PROJECT PROCUREMENT PRACTICES AND IMPLEMENTATION OF SOLAR PROJECTS IN MARSABIT COUNTY, KENYA

BY

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DECLARATION

DECLARATION BY THE CANDIDATE

This is my original work and has never been presented in any University for any academic award.

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DEDICATION

I dedicate this study to my dear family and friends. This study is also dedicated to the lecturers and colleagues who offered encouragements and suggestions to make this work comprehensive and useful in supporting implementation of solar projects in the country, and to God the Almighty for his care and unwavering love, always.

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ABSTRACT

Implementation of solar projects in Kenya and specifically in Marsabit County is faced with delays or terminations before project completion. This according to Carbon Africa is attributed to bad procurement practices. Overcoming the huddles in solar procurement processes and adopting solar technology can be a win-win solution to climate change, job creation, energy reduction gaps and pollution control. It is with this in mind that this study examined the influence of project procurement practices on implementation of solar projects in Marsabit County, Kenya. The specific objectives of this study were: To establish the effect of project procurement planning on implementation of solar projects in Marsabit County, Kenya; To determine the impact of inventory management on implementation of solar projects in Marsabit County, Kenya; To establish the effectiveness of project contract management on implementation of solar projects in Marsabit County, Kenya; To find out the level of efficiency on material management on the implementation of solar projects in Marsabit County, Kenya. The study used the program theory and the theory of constraints for its theoretical foundation. The study design used was a descriptive research design. The target population of the study was managers and staff working on different solar projects within Marsabit County. The unit of analysis was project team (contractors, engineers, project managers, suppliers) comprising of 171 staff of solar projects in Marsabit County, Kenya distributed as follows: Ambalo-Moyale mini grid(30 staffs), Illaut-Laisamis mini grid(25 staffs), Balesa-North Horr mini grids (30 staffs) Ahadad Solar project(50 staffs) and Arapal solar project(36 staffs). The study used a structured self-administered questionnaire to collect data. The collected data was analyzed through inferential and descriptive statistics. From the analyzed data it was established that there is significant relationship between project procurement planning and inventory management in the implementation of solar projects within Marsabit County. This relates to the program theory. The process of bidding, or stipulations related to qualified project winning and execution processes are like programs or inventory processes explained in the program theory. Further, Contract management and material management positively affect the implementation of solar projects in Marsabit County, Kenya. This can relate to the theory of constrain that demonstrates the needs and constraints of high-level project management spectrum in contract and material management. The study results based on the multiple linear regression model indicates that there is a positive significant relationship between project procurement planning (β=0.117, p= 0.043), inventory management (β=0.087, p= 0.019), project contract management (β=0.881, p= 0.034) and material management (β=0.015, p= 0.011) and the implementation of solar projects within Marsabit County.The study concluded that project procurement practices affects the implementation of solar projects within Marsabit County. The study recommends that there is need to improve on project procurement planning to enhance implementation of solar projects in Marsabit County, Kenya. The study further recommends that there is need to improve on inventory control in terms of integrated information systems for communication in the projects. The study proposes similar studies in other counties implementing solar projects in Kenya. The proposed counties could be with similar geographical/terrain characteristics like Marsabit County. This can be counties located in Arid and semi-arid parts of the Country.

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LIST OF ABBREVIATIONSAND ACRONYMS

ANOVA	Analysis of Variance
CDF	Constituency development Fund
CSF	Critical Success Factors
GDP	Gross Domestic Product
KOSAP	Kenya Off-Grid Solar Access Project
MBO	Management of Objectives
NEPAD	New Partnerships for Africa's Development
PM	Project Manager
PV	Photo Voltaic
PPPs	Public –Private Partnerships
RoK	Republic of Kenya
SPSS	Statistical Package for Social Science
ToC	Theory of Change
UNCTAD	United Nations Development Programme

OPERATIONAL DEFINITION OF TERMS

A Project: A project is a planned endeavor created and undertaken for development or to create change in the society. A successful project undergoes through numerous processes of planning, quality control and risk mitigations (PMBOK, 2012).

Procurement practices: Procurement practices are clearly underlined and actionable process undertaken in obtaining materials or resources or systems to operationalize a project (Baily et al., 2015)

Project Implementation: This is looked at as a process of initiating planned activities and resources specific to a defined project. Mostly done by project managers (PMBOK, 2012).

Project Management: This is the discipline of coordinating, structuring and formulation of processes that ensures smooth running of a particular project or program(Baily et al., 2015).

Project Team: Can be termed collectively as professional and non-professional individuals assigned on a task or several tasks comprising a bigger project implementation and execution (PMBOK, 2011).

Stakeholders: They are key individuals who initiate or are affected by the project. Mainly comprises of the key persons or organizations for avail recourses to the implementation of any project. Stakeholders can also be individuals who benefit from the project such as residents who served by a dam project (PMBOK, 2011)

CHAPTER ONE

INTRODUCTION

1.0 Overview

The aim of this study was to examine the project procurement practices on implementation of solar projects in Marsabit County, Kenya. This chapter presents an introduction to the study, background of the study, statement of the problem, objectives of the study, research questions, justification of the study, scope of the study and limitations of the study.

1.1 Background to the Study

Many ongoing solar projects in Marsabit County is a result of the Kenya Off-Grid Solar Access Project (KOSAP). This is a flagship project of the Ministry of Energy, financed by the World Bank aimed at providing electricity and clean cooking solutions in the remote, low density, and traditionally underserved areas of the country. The Project is part of the government's commitment to provide universal access to electricity in Kenya by 2022, universal access to modern energy services for cooking by 2030, as well as the impetus for growth in achieving Vision 2030 (Motari, 2017). The Project is implemented jointly by the Ministry of Energy, Kenya Power and Lighting (KPLC) as well as Rural Electrification and Renewable Energy Corporation (REREC). According to Otuoma (2018), even though KOSAP has succeeded in other counties lack of good procurement planning has been its main setback in some of the counties including Marsabit County.

