mean of 2.40 and S.D of 1.10 against the study composite mean of 2.10 and S.D of 1.20. As the indicator has a higher S.D than the composite values, it can be concluded that implementation of solar technology in Kenya was positively influenced.

The third indicator of dependent variable sought to evaluate the effectiveness in implementation of solar technology. From a total of 50 respondents (26 percent) agreed strongly, (34 percent) agreed, (14 percent) neutral, (18 percent) disagreed, whereas (8 percent) disagreed strongly. This indicator also had a mean of 2.50 and S.D of 1.30 against the study composite mean of 2.10 and S.D of 1.20. Given that the indicator figures exceed the composite values, it can be concluded that this statement had a favorable impact on the implementation of solar technology in Kenya.

The fourth indicator of dependent variable was to assess if there was increase in number of technicians who have sufficient technical knowledge on solar technology. From a total of 50 respondents (34 percent) agreed strongly, (50 percent) agreed, (2 percent) neutral, (10 percent) disagreed, whereas (4 percent) disagreed strongly. This indicator also had a mean of 2.00 and S.D of 1.10 against the study composite mean of 2.10 and S.D of 1.20. Due to the fact that the indicator figures fall short of the composite values, it can be inferred that the indicator had an adverse impact on the implementation of solar technology in Kenya.

The fifth indicator of dependent variable sought to assess whether there is an increase in number of users of solar technology in the county. From a total of 50 respondents (40 percent) agreed strongly, (38 percent) agreed, (6 percent) neutral, (14 percent) disagreed, whereas (2 percent) disagreed strongly. This indicator also had a mean of 2.00 and S.D of 1.10 against the study composite mean of 2.10 and S.D of 1.20. Given that the indicator figures are lower than the composite values, it can be concluded that the indicator had a detrimental effect on the implementation of solar technology in Kenya.

The sixth indicator of dependent variable was to assess if there was an increase of skills in implementing solar technology projects. From a total of 50 respondents (44 percent) agreed strongly, (32 percent) agreed, (8 percent) neutral, (8 percent) disagreed, whereas (8 percent) disagreed strongly. This indicator also had a mean of 2.00 and S.D of 1.30 against the study composite mean of 2.10 and S.D of 1.20. Because the indicator S.D figure is above the composite values, it can be settled that respondents had a convergent opinion on the implementation of solar technology in Kenya.

4.5 Stakeholder engagement and Implementation of solar technology in Kenya

The first study objective was to determine how stakeholder engagement affect Implementation of solar technology in Kenya. The responses were given in a Likert of 1 - 5 scale where; 1= strongly agree, 2= agree, 3= neutral 4= disagree and 5= strongly disagree. The results are depicted in Table 4.5

Table 4. 5: Stakeholder engagement and Implementation of solar technology in Kenya

Indicator	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	SD
Stakeholders are very important in project implementation	36(72%)	13(26%)	0(0%)	1(2%)	0(0%)	1.32	0.59
There is sufficient engagement of stakeholders in project implementation	19(38%)	11(22%)	5(10%)	11(22%)	4(8%)	2.40	1.40
Residents where the solar technology is implemented determine how far the project will go	25(50%)	8(16%)	6(12%)	9(18%)	2(4%)	2.10	1.31
Stakeholders do not affect the outcome of project implementation	20(40%)	7(14%)	4(8%)	12(24%)	7(14%)	2.58	1.55
The county government is a key stakeholder in the implementation of solar technology project	28(56%)	14(28%)	1(2%)	3(6%)	4(8%)	1.82	1.24
Integration of stakeholders to project intervention affects the project outcome	24(48%)	11(22%)	4(8%)	6(12%)	5(10%)	2.14	1.40
Composite Mean, Standard deviation						2.06	1.25

The data analysis and presentation of the results in Table 4.5 can be discussed and interpreted in the following ways;

The first indicator of independent variable sought to find out if stakeholders are very important in project implementation. From a total of 50 respondents (72 percent) agreed strongly, (26 percent) agreed, (0 percent) neutral, (2 percent) disagreed, whereas (0 percent) disagreed strongly. This indicator also had a mean of 1.32 and S.D of 0.59 against the study composite mean of 2.06 and S.D of 1.25. By way of the indicator values being below the composite values, it can be inferred that respondents had a divergent opinion on implementation of solar technology in Kenya.

The second indicator of independent variable was to determine whether there is sufficient engagement of stakeholders in project. From a total of 50 respondents (38 percent) agreed strongly, (22 percent) agreed, (10 percent) neutral, (22 percent) disagreed, whereas (8 percent) disagreed strongly. This indicator also had a mean of 2.40 and S.D of 1.40 against the study composite mean of 2.06 and S.D of 1.25. Because the indicator exhibits a greater standard deviation than the composite values, it can be inferred that this statement had a positive impact on the implementation of solar technology in Kenya.

The third indicator of independent variable sought to evaluate whether the residents where the solar technology is implemented determine how far the project goes. From a total of 50 respondents (50 percent) agreed strongly, (16 percent) agreed, (12 percent) neutral, (18 percent) disagreed, whereas (4 percent) disagreed strongly. This indicator also had a mean of 2.10 and S.D of 1.31 against the study composite mean of 2.06 and S.D of 1.25. Given that the indicator figures surpass the composite values, it can be deduced that respondents had a convergent opinion on the rollout of solar technology in Kenya.

The fourth indicator of independent variable was to assess if stakeholders do not affect the outcome of project implementation. From a total of 50 respondents (40 percent) agreed strongly, (14 percent) agreed, (8 percent) neutral, (24 percent) disagreed, whereas (14 percent) disagreed strongly. This indicator also had a mean of 2.58 and S.D of 1.55 against the study composite mean of 2.06 and S.D of 1.25. Considering that the indicator numbers exceed the composite values, we can conclude that this statement had a favorable impact on the adoption of solar technology in Kenya.

The fifth indicator of independent variable sought to assess whether the county government is a key stakeholder in the implementation of solar technology project. From a total of 50 respondents (56 percent) agreed strongly, (28 percent) agreed, (2 percent) neutral, (6 percent) disagreed, whereas (8 percent) disagreed strongly. This indicator also had a mean of 1.82 and S.D of 1.24 against the study composite mean of 2.06 and S.D of 1.25. Given that the indicator figures fall below the composite values, it can be inferred that this statement had a detrimental impact on the implementation of solar technology in Kenya.

The independent variable's sixth indicator aimed to determine the impact of integrating stakeholders into project intervention on the project outcome. Out of 50 participants, 48% strongly agreed, 22% agreed, 8% were neutral, 12% disagreed, and 10% strongly disagreed. The indicator posted a mean value of 2.14 with a standard deviation (S.D) of 1.40, in comparison to the study's composite mean of 2.06 and an S.D of 1.25. Since the S.D for this indicator exceeds the composite value, it suggests that the statement had a positive effect on the adoption of solar technology in Kenya. Subsequent to this, a correlation analysis was performed, with results presented as follows:

4.5.1 Correlation Analysis of stakeholder engagement and Implementation of solar technology in Kenya

Pearson's correlation analysis was used to determine the strength as well as direction of the correlation between independent variable (stakeholder engagement) and dependent variable (Implementation of solar technology in Kenya). The following are correlation analysis results, as shown in Table 4.6

Table 4.6: Correlation Analysis of stakeholder engagement and Implementation of solar technology in Kenya

Variable		**Stakeholder engagement**	**Implementation of solar technology in Kenya**
Stakeholder engagement	Pearson' Correlation	1.000	0.398
	Sig(2-tailed)		0.000
	N	50	50
Implementation of solar technology in Kenya	Pearson' Correlation	0.398	1.000
	Sig(2-tailed)	0.000	
	N	50	50

Correlation is significant at 0.05 level (2 - tailed)

Correlation analysis results showed a significant as well as a positive relationship between stakeholder engagement and implementation of solar technology in Kenya (r =0.398, p<0.000). Moreover, this simply means, the more stakeholder engagement is done the better the implementation of solar technology in Kenya.

4.5.2 Model Summary of stakeholder engagement and Implementation of solar technology in Kenya

Model Summary Regression Analysis was run using SPSS Version 22 to examine the associations between independent variable (stakeholder engagement) and dependent variable (Implementation of solar technology in Kenya) and results were presented in Table 4.7

Table 4. 7: Model Summary of stakeholder engagement and Implementation of solar technology in Kenya

Model	R	R - Square	Adjusted R - Square	Standard Error of Estimate
1	0.398	0.158	0.141	0.83675

a. Predictor: (Constant) Stakeholder engagement

Analysis from Table 4.7 show that stakeholder engagement has a significant effect on implementation of solar technology in Kenya as R^2=0.158 shows an increase in stakeholder engagement would lead to 15.8 percent influence in implementation of solar technology in Kenya.

4.5.3 Regression ANOVA Analysis of stakeholder engagement and Implementation of solar technology in Kenya

ANOVA regression analysis was used to examine the degree of association between dependent variable (Implementation of solar technology in Kenya) and independent variable (stakeholder engagement). Results were presented in Table 4.8

Table 4. 8: ANOVA Analysis between stakeholder engagement and Implementation of solar technology in Kenya

Model		Sum of Squares	Df	Mean Squares	F	Sig.
1	Regression	6.309	1.000	6.309	9.01052	0.004
	Residuals	33.607	48	0.700		
	Total	39.916	49			

a. Dependent Variable: Implementation of solar technology in Kenya
b. Predictors:(Constant); Stakeholder engagement

ANOVA analysis from table 4.8 shows that p=0.004 is below 0.05 the alpha level, hence significant. As a result, we concluded that stakeholder engagement is important in implementation of solar technology in Kenya.

4.5.4 Regression Coefficients of stakeholder engagement and Implementation of solar technology in Kenya

Regression Coefficients analysis was deployed to evaluate the degree of association between stakeholder engagement and implementation of solar technology in Kenya and results were presented in Table 4.9

Table 4. 9: Regression Coefficients Analysis between stakeholder engagement and Implementation of solar technology in Kenya

Model	Unstandardized coefficient		standardized coefficient	T	Sig.
	B	Std. Err	Beta		
1(Constant)	1.271	0.322		3.950	0.000
Stakeholder engagement	0.436	0.145	0.398	3.002	0.004

Dependent1variable: Implementation of solar technology in Kenya
Predictors: (Constant) Stakeholder engagement

Regression coefficients analysis results between stakeholder engagement and implementation of solar technology in Kenya shows that p=0.004 is below 0.05 the alpha level hence significant. As a result, we concluded that stakeholder engagement has a significant impact on the implementation of solar technology in Kenya.