Eberhard, Gratwick and Morella (2016) also concurs that implementation of solar projects within Marsabit County is sometimes faced with challenges leading to project abandonment,

key among them being the adaptation to transparent procurement practices (World Bank, 2017). A fact-finding report by ERC (2017) indicates that human conflicts and corruption in the procurement processes are the two key reasons why solar projects have always stalled in Marsabit County. The Pastoral communities are not receptive to allowing the installation of solar panels for fear of losing grazing land. Further, project managers and community leaders have occasionally been accused of embezzling donor funds intended for solar project execution in Marsabit County (ERC, 2017).

1.1.1 Global Perspective of Solar Projects

Among, Gulf Cooperation Council (GCC) countries that comprise Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates (UAE), Masud, Wirba and Alshammari (2018) found that the main challenges facing the implementation of solar energy projects included technological challenges, inadequate public/private initiatives, inadequate research and development and inadequate legislation and regulatory framework. In regard to technological challenges dust deposition affected the performance of multi-crystalline PV module. In addition, decrease in PV power and voltage is strongly dependent on the contaminant type and the level of deposition (International Finance Corporation, 2017).

In India Rachit and Vinod (2016) indicates that despite the many benefits of solar PV Plants, specifically on a 20–60MW generation planned on a 1 km square land, these projects were facing challenges such as land, financial resources and technology (storage problem), which often led to cost and time overrun. In addition, for the government of India to achieve 60 GW for utility scale projects by 2022, approximately $ 40 billion would be required, which was not available at the start of the project. In support of the PV projects, the government started providing Rs. 15,050 cr. which in a true sense was a subsidy for increased solar capacity. In

another study, According to Indragandhi, Subramaniyaswamy and Logesh (2017) indicate that the main challenges facing the implementation and management of PV projects include resources availability, resource configuration strategies and soft computing techniques.

In Germany, Wirth (2018) indicated that PV-generated power amounted to about 40 TWh and covered approximately 7.2 percent of all power consumed in Germany's by the year 2017. However, many solar PV Plants were found to experience challenges like inadequacy in skilled personnel and inadequacy in funds.

1.1.2 African Perspective of Solar Projects

The spread of solar and other modern energy technologies in African countries is considerably low. According to Abdullahi, Suresh and Oloke (2017) African countries are always placed last in having a constant supply of solar energy despite the increased global solar power generation and expansion processes. Global solar energy consumption matrix by World Bank (2019) indicates that Africa provides only 1% of global solar market demand. Further, the region only has 9% of installed grid on photo-voltaics (PV) which generates electricity using solar energy systems. Despite its slowed connectivity, many players have come in to tap on the untapped potential witnessed in Africa. This has seen some little increase in solar PV technology with 1% in 2010 to a remarkable 4% in 2015 (World Bank, 2019).

Some of the African countries who have successfully adopted solar PV Panels include Morocco, Nigeria, South Africa, Ghana and Chad. Morocco so far has one of the most ambitious solar projects in the world (Wirth, 2018). This is based on her government's pro solar policies initiated to direct her energy industry: The policies have been documented

under National Energy Strategy (NES) whose major objective is to ensure that 20% of the country's energy needs is met through renewable energies. However, the implementation of the PV in Morocco is facing challenges such as low technological capacity, funding challenges, governance challenges as well as knowledge development and diffusion.

1.1.3 Kenyan perspective of Solar Projects

According to Oirere (2017), lack of access to financing and the high level of corruption in the procurement of solar energy projects or related materials has greatly hampered the growth of solar energy in Kenya. Different institutions and investors in solar energy are actively involved in resource mobilization towards ensuring Kenya becomes a regional hub in solar energy usage. The Government has also initiated different solar harvesting generation programs in different counties across the Country. According to Kiara (2016), Kenyan energy regulation commission has always sourced for investors across the world to invest in Kenyan solar energy. Wooing of investors is done in various forms including the gazettement of regions with high potential of solar harvesting such as Marsabit County in North Eastern Kenya.

Despite the huge efforts by the energy regulatory commission to woe investors, delays in project completion occasioned by procurement inconsistencies due to corruption has created a downfall to the entire solar project initiation (Kabeyi, 2012). Other challenges in the industry include: time overrun as a result of procurement issues, cost overrun due to corruption and ineffective human resource planning as well as operations and maintenance challenges. In addition, Tigabu, Kingiri and Odongo (2017) indicates that the main issues affecting solar resource exploitation in Kenya include unsustainable up-front system costs

demanded by Kenyan stakeholders from donors and foreign investors, high taxes from both County and National government, inadequate skilled personnel and capital constraints. According to Kiara (2016), access to finance is the most significant challenge to the penetration of solar energy technology in Kenya. The effects of limited financing options are felt by all players from manufacturers to importers, distributors, dealers and end users. In Marsabit County, Keriri (2013) indicates that the main factors affecting the implementation of renewable energy projects include human conflicts and procurement issues.

1.1.4 Project Procurement Practices

Project procurement is fundamental to successful project implementation (Musembi et al, 2018). It is imperative that different variables in project procurement need thorough analysis before project implementation (Kabega, Kule & Mbera, 2016). Part of the cycle in project procurement management is to develop a structured and pre -determined framework for acquisition of the required materials, services, works and contracts, and guide project execution in order to meet the expectations of the user(s) (Jeptepkeny, 2015).

Mburu and Gikonyo (2019), states that procurement method in projects is necessary since it ensures fair competition between local and international suppliers, contractors and service providers in the projects. The common project procurement methods adopted in the projects include open tendering, direct procurement, single sourcing, restricted tendering, request for proposals and request for quotations. This will enhance completion of projects in time and within the estimated cost.