4.6 Resource allocation and Implementation of solar technology in Kenya

The first study objective was to determine how resource allocation influence implementation of solar technology in Kenya. The responses were given in a Likert of 1 - 5 scale where; 1= strongly agree, 2= agree, 3= neutral 4= disagree and 5= strongly disagree. The results are depicted in Table 4.10

Table 4. 10: Resource allocation and Implementation of solar technology in Kenya

Indicator	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	SD
There is need for adequate funding solar projects in order to promote implementation	40(80%)	9(18%)	1(2%)	0(0%)	0(0%)	1.22	0.46
Counties should promote technicians through allocating funds to support technicians get skills	31(62%)	15(30%)	3(6%)	0(0%)	1(2%)	1.50	0.79
There is openness and transparency in project funding	6(12%)	9(18%)	5(10%)	16(32%)	14(28%)	3.46	1.39
Project development funds are available for implementation of projects in the county	10(20%)	12(24%)	9(18%)	14(28%)	5(10%)	2.84	1.31
Counties suffer a blow of inconsistency in funding thus affecting implementation of projects	22(44%)	21(42%)	3(6%)	4(8%)	0(0%)	1.78	0.89
Solar technology requires to be allocated funds that will assist security personnel discharge their services to avoid vandalism and promote implementation	27(54%)	20(40%)	4(8%)	0(0%)	1(2%)	1.56	0.76
Composite Mean, Standard deviation						2.06	0.93

The data analysis and presentation of the results in Table 4.10 can be discussed and interpreted in the following ways;

The first indicator of independent variable sought to find out if there is need for adequate funding solar projects in order to promote implementation. From a total of 50 respondents (80 percent) agreed strongly, (18 percent) agreed, (2 percent) neutral, (0 percent) disagreed, whereas (0 percent) disagreed strongly. This indicator also had a mean of 1.22 and S.D of 0.46 against the study composite mean of 2.06 and S.D of 0.93. By way of the indicator values being below the composite values, it can be inferred a divergent opinion on implementation of solar technology in Kenya.

The second indicator of independent variable was to determine whether Counties should promote technicians through allocating funds to support technicians get skills. From a total of 50 respondents (62 percent) agreed strongly, (30 percent) agreed, (6 percent) neutral, (0 percent) disagreed, whereas (2 percent) disagreed strongly. This indicator also had a mean of 1.50 and S.D of 0.79 against the study composite mean of 2.06 and S.D of 0.93. As the indicator has lower than the composite values, it can be concluded that there as a detrimental effect on implementation of solar technology in Kenya.

The third indicator of independent variable sought to evaluate whether there is openness and transparency in project funding. From a total of 50 respondents (12 percent) agreed strongly, (18 percent) agreed, (10 percent) neutral, (32 percent) disagreed, whereas (28 percent) disagreed strongly. This indicator also had a mean of 3.46 and S.D of 1.39 against the study composite mean of 2.06 and S.D of 0.93. Since the indicator numbers are above the composite values, it can be settled that a convergent opinion on implementation of solar technology in Kenya was evident.

The fourth indicator within the independent variable aimed to evaluate the availability of project development funds for implementing projects in the county. Out of a total of 50 respondents, 20 percent strongly agreed, 24 percent agreed, 18 percent were neutral, 28 percent disagreed, and 10 percent strongly disagreed. This indicator also displayed a mean value of 2.84 and a standard deviation (S.D) of 1.31, in contrast to the study's composite mean of 2.06 and an S.D of 0.93. Because the indicator values exceed those of the composite, it can be concluded that indicator revealed a positive influence on the implementation of solar technology in Kenya.

The fifth indicator of independent variable sought to assess whether Counties suffer a blow of inconsistency in funding thus affecting implementation of projects. From a total of 50 respondents (44 percent) agreed strongly, (42 percent) agreed, (6 percent) neutral, (8 percent) disagreed, whereas (0 percent) disagreed strongly. This indicator also had a mean of 1.78 and S.D of 0.89 against the study composite mean of 2.06 and S.D of 0.93. Since the indicator numbers are below the composite values, it can be settled that there was a negatively influence on implementation of solar technology in Kenya.

The sixth indicator of independent variable was to assess if Solar technology requires to be allocated funds that assisted security personnel discharge their services to avoid vandalism and promote implementation. From a total of 50 respondents (54 percent) agreed strongly, (40 percent) agreed, (8 percent) neutral, (0 percent) disagreed, whereas (2 percent) disagreed strongly. This indicator also had a mean of 1.56 and S.D of 0.76 against the study composite mean of 2.06 and S.D of 0.93. Because the indicator values are below the composite values, it can be settled that this statement implementation of solar technology in Kenya. Subsequent correlational results in support to this are provided below

Table 4. 11: Correlation Analysis of resource allocation and Implementation solar technology in Kenya

Variable		Resource allocation	Implementation of solar technology in Kenya
Resource allocation	Pearson' Correlation	1	0.268
	Sig(2-tailed)		0.000
	N	50	50
Implementation of solar technology in Kenya	Pearson' Correlation	0.268	1
	Sig(2-tailed)	0.000	
	N	50	50

Correlation is significant at 0.05 level (2 - tailed)

Correlation analysis results shows a significant as well as a positive relationship between resource allocation and implementation of solar technology in Kenya ($r = 0.268$, $p < 0.000$). Moreover, this simply means, the more resource allocation is done properly the better the implementation of solar technology in Kenya. Again, the association is significant indicating that resources allocation can be experienced positively in implementation of solar technology in Kenya.

4.6.1 Model Summary of resource allocation and Implementation of solar technology in Kenya

Model Summary Regression Analysis was run using SPSS Version 22 to examine the associations between independent variable (resource allocation) and dependent variable (Implementation of solar technology in Kenya) and results were presented in Table 4.12

Table 4. 12: Model Summary of resource allocation and implementation of solar technology in Kenya

Model	R	R - Square	Adjusted R - Square	Standard Error of Estimate
1	0.268	0.072	0.053	0.87854

a. Predictor: (Constant) Resource allocation

Analysis from Table 4.12 show that Resource allocation has a significant effect on implementation of solar technology in Kenya as R^2=0.072 shows an increase in resource allocation would lead to 7 percent influence in implementation of solar technology in Kenya.