1.2 Statement of the Problem

Solar projects in Kenya and specifically in Marsabit County have been mainly implemented by donor and NGO projects for dispensaries, hospitals, and offices, and in telecommunication technology. Marsabit County as Eberhard, Gratwick and Morella, (2016) argues is among the 14 counties who have benefited from an off-grid solar access project by Kenya Power and Lighting (KPLC), Ministry of Energy and Rural Electrification and Renewable Energy Corporation (REREC). The project initiated in July 2017 by the ministry of energy under a $USD 150 million funding from World Bank is expected to connect 277,000 household within the beneficiary counties (World Bank, 2018). Eberhard, Gratwick and Morella (2016) further indicate that Marsabit County's enormous bare land space makes it a suitable site for the installation of solar systems. For instance, Waldaa area within the county has the largest installations out of the 14 counties recommended for the project. The challenge however has been lack of open procurement processes and community conflicts. This has resulted into delays in the project completion (World Bank 2019).

According to Langat, (2012), current solar projects in Marsabit County are faced by lengthy bureaucratic procurement processes mainly in the acquisition of raw materials. Further, corruption and discriminatory awards of tenders has made some solar projects to fail. According to Kabega, Kule and Mbera (2016) many solar projects believed to have failed due to poor project procurement practices. Masud et al., (2018) argues that past solar energy projects within Marsabit County have always been stalled or done off their initial design due to the embezzlement of project funds during the procurement process by project managers. Motari (2017) further observed in 2017 that World Bank pulled off a major solar project meant to connect over 10,000 households in Marsabit County due to procurement

malpractices. This might just be a few solar projects which never took off or stalled due to improper procurement processes.

Despite this clear corporate evidence on failed projects within Marsabit County due to challenges in procurement practices, there is need to study the influence of project procurement practices in the County. Further, few studies done on the implementation of solar projects do not address the issue of procurement practices. For instance, Keriri (2013) conducted a study on the factors influencing adoption of solar technology in Laikipia North Constituency; Kabeyi (2012) examined the challenges of implementing thermal power-plant projects in Mombasa County; and Kiara (2016) examined the determinants of the implementation of infrastructure development projects in renewable energy sector in Kenya Power Limited. It is based on this premise that the current study sought to examine the project procurement practices on the implementation of solar projects in Marsabit County, Kenya.

1.3 General Objective

The general objective of the study was to examine the influence of project procurement practices on implementation of solar projects in Marsabit County, Kenya.

1.3.1 Specific Objectives

The specific objectives of this study were:

i. To analyze the influence of project procurement planning on implementation of solar projects in Marsabit County, Kenya.
ii. To determine the influence of inventory management on implementation of solar projects in Marsabit County, Kenya.

iii. To describe the influence of project contract management on implementation of solar projects in Marsabit County, Kenya

iv. To explain the influence of material management on implementation of solar projects in Marsabit County, Kenya.

1.4 Hypotheses of the Study

The study was guided by the following hypotheses;

$Ho_{1.}$ There is no significant relationship between project procurement planning and implementation of solar projects in Marsabit County, Kenya

$Ho_{2.}$ There is no significant relationship between inventory management and implementation of solar projects in Marsabit County, Kenya

$Ho_{3.}$ There is no significant relationship between project contract management and implementation of solar projects in Marsabit County, Kenya

$Ho_{4.}$ There is no significant relationship between material management and implementation of solar projects in Marsabit County, Kenya

1.5 Justification of the Study

Kabeyi (2012) points out that implementation of solar projects in Kenya experience delays occasioned by material sourcing and long procurement processes. In addition, Tigabu, Kingiri and Odongo (2017) indicate that the main issues affecting solar resource exploitation in the rural areas include high up-front system costs, high import taxes, lack of adequate skilled personnel, luck of reliable knowledge about the technology and capital constraints. Even though both studies were elaborate in explaining financing and human resource

challenges, they did not conclusively discuss the effect of procurement practices in the implementation of solar project. This study compliments the two studies by detailing the influence of project procurement practices on implementation of solar projects in Marsabit County. It elaborately demonstrates how procurement planning, inventory management, project contract management and material management affect the implementation of solar projects in Marsabit County, Kenya.

1.6 Significance of the Study

The study will be beneficial but not limited to the following stakeholders:

The findings of this study are of great importance to the management of companies implementing solar projects, the government of Kenya and policy makers and other researchers and academicians. To the management of companies implementing photovoltaic power plants, the study provides necessary information that can be used to deal with determinants of utilization of photovoltaic power plants in Nairobi County including project procurement planning, project funding, contract management and procurement methods. These companies can use the findings of this study to come up with strategies to deal with related challenges.

To the government of Kenya; the study provides information on the challenges facing the implementation of solar projects that can be used to formulate policies focusing on role of project procurement practices on implementation of government funded solar projects. In addition, the study provides information on how various government policies impact on the implementation of solar projects. This information can be used in the revision of the current policies and the formulation of new policies to improve the implementation of solar projects.

The study adds more information to the body of knowledge on project procurement practices and implementation of government funded solar projects. To other researchers and academicians, the study provides information on utilization of photovoltaic power plants and its determinants. In addition, the study provides a basis upon which further studies can be conducted on implementation of government funded solar projects.

1.7 Scope of the Study

The aim of the study was to examine the influence of project procurement practices on implementation of solar projects in Marsabit County, Kenya. The study was conducted in Marsabit County which is located on the Northern part of Kenya. Target respondents were direct individuals involved in solar project implementation. They included: Project managers, technicians, contractors, sub-contractors and County procurement officers all linked to various solar projects within Marsabit County; distributed as follows: Ambalo-Moyale mini grid(30 staffs), Illaut-Laisamis mini grid(25 staffs), Balesa-North Horr mini grids (30 staffs) Ahadad Solar project(50 staffs) and Arapal solar project(36 staffs). Primary data was collected a structured a semi-questionnaire administered via a drop and pick later approach. The data was then analyzed statistically using SPSS version 22. Data collection was done between the Month of June and July 2020. Key areas of focus by the study were: influence of project procurement planning on implementation of solar projects in Marsabit County, influence of inventory management on implementation of solar projects in Marsabit County, influence of project contract management on implementation of solar projects in Marsabit County and the influence of material management on implementation of solar projects in Marsabit County.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This chapter reviews literature in relation to influence of project procurement practices on implementation of solar projects in Marsabit County, Kenya. This chapter commences with theoretical frameworks followed by concepts of the study which discusses the link between the project procurement practices and solar project implementation. The chapter further presents the empirical review and ends with research gaps.

2.1 Theoretical Framework

A theory is made up of a group of coherent and tested propositions that are deemed as accurate and can be used as predications and explanations of study phenomenon. Based on this explanation, the study adopted both the Program Theory and the Theory of Constraints

2.1.1 Program Theory

Main proponents of the program theory are (Chen, 1990b; Lipsey, 2000; Reynolds, 1998; Rogers et al, 2000; Rogers, 2000a; Sedani & Sechrest, 1999; Stufflebeam, 2000: Weiss, 1997). The theory's initial proponent Lipsey (1990) asserts that by identifying important program components and offering data on how these components relate to each other, it contributes to assessment practice. Information collection plans are then included in the framework to provide information to measure the extent, nature and occurrence of each aspect. It is evaluated within the structure once the information on the components is

gathered. The theory of the program is a plausible and reasonable model of how a program should operate (Chen 2014). Tawiah (2014) indicated that this is a proposal regarding input conversion into output and how a poor situation can be transformed into a better one through outputs. It is also demonstrated as the method by which parts of the program are assumed to influence results.

Chen (2014) reasoned that a program theory involves organizational plan on how to deploy resources and ensure the programs and related activities achieve their core values and objectives. The theory also deals with the procurement plan of service utilization that analyses how the expected target population gets the desired intervention quantity. This is through the interaction of the procurement management. Finally, the program theory examines how the planned action represents the required social benefits for the designated target population. Rogers, as Chen (2014) cites, shows the benefits of surveillance and assessment using a theory-based structure to enhance project procurement. It includes the capacity to assign project results from particular projects or operations as well as identifying expected and unwanted program results due to poor project procurement practices. Evaluations based on theory as such allow the evaluator to comprehend why and how the project works as enhanced by project procurement practices (Sambo et al, 2014).

The study used the theory to explain the project procurement practices of solar projects in Kenya. The process of bidding, or stipulations related to qualified project winning and execution processes are like programs explained in the theory. The project donors or entities involved in quality management acts like program evaluators. Just like this study which explores procurement practices and the implementation of solar projects in Marsabit County, this theory explains the linkages between planned action and social benefits.

2.1.2 Theory of Constraints

The theory of constraints was developed by Eliyahu Goldrat (1976) who assumed that the ultimate goal of most organizations is to make a profit and other goals are derived from this goal. However, it is especially the constraints that prevent organizations from generating maximum profits. According to Gupta &Boyd (2008), however profitable the organization is, there are some unavoidable constraints within that organization. The theory of constraints (TOC) can be used to demonstrate how managers can effectively manage organizations based on the assumption of system thinking and constraint management (Naomi, 2014). The philosophical assumption of the theory of constraints looks at change within two level perspectives in any organization. This are, measures that drive the organization, and methods employed within the organization (Gupta & Boyd, 2008). The constraints are further demonstrated within the needs and constraints of a high-level project management spectrum (Lau & Kong, 2006) and therefore for effective project procurement management, constraints have to be managed.

According to Büker and Schell-Straub (2017), constraints on project management can create an uphill task in effective project implementation process. Any project constrain will distract its timeframe, budget, and content. The three are commonly referred to as triple constraints which provide success measures to projects. Venture supervisors see triple limitations as key to a venture's prerequisites and achievement. Streamlining these three elements learn extend quality and auspicious finish. Every one of the three limitations of tasks scope (a measure of value), cost and time have their individual impacts on ventures' execution yet since these components have some relationship, one imperative bear an impact on others which in the

end creates a more complicated implementation structure that can produce project failures (Hair, 2011).

Both the program theory and constraints theory form the basis of this study. The study uses the program theory to explain solar project initiation processes which involves the process of selecting the project team including the bidding process. The project team selection process can be equated to the organizational plan of deploying resources and organizational activities around resource deployment explained in the program theory. Further, theory of Constraints can well explain the project procurement planning and inventory management as a process for implementation of solar projects based on its predisposition as brought out by Chen (2014) that operationalization of any program should specify structures and processes forming that program at the onset

Constraints theory is applicable to this study especially in demonstrating the processes of project contract management and material management as a process of solar project implementation. Just as explained in constraint theory by Gupta & Boyd (2008), that any organization however profitable it is, faces some constraints in its normal day to day businesses, even successful solar projects always face some constrains during contract and material management or even the overall execution. According to Nzai (2018), initiation and execution of solar projects in Kenya always face numerous challenges which should be overcome by solar project teams. This varies from high taxes on solar equipment's, procurement malpractices to unreceptive beneficiary community.

2.2 Concept of Project Implementation

Tigabu, Kingiri and Odongo (2017) states that project implementation occurs at the third phase of a project kick off. This involves putting the project plan into action. It's here that the project manager will coordinate and direct project resources to meet the objectives of the project plan. As the project unfolds, it's the project manager's job to direct and manage each activity, every step of the way. That's what happens in the implementation phase of the project life cycle: The project manager follows the initial plan designed for that project. According to Kikwasi (2012), the implementation phase is where the project team actually does the project work to produce the deliverables. The word "deliverable" means anything that the project delivers. The deliverables for the project include all products or services to which the team assigned to the project performs for the client, customer, or sponsor, including all the project management documents.

The steps undertaken to build each deliverable will vary depending on the type of project being undertaken. For instance, engineering and telecommunications projects will focus on using equipment, resources, and materials to construct each project deliverable, whereas computer software projects may require the development and implementation of software code routines to produce each project deliverable. The activities required to build each deliverable will be clearly specified within the project requirements document and project plan (Project Management Institute, 2013).

According to Aluya (2014), a project is only successful if it comes on schedule, on budget, it achieves the deliverables originally set for it and it is accepted and used by the clients for whom the project was intended. Kikwasi (2012) affirms that projects possess certain

characteristics that distinguish them from any other activity in the organization meaning that any project will have a start and an end date and will produce unique results which are characterized by progressive elaboration. Due to their uniqueness and greater uncertainty, projects cannot be understood entirely at or before the start and therefore planning and execution of projects happen many times in separate stages or phases. 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 (Sebitosi & Pillay, 2007).