4.6.2 Regression ANOVA Analysis of resource allocation and Implementation of solar technology in Kenya

ANOVA regression analysis was used to examine the degree of association between dependent variable (Implementation of solar technology in Kenya) and independent variable (Resource allocation). Results were presented in Table 4.13

Table 4.13: ANOVA Analysis between resource allocation and Implementation of solar technology in Kenya

Model		Sum of Squares	Df	Mean Squares	F	Sig.
1	Regression	2.868	1	2.868	3.716	0.000
	Residuals	37.048	48	0.772		
	Total	39.916	49			

c. Dependent Variable: Implementation of solar technology in Kenya
d. Predictors:(Constant); Resource allocation

ANOVA analysis from table 4.13 shows that p=0.000 is below 0.05 the alpha level, hence significant. As a result, we conclude that resource allocation is important implementation of solar technology in Kenya.

4.6.3 Regression Coefficients of resource allocation and Implementation of solar technology in Kenya

Regression Coefficients analysis was deployed to evaluate the degree of association between resource allocation and implementation of solar technology in Kenya and results were presented in Table 4.14

Table 4. 14: Regression Coefficients Analysis between resource allocation and Implementation of solar technology in Kenya

Model	Unstandardized coefficient		standardized coefficient	t	Sig.
	B	Std. Err	Beta		
1(Constant)	1.136	0.551		2.062	0.045
Contractor's Construction Experience	0.502	0.260	0.268	1.928	0.000

Dependent variable: Implementation of solar technology in Kenya

Predictors: (Constant) Resource allocation

Regression coefficients analysis results between resource allocation and implementation solar technology in Kenya shows that p=0.000 is below 0.05 the alpha level hence significant. As a result, we concluded that resource allocation has a significant impact on the implementation of solar technology in Kenya.

4.7 Use of technology and Implementation of solar technology in Kenya

The first study objective was to determine how use of technology affect implementation of solar technology in Kenya. The responses were given in a Likert of 1 - 5 scale where; 1= strongly agree, 2= agree, 3= neutral 4= disagree and 5= strongly disagree. The results are depicted in Table 4.15

Table 4. 15: Use of technology and Implementation of solar technology in Kenya

Indicator	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	SD
Technology affects implementation of solar technology projects	27(54%)	10(20%)	0(0%)	8(16%)	5(10%)	2.08	1.45
Installation of solar systems uses technology	33(66%)	15(30%)	2(4%)	0(0%)	0(0%)	1.38	0.57
Stakeholders determine how far the project will go	23(46%)	12(24%)	8(16%)	6(12%)	1(2%)	2.00	1.14
Automatic switching ON/OFF of solar lights in streets uses technology	35(70%)	14(28%)	1(2%)	0(0%)	0(0%)	1.32	0.51
The process of using solar panels to convert sunrays to energy in itself is technology in practice	33(66%)	16(32%)	0(0%)	1(2%)	0(0%)	1.38	0.60
Counties should promote use of technology in implementing projects	33(66%)	14(28%)	2(4%)	1(2%)	0(0%)	1.42	0.67
Composite Mean, Standard deviation						1.60	0.82

The data analysis and presentation of the results in Table 4.15 can be discussed and interpreted in the following ways;

The first indicator of independent variable sought to find out if technology affects implementation of solar technology projects. From a total of 50 respondents (54 percent) agreed strongly, (20 percent) agreed, (0 percent) neutral, (16 percent) disagreed, whereas (10 percent) disagreed strongly. This indicator also had a mean of 2.08 and S.D of 1.45 against the study composite mean of 1.60 and S.D of 0.82. By way of the indicator values being above the composite values, it can be inferred that respondents revealed a positive influence on implementation of solar technology in Kenya.

The second indicator of independent variable was to determine whether installation of solar systems uses technology. From a total of 50 respondents (66 percent) agreed strongly, (30 percent) agreed, (4 percent) neutral, (0 percent) disagreed, whereas (0 percent) disagreed strongly. This indicator also had a mean of 1.38 and S.D of 0.57 against the study composite mean of 1.60 and S.D of 0.82. As the indicator has lower values than the composite values, it can be concluded that there was a divergent opinion on implementation of solar technology in Kenya.

The third indicator within the independent variable aimed to assess whether stakeholders have an influence on the project's progression. Out of the total 50 respondents, 46 percent strongly agreed, 24 percent agreed, 16 percent were neutral, 12 percent disagreed, and 2 percent strongly disagreed. This indicator also had an average value of 2.00 and a standard deviation (S.D) of 1.14, in contrast to the study's composite mean of 1.60 and an

S.D of 0.82. As the indicator values surpass those of the composite, it can be concluded that a positive impact on the implementation of solar technology in Kenya was evident.

The fourth indicator within the independent variable aimed to determine whether the automatic switching ON/OFF of solar street lights involves the use of technology. Out of a total of 50 respondents, 70 percent strongly agreed, 28 percent agreed, 2 percent were neutral, and none disagreed or strongly disagreed. This indicator also had an average value of 1.32 and a standard deviation (S.D) of 0.51, in contrast to the study's composite mean of 1.60 and an S.D of 0.82. As the indicator values are lower than those of the composite, it can be concluded that this statement had a divergent opinion on the implementation of solar technology in Kenya.

The fifth indicator within the independent variable aimed to assess whether the process of converting sunlight into energy using solar panels constitutes a practical technology. Out of a total of 50 respondents, 66 percent strongly agreed, 32 percent agreed, and none were neutral, while 2 percent disagreed and none strongly disagreed. This indicator also had an average value of 1.38 and a standard deviation (S.D) of 0.60, in contrast to the study's composite mean of 1.60 and an S.D of 0.82. Since the indicator figures are lower than those of the composite, it can be concluded that this statement negatively influenced the implementation of solar technology in Kenya.

The sixth indicator of independent variable was to assess if Counties should promote use of technology in implementing projects. From a total of 50 respondents (66 percent) agreed strongly, (28 percent) agreed, (4 percent) neutral, (2 percent) disagreed, whereas (0 percent) disagreed strongly. This indicator also had a mean of 1.42 and S.D of 0.67

against the study composite mean of 1.60 and S.D of 0.82. Because the indicator values are below the composite values, it can be settled that a negative influence on implementation of solar technology in Kenya was ascertained.

In addition, correlation results are discussed below

4.7.1 Correlation Analysis of use of technology and Implementation of solar technology in Kenya

Pearson's correlation analysis was used to determine the strength as well as direction of the correlation between independent variable (use of technology) and dependent variable (Implementation of solar technology in Kenya). The following are correlation analysis results, as shown in Table 4.16

Table 4. 16: Correlation Analysis of use of technology and Implementation of solar technology in Kenya

Variable		**Use of technology**	**Implementation of solar technology in Kenya**
Use of technology	Pearson' Correlation	1	0.775
	Sig(2-tailed)		0.000
	N	50	50
Implementation of solar technology in Kenya	Pearson' Correlation	0.775	1
	Sig(2-tailed)	0.000	
	N	50	50

Correlation is significant at 0.05 level (2 - tailed)

Correlation analysis results shows a significant as well as a positive relationship between use of technology and implementation of solar technology in Kenya (r =0.775, p<0.000). Moreover, this simply means, the more technology is adopted the better the implementation of solar technology in Kenya. Again, the association is significant indicating that use of technology can be experienced positively in implementation of solar technology in Kenya.

4.7.2 Model Summary of use of technology and Implementation of solar technology in Kenya

Model Summary Regression Analysis was run using SPSS Version 22 to examine the associations between independent variable (use of technology) and dependent variable (Implementation of solar technology in Kenya) and results were presented in Table 4.17

Table 4. 17: Model Summary of use of technology and Implementation of solar technology in Kenya

Model	R	R - Square	Adjusted R - Square	Standard Error of Estimate
1	0.41	0.201	0.019	.19113

a. Predictor: (Constant) Use technology

Analysis from Table 4.17 show that Use of technology has a significant effect on implementation of solar technology in Kenya as R^2=0.201 shows an increase in use of technology would lead to 20 percent influence in implementation of solar technology in Kenya.

4.7.3 Regression ANOVA Analysis of Use of technology and Implementation of soalr technology in Kenya

ANOVA regression analysis was used to examine the degree of association between independent variable (Use of technology) and dependent variable (Implementation of solar technology in Kenya). Results were presented in Table 4.18

Table 4. 18: ANOVA Analysis between Use of technology and Implementation of solar technology in Kenya

Model		Sum of Squares	Df	Mean Squares	F	Sig.
1	Regression	0.069	1	0.069	0.083	0.000
	Residuals	39.848	48	0.830		
	Total1	39.916	49			

e. Dependent Variable: Implementation of solar technology in Kenya
f. Predictors:(Constant); Use of technology

ANOVA analysis from table 4.18 shows that p=0.000 is below 0.05 the alpha level, hence significant. As a result, we conclude that use of technology is important in implementation of solar technology in Kenya.

4.7.4 Regression Coefficients of use of technology and Implementation of solar technology in Kenya

Regression Coefficients analysis was deployed to evaluate the degree of association between use of technology and implementation of solar technology in Kenya and results were presented in Table 4.19

Table 4. 19: Regression Coefficients Analysis between use of technology and Implementation of solar technology in Kenya

Model	Unstandardized coefficient		standardized coefficient	T	Sig.
	B	Std. Err	Beta		
1(Constant)	2.045	0.455		4.494	0.775
Use of technology	0.079	0.273	0.041	0.287	0.000

Dependent1variable: Implementation of solar technology in Kenya

Predictors: (Constant) Use of technology

Regression coefficients analysis results between use of technology and implementation solar technology in Kenya shows that p=0.000 is below 0.05 the alpha level hence significant. As a result, we concluded that use of technology has a significant impact on the implementation of solar technology in Kenya.

4.8 Level of expertise and Implementation of solar technology in Kenya

The first study objective was to determine how level of expertise affect implementation of solar technology in Kenya. The responses were given in a Likert of 1 - 5 scale where; 1= strongly agree, 2= agree, 3= neutral 4= disagree and 5= strongly disagree. The results are depicted in Table 4.20

Table 4.20: Level of expertise and Implementation of solar technology in Kenya

Indicator	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**	**Mean**	**SD**
Many project team members are competent in projects	19(38%)	13(26%)	8(16%)	7(14%)	3(6%)	2.24	1.27
Many project team members are well educated	19(38%)	14(28%)	6(12%)	6(12%)	5(10%)	2.28	1.36
Many project teams are confident of their work	17(34%)	16(32%)	9(18%)	7(14%)	1(2%)	2.18	1.12
Technicians ought to have sufficient technical knowledge on solar technology	32(64%)	15(30%)	1(2%)	2(4%)	0(0%)	1.46	0.73
Technicians should attend CBET trainings in order to acquire relevant skills	41(82%)	9(18%)	0(0%)	0(0%)	0(0%)	1.18	0.39
The project manager conceptual skills in implementing projects	31(62%)	15(30%)	3(6%)	1(2%)	0(0%)	1.48	0.71
Composite Mean, Standard deviation						1.80	0.93

The data analysis and presentation of the results in Table 4.20 can be discussed and interpreted in the following ways;

The first indicator within the independent variable aimed to determine whether a significant number of project team members possess competence in projects. Out of a total of 50 respondents, 38 percent strongly agreed, 26 percent agreed, 16 percent were neutral, 14 percent disagreed, and 6 percent disagreed strongly. This indicator also had an average value of 2.24 and a standard deviation (S.D) of 1.27, as compared to the study's composite mean of 1.80 and S.D of 0.93. Given that the indicator values exceed the composite values inferring a positive impact on the implementation of solar technology in Kenya.