The project management institute (PMI) defines project management as the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements (Project Management Institute, 2013). This means that project procurement management is all about managing resources efficiently and effectively in order to get a project completed successfully. The PMI identified some five process groups that form the building block for any project life cycle that project procurement management practices is necessary. These process groups are: initiation process group, planning process group, execution process group, monitoring and control process group and closing process group.

Implementation of solar projects has been critical towards achieving the goal for which the project is initiated and intended. Several such projects in Marsabit County funded by the government of Kenya are known to have stalled (white elephants). Some of these stalled projects in Marsabit County include: “Kenya Off-Grid Solar Access Project (KOSAP)”, funded jointly by the government of Kenya and World Bank (ERC, 2017). The project was commissioned in June 2017 by Kenyan Energy Ministry and was expected to be completed by December 2019. The project stalled one year down the line with only 20% of the work

done, the few panels installed are very rusty and any further development would mean starting over again (Eberhard, Gratwick and Morella 2016). Another stalled solar project is "Solar PV stand-alone home power systems" financed by Kenya power and Lighting Company in 2016. The project was meant to generate more power towards County grid through installed panels on roofs of public institutions such as schools, health centers and hospitals (ERC, 2017). Unfortunately, procurement of panels and other materials were marred with corruption making the overhead costs to be too expensive for KPLC to initiate continue with the project. Out of 1000 target institutions, only 50 had panels installed making the implementation of the project to stall. According to Gwaya, Masu & Wanyona, (2014) few solar projects have been completed but not in line with minimum threshold, while others have dragged on for many years before their successful completion.

2.3 Concept of Procurement Management and the implementation of solar projects

Guth (2007) defined project procurement management as a coordinated effort based on outside suppliers to acquire goods and services for projects. These relationships are made regularly on a contract basis with the goal that the required items or services are received on time and meet the principles required by the procurement project or organization. According to Baily, Farmer, Croker, Jessop, and Jones (2015) project procurement management is worth nothing without an unimpeachable set of procurement processes. Tebele and Jowah (2014) states that the project manager should always have an understanding of structural, social or management of any project if any chances of high success are to be spelled out. Emmett and Crocker (2013) agree, signifying procurement as an essential stage of project management to ensure that project deliverables and objectives will result in the meeting of stakeholder expectations; this cannot be achieved without calculated procurement processes.

According to Verzuh (2015), although considerable developments in procurement have been made in previous decades, for instance, in the form of the centralized procurement systems, Just in Time (JIT) and Total Quality Management (TQM) programmes, this has happened for the most part, in economically developed countries. In various economies of developing countries, procurement has not had such a critical effect in the project management industry (Marco et al. 2012). Kaspar and Puddephatt (2012) points out that little effort is made to warrant policies, rules and institutional frameworks governing the procurement systems, especially in terms of ensuring that business or client funds are divided out in the utmost efficient and economical way so that the system delivers the best value for money.

Project procurement management is a coordinated effort that occurs outside suppliers to acquire goods and services for projects. These relationships are made regularly on a contract basis with the goal that the required items or services are received on time and meet the principles required by the project (Guth, 2007). According to Baily, Farmer, Croker, Jessop, and Jones (2015) project execution is worth nothing without an unimpeachable set of procurement processes. Tebele and Jowah (2014) states that any effective project management involves a lot of professional coordination of the structures and the management processes around all components of the project design.

Meredith& Mantel (2012) notes that procurement in itself is the process of acquiring goods and services designed on a particular project. On the other hand, Public Procurement (PP) is a function of government stipulating decisions about the services that will be delivered to local authorities and the communities they serve (Meredith& Mantel, 2012). Emmett and Crocker (2013) adds that procurement signifies an essential stage of project execution to ensure that project deliverables and objectives will result in meeting the stakeholders

expectations; this cannot be achieved without calculated procurement processes. PMBoK (2014) indicates that project procurement incorporates every one of the processes important for buying or gaining the products, services, or results required from outside the project team to execute the project. Project management is a strategic process and therefore the project manager needs to develop a concrete (detailed) strategy to successfully implement the project. Project procurement should be process-oriented and strategic because of its centrality to implementation. This depends on the mechanisms used that should involve adoption of good management information system as well as strong interpersonal relations with suppliers and donors.

Shrimali and Kniefel (2011) observe that the strategic role of procurement is to perform sourcing related activities in order to achieve the overall objectives of the organization. Among the basic procurement activities that influences successful project implementation are supplier selection, evaluation, ongoing management and total quality management, this it ranges from a support role to a strategic function by anticipating and meeting the resource requirements of all functional areas in a project through coordination of rebound logistics and all material inflows and timely allocation in projects.

Some project contracts once awarded fail to comply with the entire performance criterion because the contractor fails to follow the work plan. This failure to observe the project time schedule would definitely lead to both cost and time over-runs, which may ultimately cause stagnation as more funds are sought, or the contract mobilizes equipment to the site. Contractors can improve on implementation logistics through JIT while clients can strategically manage projects through an online procurement management process (e-procurement) (PMBoK, 2014)

2.3.1 Project Procurement Planning and implementation of solar projects

Depaoli et al., (2013) indicated that project procurement planning is one of the most critical areas in project management. It incorporates wide administrative elements of organizing, leading, communicating, staffing and controlling. In project procurement planning, there is a stratified way of building and maintaining healthy relationships between purchasing departments and external suppliers in order to work productively in ordering, receiving, reviewing and approving of all procurement items essential for project execution. The PMBoK (2014) looks deep into the phases of procurement processes that identify the risks and challenges involved in procurement management.

According to Martin and Rice (2015), a well-planned procurement management creates better documentation of all project procurement decisions, specifying the approaches and potential sellers. It enables the executing, conduct procurements, obtains supplier responses, selects supplier and awards contract. Further, it helps in monitoring and controlling, conduct procurements manages procurement relationships, monitors contract performance and makes deviations and amendments as required, closing conduct procurements, concludes project procurements (Martin and Rice, 2015).

Project procurement planning can mitigate the risks and uncertainties experienced in project implementation process that are varied and ranging from natural, political to financial risks, which could impede both procurement and implementation. The World Bank in its procurement manual has identified non-conventional risks, which affects projects through delays or complete disruption (World Bank, 2017). These risks are ambiguities about procurement responsibilities in project administration, absence of sound well-established

procurement practices, lack of experience or capacity in the implementing agency to handle the procurement process and propensities for corruption in the selection of contractors and the subsequent management of contract performance. Others include uncertainties about the availability of project execution prerequisites such as rights-of-way, authorizations and permits, relocation plans for affected populations; and Community opposition to or lack of understanding and support for, the project.

According to World Bank report (2017), most utilities in the West Africa Region have nascent planning capacities that are required to develop a least-cost generation plan to organize and contract the future generation required in the medium to long-term. Due to lack of planning, solar deployment in the Region has been mainly through unsolicited proposals that are usually more expensive than contracts resulting from an organized process such as competitive bidding. Ultimately, solar generation procurement in the West African Region for the time being tends to be a slow and protracted process that penalizes ability to materialize the full economic benefits of solar deployment.

In Australia, Martin& Rice (2015) researched on the effect of project planning on Utilization of solar energy projects. The study used descriptive research design and established that RE supply projects can benefit from standardized approval processes and documentation, a 360° approach of engaging with stakeholders in the extended electricity grid access. The prospected future of electrification and green energy generation in Africa lies in solar power generation and wind tapping. Poor implementation of projects related to solar power generation is however seen as the key impediments to the electrification processes (World Bank, 2017).

Recently, many African countries have seen the need for effective management solar projects. In a report by PPOA, 2009, African nations are steadily adopting the new norm of procurement process at both central and local government levels, and its subsequent contribution to improved governance of the projects. In Kenya for instance, public procurement processes have been put under central online procurement system (Procurement). This was implemented through a procurement act by the parliament in 2015. The act further tabulates that any won project through a public procurement should rightfully declare all the returns on investments or project expenditure through an online open process (Tigabu, Kingiri, & Odongo, 2017).

2.3.2Inventory management and implementation of solar projects

Project inventory is defined as a stock of materials imperative to project operations (Ocharo & Kimutai, 2018). Projects hold inventory as raw materials, work in progress and finished goods to support efficient implementation of construction projects. Project inventory management is defined as the synchronized management of processes relating to procurement, storage, issuance and internal distribution of the materials for construction. It also involves the regulation. Inventory is directly linked to the project operations hence a good system of project inventory management is bound to have a direct impact on implementation of the project (Ikejemba et al, 2017).

Project inventory control provides an avenue for cushioning project against inconsistencies in demands and availability of items for construction. These inconsistencies are caused by fluctuating demands, mismatches in supplier deliveries and inaccuracy in inventory control.

This can be achieved by ensuring that there is planning, inventory process automation, modeling and categorization of project inventory (Wyatt &Silvester, 2018).

Project inventory collaborative planning reduces the bullwhip effect, enhances user satisfaction, and implementation process within project construction supply chain (Yang & Fu, 2012). The inclusion of project suppliers in the planning process may mitigate the risk of using inaccurate information to guide capacity plans. This is done by use of advanced planning system and sharing point of sales data which prevents holding of excessive inventory, insufficient forecasts, misguided capacities and poor project implementation (Carbon Africa Limited, 2016).

2.3.3 Project Contract Management and Implementation of Solar projects

Selecting a proficient and dependable contractor is one of the greatest problems consumers who wish to achieve project success face (Kumah-Abiwu, 2016). The first process to a project contract management is bid assessments. Assessing a bid is very crucial especially if it is done in an open manner. It comprises checking for the technical, professional and financial ability (Claire, 2008). When the bid assessment is done in a professional manner, chances of project failure or other malpractices associated with it is always minimized. According to Coughlin & Kandt (2011), most donors require that funding recipients evaluate contractor performance and document, as appropriate, whether contractors have met the terms, conditions and specifications of the contract.

Forsyth (2016) argue that, project contract management is not all about accessing and allocating a contract to a qualified bidder. It involves evaluating the capabilities of each bidder. Because of the high costs of setting up solar projects, it is always imperative that

proper evaluations are done before any solar contract is awarded. The procurement entity should also confirm to certain quality specifications in dictating bidding terms. This should include project risks or limitations and the proposed solution to those limitations. In general sense, the technical ability to evaluate bidder's details can lead to the successful implementation of any project (Ketlogetswe, 2009). When evaluating the project team for instance, the size/numbers of the project team will not matter unless experience and availability of qualified contractors if carefully evaluated.

A report by Project Management Institute (2013) indicated that project contracting and communicating with suppliers about delivery dates and payment conditions must be well stated before awarding the contract. To ensure that deliveries are received on time and the budget is not exceeded; all conditions stated should be recorded in the project procurement contract. Additionally, a detailed delivery calendar must be negotiated and approved by parties in the purchasing process in the contract.

2.3.4 Material management and implementation of solar projects

Project materials management is a holistic approach in managing a project integral planning and coordination of acquiring, storing moving and controlling of materials in a way that optimizes project resources with minimal costs. Project materials management involves making tradeoff between achieving high levels of project implementation. The higher the level of project implementation, the higher the costs involved hence the need to balance between what goods to make and when with the capacity of the project (Brooks & Urmee, 2014). This is done by project demand forecasting and effective supplier collaboration.

Project demand forecasting is a prediction of an actual future value of interest in a future period of time that is used to as a prime factor in decision making in a supply chain. Accurate project forecasting has positive effect on order fulfillment, risk reduction and measurement of supply chain improvement initiatives whilst poor forecasting leads to stale stock, inventory proliferation and jammed distribution channels which uses up resources that could instead be used for product development and growth activities (Carleton et al, 2018). Project demand forecasting sets the avenue for capacity observations, financing requirements and stakeholder confidence.