The second indicator within the independent variable aimed to ascertain whether many project team members are well-educated. Out of a total of 50 respondents, 38 percent strongly agreed, 28 percent agreed, 12 percent were neutral, 12 percent disagreed, and 10 percent disagreed strongly. This indicator also had an average value of 2.28 and a standard deviation (S.D) of 1.36, in contrast to the study's composite mean of 1.80 and S.D of 0.93. As the indicator values are higher than the composite values, it can be concluded that here was a convergent opinion on the implementation of solar technology in Kenya.

The third indicator within the independent variable aimed to evaluate whether many project teams are confident in their work. Out of a total of 50 respondents, 34 percent strongly agreed, 32 percent agreed, 18 percent were neutral, 14 percent disagreed, and 2 percent disagreed strongly. This indicator also had an average value of 2.18 and a standard deviation (S.D) of 1.12, compared to the study's composite mean of 1.80 and

S.D of 0.93. Since the indicator values surpass the composite values, it can be established a convergent impact on the implementation of solar technology in Kenya from the respondents.

The fourth indicator within the independent variable aimed to assess whether technicians should possess sufficient technical knowledge of solar technology. Out of a total of 50 respondents, 64 percent strongly agreed, 30 percent agreed, 2 percent were neutral, 4 percent disagreed, and none strongly disagreed. This indicator also had an average value of 1.46 and a standard deviation (S.D) of 0.73, as compared to the study's composite mean of 1.80 and S.D of 0.93. Because the indicator values fall below the composite values, it can be concluded that this statement had a divergent opinion on the implementation of solar technology in Kenya.

The fifth indicator within the independent variable aimed to assess whether technicians should undergo CBET trainings to acquire relevant skills. Out of a total of 50 respondents, 82 percent strongly agreed, 18 percent agreed, and none were neutral, disagreed, or strongly disagreed. This indicator also had an average value of 1.18 and a standard deviation (S.D) of 0.39, compared to the study's composite mean of 1.80 and S.D of 0.93. Since the indicator values are lower than the composite values, it can be determined that this statement had a divergent opinion on the implementation of solar technology in Kenya.

The sixth indicator within the independent variable aimed to assess whether the project manager's conceptual skills in implementing projects affect the implementation of solar technology. Out of a total of 50 respondents, 62 percent strongly agreed, 30 percent agreed, 6 percent were neutral, 2 percent disagreed, and none strongly disagreed. This indicator also had an average value of 1.48 and a standard deviation (S.D) of 0.71, compared to the study's composite mean of 2.10 and S.D of 1.20. Given that the indicator values are lower than the composite values, it can be concluded that this statement had a deferring opinion on the implementation of solar technology in Kenya. The following are correlation analysis results, as shown in Table 4.21

Table 4.21: Correlation level of expertise and Implementation of solar technology in Kenya

Variable		**Level of expertise**	**Implementation solar technology in Kenya**
Level of expertise	Pearson' Correlation	1	0.229
	Sig(2-tailed)		0.000
	N	50	50
Implementation solar technology in Kenya	Pearson' Correlation	0.229	1
	Sig(2-tailed)	0.000	
	N	50	50

Correlation is significant at 0.05 level (2 - tailed)

Correlation analysis results shows a significant as well as strong positive relationship between level of expertise and implementation of solar technology in Kenya (r =0.229, p<0.000). Moreover, this simply means, the more the level of expertise is enhanced the better the implementation of solar technology in Kenya. Again, the association is significant indicating that level of expertise can be experienced positively in implementation of solar technology in Kenya.

4.8.1 Model Summary of level of expertise and Implementation of solar technology in Kenya

Model Summary Regression Analysis was run using SPSS Version 22 to examine the associations between independent variable (level of expertise) and dependent variable (Implementation of solar technology in Kenya) and results were presented in Table 4.22

Table 4. 22: Model Summary of level of expertise and Implementation of solar technology in Kenya

Model	R	R - Square	Adjusted R - Square	Standard Error of Estimate
1	0.229	0.052	0.033	0.88770

a. Predictor: (Constant) Level of expertise

Analysis from Table 4.22 show that level of expertise has a significant effect on implementation of solar technology in Kenya as R^2=0.052 shows an increase in level of expertise would lead to 5.2 percent influence in implementation of solar technology in Kenya.

4.8.2 Regression ANOVA Analysis of level of expertise and Implementation solar technology in Kenya

ANOVA regression analysis was used to examine the degree of association between dependent variable (Implementation of solar technology in Kenya) and independent variable (Level of expertise). Results were presented in Table 4.23

Table 4. 23: ANOVA Analysis between level of expertise and Implementation of solar technology in Kenya

Model		Sum of Squares	Df	Mean Squares	F	Sig.
1	Regression	2.092	1	2.092	2.654	0.000
	Residuals	37.824	48	0.788		
	Total1	39.916	49			

g. Dependent Variable: Implementation of solar technology in Kenya
h. Predictors:(Constant); Level of expertise

ANOVA analysis from table 4.23 shows that p=0.000 is below 0.05 the alpha level, hence significant. As a result, we conclude that level of expertise is important implementation of solar technology in Kenya.