Project supplier collaboration involves two or more independent working jointly in the planning and execution of project supply chain activities. It involves a productive relationship which ensures benefits and risks are shared, there is a win-win orientation, focus is on value that can be accrued beyond expectations, leveraging on supplier innovations and capabilities, segmentation of supplier base and joint coordination of performance and systems in a project (Feng & Richards, 2018). Due to technological changes in projects and more accessible technology on the web, solar projects have increasingly turned collaboration at different tiers of the supply chain whereby there is joint decision making and collective sharing of risks and benefits of the outcomes (Wirth, 2018).

2.4 Empirical Review

Ikejemba et al (2017) researched on factors affecting Utilization of PV projects in Africa and found that despite the differences in economic, social and geographical composition of African countries, explanations on failed projects bear similar narratives. Mostly stated are poor project planning leading to project failure followed by poor maintenance and lack of

public acceptance and inclusion. Sambo et al (2014) conducted research on the effect of project planning on Utilization of solar PV projects in Nigeria. The researchers adopted in-depth analysis of performances of existing systems during their studies. The study found that Utilization plan of standard solar PV projects in the country bears great economic and infrastructural advantages to the energy sector. The study also established that poor planning leads to failure of several solar PV projects being installed across the country.

A study by Onyango (2012) examined procurement effects on planning in public and private institutions. Literature for the study on procurement effect on planning in public and private institutions reviews that proper procurement processes leads to complete operationalization and success of any solar project in Kenya. The study adopted the procurement models, PPOA entry manual derived from PPDA Act of (2005) as well as the PPDR (2006). Guidelines on the effective measures towards institutional improvement and quality were given as the recommendations for the study.

Adero and Ayub (2017) did a study to establish the effect of procurement practices on procurement performance of public sugar manufacturing firms in Western Kenya. The specific objectives of the study were to establish the effect of procurement planning on procurement performance of public sugar manufacturing firms in western Kenya. According to the study findings, there is a positive and significant impact when especially on sugar manufacturing firms in Western Kenya if proper procurement planning and performance evaluation is applied.

Ocharo and Kimutai (2018) researched on the effect of project planning in power sector projects in Kenya. The study used explanatory survey research design. The study found that

most power projects in Kenya are well planned but those plans were not well implemented and did not fully involve all the stakeholders when they were in the project design stage and that project monitoring, assessment; follow up, evaluation and feedback were not adhered to making the project utilization process below expectations.

Xiarchos and Lazarus (2013) conducted a study on factors which influence adoption of solar power generation systems in United States. The researcher descriptively brought out the facts underlying the study. The study found out that the State financial instruments, such as rebates, grants, investment tax credits, and production incentives has no significant effect on adoption of power generation systems. Shrimali and Kniefel (2011) researched on the effect of project funding on implementation of solar energy projects in India. The study used a fixed-effects model with State-specific time-trends for State-level data from 1991-2007 and found that clean energy funds have a significant impact on implementation of renewable energy. Similarly, Romig et al. (2018), researched on factors which affect implementation of photovoltaic projects in India. The study adopted descriptive research design and found that inadequate funding affected successful implementation photovoltaic projects.

Kiara (2013) researched on effect of project funding on implementation of renewable energy projects in Kenya Electricity Generating Company. A descriptive survey research design was used to obtain data. The study found that project funding has a positive and significant effect on implementation of renewable energy projects. The study also established that KenGen finances renewable projects by use of equity and debt hence resulting to reduction in the cost of renewable energy in KenGen because of technological advancement in efficiency under mass production.

Otuoma (2018) researched on how project funding influenced implementation of photovoltaic power projects in Homabay County. The researcher adopted descriptive research design during the study and found that availability installation funds considerably influence the implementation of solar energy projects in Homabay County. Motari (2017) also conducted a study on the effect of project funding on implementation of solar energy projects in Remba, Homabay County. The researcher used descriptive research method and established that project funding has a significant influence on implementation of solar energy project as shown by minimum budget allotment to renewable energy which has greatly influenced the successful implementation of the projects.

Mutwiri (2015) researched on determinants of the uptake of solar photovoltaic by ERC licensed firms in Kenya. The research design employed in conducting this study was descriptive research design. The study found that government incentives were found to be the highest in determining the uptake of solar PV. Moreover, Wamalwa and James (2018) conducted research to determine the effect of project funding on the implementation of NGO projects within Busia County. A sample size of 96 respondents answered structured questionnaires on the uptake of solar photovoltaic processes by ERC companies. The finding of the study indicates that there is a major intersection points between financing, involvement of local communities, communications and NGO project implementations.

Mutua, Waiganjo and Oteyo (2014) set out to determine the influence of contract management in relation to the project outsourcing in medium manufacturing firms within Nairobi County in Kenya. According to the study findings IT and marketing projects are the most outsourced projects in Nairobi County. The study further reveals that management of projects is termed as the most important factor in success of any outsourced project. The

study demonstrates that 66% variation in any project is as a result of proper contract management. Additionally, 99% stated that proper contact management should have properly spelled objectives while management training should be an issue that can be improved on.

2.5 Conceptual Framework

A conceptual framework is made up of ideas and principles that are from relevant enquiry fields and used to come up with a relevant presentation. The current research conceptual framework is based on the project procurement practices on implementation of solar projects in Marsabit County. The independent variables are project procurement planning, inventory management, contract management and material management while the dependent variable is implementation of solar projects. The conceptual framework in Figure 2.1 shows the hypothesized relationship between the independent variables and the dependent variable.