4.8.3 Regression Coefficients of level of expertise and Implementation of solar technology in Kenya

Regression Coefficients analysis was deployed to evaluate the degree of association between level of expertise and implementation of solar technology in Kenya and results were presented in Table 4.24

Table 4.24: Regression Coefficients Analysis between level of expertise and Implementation of solar technology in Kenya

Model	Unstandardized coefficient		standardized coefficient	t	Sig.
	B	Std. Err	Beta		
1(Constant)	1.600	0.372		4.303	0.110
Level of expertise	0.316	0.194	0.229	1.629	0.000

Dependent1variable: Implementation of solar technology in Kenya
Predictors: (Constant) Level of expertise

Regression coefficients analysis results between level of expertise and implementation of solar technology in Kenya shows that p=0.000 is below 0.05 the alpha level hence significant. As a result, we concluded that level of expertise has a significant effect on the implementation of solar technology in Kenya.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This section gives a prose of the findings, discussions, conclusions and recommendations according to the findings of the study, suggestions for more research and contribution to the body of knowledge.

5.2 Summary of Findings

The main objective of the study was to investigate the factors affecting the implementation of solar technology in Nyamira County, Kenya. The following specific objectives were used in the study: To establish how stakeholders' engagement affect the implementation solar technology in Nyamira County, Kenya; To find out how resource allocation affects the implementation solar technology in Nyamira County, Kenya; To assess how use of technology affects the implementation solar projects in Nyamira County, Kenya; To determine how the level of expertise affects the implementation of solar technology in Nyamira County, Kenya. Summary of the study findings is as shown below.

5.2.1 Stakeholder engagement and Implementation of solar technology in Kenya

Objective number one was to establish how stakeholders' engagement affect the implementation solar technology in Nyamira County, Kenya. Findings revealed that implementation of solar technology projects often involves community engagement, government agencies and project teams. Engaging the local community fostered support, awareness, and a sense of ownership, which lead to smoother project implementation and acceptance of solar technology in Kenya.

5.2.2 Resource allocation and Implementation of solar technology in Kenya

Objective number two was to find out how resource allocation affects the implementation solar technology in Nyamira County, Kenya. Findings revealed that efficient resource allocation was crucial for the successful implementation of solar technology projects. Proper planning and allocation of financial, human, and material resources are essential to ensure project feasibility, timely completion, and desired outcomes in the implementation of solar technology in Kenya.

5.2.3 Use of technology and Implementation of solar technology in Kenya

Objective number three was to assess how use of technology affects the implementation solar projects in Nyamira County, Kenya. The use of technologies such as darkness sensing, automatic on/off sensors have significantly improved the efficiency, reliability, and cost-effectiveness of solar technology. Innovations such as high-efficiency solar panels, energy storage solutions, and smart grid integration have propelled the industry forward in implementation of solar technology in Kenya.

5.2.4 Level of expertise and Implementation of solar technology in Kenya

Objective number four was to determine how the level of expertise affects the implementation of solar technology in Nyamira County, Kenya. Developing a skilled workforce through education and training programs ensures a pool of experts to drive the continued growth and success of the solar industry. Expertise plays a key role in identifying and mitigating risks associated with project implementation. This reduces the likelihood of costly delays, errors, and unexpected challenges in the implementation of solar technology in Kenya.

5.2.5 Implementation of solar technology in Kenya

This was the dependent variable in this study. Implementation of solar technology in Kenya is low and it is being implemented successfully. The implementation of solar technology projects has demonstrated substantial potential in transforming the global energy landscape. While challenges exist, the combination of technological innovation, policy support, stakeholder engagement, and new business models makes the future of solar energy bright. The industry's growth is not just about harnessing sunlight but also about addressing broader economic, environmental, and social objectives.

5.3 Conclusions

The main objective of the study was to investigate the factors affecting the implementation of solar technology in Nyamira County, Kenya.

Regarding objective one, the findings revealed that effective stakeholder engagement fostered collaborative decision-making by involving various parties, including local communities, government entities, investors, county government, and industry experts. This ensured that projects address diverse needs and concerns.

Concerning objective two, this study demonstrated that adequate allocation of financial resources, human resource and security funds was essential for realizing the economic viability of solar projects. Careful evaluation of costs, including equipment, installation, operation, and maintenance, ensured that the project remains financially feasible.

In respect to objective three, this study demonstrated the use of technology has revolutionized the implementation of solar technology, making it more efficient, reliable, and accessible. Continued technological innovation, along with strategic integration of these advancements, is essential for realizing the full potential of solar energy in addressing energy needs, environmental concerns, and the transition to a more sustainable future in the implementation of solar technology in Kenya. Therefore, the study established that effective use of technology promotes the implementation of solar technology.

As per objective four, this study demonstrated that the level of expertise is a critical factor in the successful implementation of solar technology projects. A skilled and knowledgeable team contributes to effective decision-making, innovation, quality assurance, regulatory compliance, and long-term sustainability. Investing in expertise ensures that solar initiatives achieve their intended goals and contribute to the broader adoption of renewable energy. Therefore, the study established that expertise fosters implementation of solar technology.

5.4 Recommendations

The study recommended the following;

i. Engagement of stakeholders early enough involving local communities, governments, investors, and relevant experts from the outset. Their insights can help shape the project, build support, and address potential challenges.

Stakeholders' involvement at any given stage of the project so that it can build confidence and trust during and after the implementation period.

ii. Comprehensive resource allocation and planning starting with thorough planning that includes site assessment, energy needs analysis, budgeting, and regulatory considerations. A well-defined plan serves as a roadmap for solar project execution. The government to allocate adequate funding for enhanced implementation of solar technology in the country in order to ensure solar technology users use solar for both commercial and domestic purposes.

iii. The county government to carry out technology evaluation on the appropriate solar technology based on the project's goals and location considering factors like efficiency, durability, cost-effectiveness, and compatibility with energy storage solutions.

iv. Expertise and training on operations team with the necessary expertise in solar technology, engineering, project management, and regulatory compliance. Ongoing training ensures that the team is up-to-date with the latest advancements on the implementation of solar technology

5.5 Suggestion for Further Studies

This study identified the following areas that may be explored in further studies;

i. Related research be performed on solar technology projects being implemented in other part of the counties. Explore the potential of hybrid energy systems that combine solar technology with other renewable sources such as wind, hydro, or biomass. Assess the benefits and challenges of integrating multiple renewable sources to create more reliable and consistent power generation.

ii. A related study be done on other factors that influence implementation solar technology projects such as: Smart cities and urban integration aiming at examining the integration of solar technology in urban environments, including building-integrated photovoltaics (BIPV) and solar-powered smart city infrastructure. Explore the challenges and opportunities of incorporating solar into urban planning.

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APPENDICES

Appendix I: Interview schedule senior management officers (CECMs and Directors)

1. What is your designation?

2. What are some of the factors affecting the implementation of Solar technology in Nyamira County?

3. How does stakeholder engagement affect the implementation of solar technology in Nyamira County?

4. To what extent does resource allocation affect the implementation of solar technology in Nyamira County?

5. How does use technology affect the implementation of solar technology in Nyamira County?

6. In which way does level of expertise affect the implementation of solar technology project in Nyamira County?

7. What are the challenges of implementing of solar technology in Nyamira County?

Thank you for your Participation

Appendix II: Questionnaire county employees and solar users

This purpose of this questionnaire is to gather research information *Factors Affecting the Implementation of Solar Technology in Nyamira County, Kenya*. The questionnaire has Two Section. For each section, kindly respond to all items using a tick. Tick only one response per question.

PART I: DEMOGRAPHIC CHARACTERISTICS

a) Gender of respondents

Male ( )

Female ( )

b) Specify your age bracket in years

Below 25years ( )

25-29years ( )

30-34years ( )

35-39years ( )

40-44years ( )

45-49years ( )

50 and above ( )

PART II: SPECIFIC OBJECTIVES

SECTION A: STAKEHOLDERS' ENGAGEMENT AND IMPLEMENTATION OF SOLAR TECHNOLOGY

Kindly select your level of agreement with the below statements by ticking only once in each of the questions?

Use the scale where 1= strongly agree, 2= agree, 3= neutral 4= disagree and 5= strongly disagree

	Statement	**1**	**2**	**3**	**4**	**5**
1	Stakeholders are very important in project implementation					
2	There is sufficient engagement of stakeholders in project implementation					
3	Resident where the solar technology is implemented determine how far the project will go					
4	Stakeholders do not affect the outcome of project implementation					
5	The county government is a key stakeholder in the implementation of solar technology project					
6	Integration of stakeholders to project intervention affects the project outcome					

SECTION B: RESOURCE ALLOCATION AND IMPLEMENTATION OF SOLAR TECHNOLOGY

Kindly select your level of agreement with the below statements by ticking only once in each of the questions?

Use the scale where 1= strongly agree, 2= agree, 3= neutral 4= disagree and 5= strongly disagree

	Statement	**1**	**2**	**3**	**4**	**5**
1	There is need for adequate funding solar projects in order to promote implementation					
2	Counties should promote technicians through allocating funds to support technicians get skills					
3	There is openness and transparency in project funding					
4	Project development funds are available for implementation of projects in the county					
5	Counties suffer a blow of inconsistency in funding thus affecting implementation of projects					
6	Solar technology requires to be allocated funds that will assist security personnel discharge their services to avoid vandalism and promote implementation					

SECTION C: USE OF TECHNOLOGY AND IMPLEMENTATION OF SOLAR TECHNOLOGY

Kindly select your level of agreement with the below statements by ticking only once in each of the questions?

Use the scale where 1= strongly agree, 2= agree, 3= neutral 4= disagree and 5= strongly disagree

	Statement	**1**	**2**	**3**	**4**	**5**
1	Technology affects implementation of solar technology projects					
2	Installation of solar systems uses technology					
3	Stakeholders determine how far the project will go					
4	Automatic switching ON/OFF of solar lights in streets uses technology					
5	The process of using solar panels to convert sunrays to energy in itself is technology in practice					
6	Counties should promote use of technology in implementing projects					

SECTION D: LEVEL OF EXPERTISE AND IMPLEMENTATION OF SOLAR TECHNOLOGY

Kindly select your level of agreement with the below statements by ticking only once in each of the questions?

Use the scale where 1= strongly agree, 2= agree, 3= neutral 4= disagree and 5= strongly disagree

	Factor	**1**	**2**	**3**	**4**	**5**
1	Many project team members are competent in projects					
2	Many project team members are well educated					
3	Many project teams are confident of their work					
4	Technicians ought to have sufficient technical knowledge on solar technology					
5	Technicians should attend CBET trainings in order to acquire relevant skills					
6	The project manager conceptual skills in implementing projects					

SECTION E: IMPLEMENTATION OF SOLAR TECHNOLOGY

Kindly select your level of agreement with the below statements by ticking only once in each of the questions?

Use the scale where 1= strongly agree, 2= agree, 3= neutral 4= disagree and 5= strongly disagree

	Factor	**1**	**2**	**3**	**4**	**5**
1	Sustainability in the implementation of solar technology is evident					
2	There is efficiency in implementation of solar technology					
3	There is effectiveness in implementation of solar technology					
4	Increase in number of Technicians who have sufficient technical knowledge on solar technology					
5	There is an increase in number of users of solar technology in the county					
6	There is an increase of skills in implementing solar technology projects					

Thank you for your Participation

Appendix III: Research Permit

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