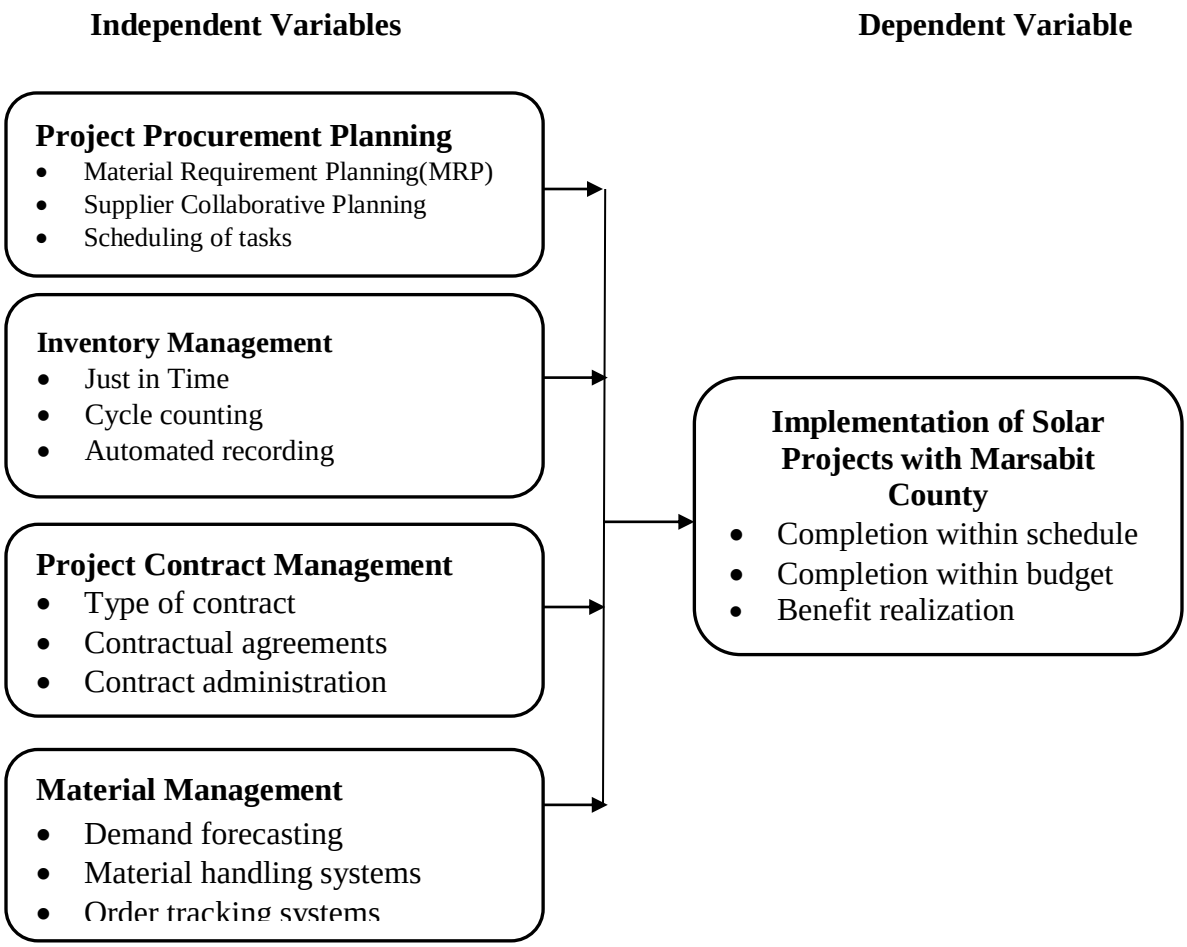

Figure 2.1: Conceptual framework

2.6 Chapter Summary and Research Gap

This chapter has examined both the theoretical and empirical literature relevant to the study. The review indicated that procurement planning, procurement funding, contract management and procurement methods are the most important element of the implementation of solar plants projects. The independent variables which include: project procurement planning, inventory management, project contract management and material management have been reviewed in this chapter. The chapter also indicated the conceptual framework; research gaps have also been identified and highlighted in this chapter.

Although various studies have been conducted, research to examine the factors affecting the implementation of solar projects has not been exhaustively done; they were conducted in other countries and those conducted in Kenya are limited to various industries and organizations. From a global perspective, Ludovique, Szklo and Schaeffer (2017) conducted a study on cost overruns and delays on energy megaprojects in Brazil; Masud, Wirba and Alshammari (2018) examined solar energy potentials and benefits in the gulf cooperation council countries; and Forsyth (2016) studied the impediments implementing renewable energy projects in South Africa. However, different countries around the world are characterized by different socio-economic environments, environmental factors and legal frameworks regarding implementation of PV projects and hence the findings from one country cannot be generalized to another.

In Kenya, Kabeyi (2012) conducted a study on the challenges of implementing thermal power-plant projects in Kipevu III 120 Mw Power Station; Keriri (2013) conducted a study on the factors influencing adoption of solar technology in Laikipia North Constituency; and Kiara (2016) studied the determinants that influence the implementation of infrastructure development projects in renewable energy sector in Kenya Electricity Generating Company Limited. Nonetheless, besides being limited to specific institutions, these studies did not show the effect of project procurement planning, inventory management, project contract management and material management on implementation of solar projects. Further, the methodology applied in the study by Kabeyi (2012), Keriri (2013) and Kiara (2016) were comparative, they did a comparison on the adaptation of solar technology across different counties. They used quantitative methods to review data between different Counties of their focus. The main theory used across all the studies was Institutional Theory by DiMaggio and

Powell (1983). Even though this study uses quantitative methods just like Kabeyi (2012), Keriri (2013) and Kiara (2016) studies, it is not a comparison study, it is descriptive. Comparison studies equate problems across different scenarios which might be misleading as each problem is unique in nature. This study is a descriptive study. It explores the procurement practices in the implementation of solar projects in Marsabit County. Institutionalized theory used in Kabeyi (2012), Keriri (2013) and Kiara (2016) studies also discusses the general concepts of an institution. This study has opted for program theory and theory of Constraints. Program theory explains the linkages between planned action and social benefits while theory of constrains explains the challenges in procurement process.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Overview

This chapter has highlighted the procedures followed when conducting the study to meet the study objectives stated in chapter one. The chapter has indicated the research design which was adopted, target population used during the study, sampling frame, sample and sampling techniques which were used to select sample size for the study, research collection tools (instruments) and data collection procedure followed during the study. Finally, the chapter has stated the pilot study, data analysis and presentation.

3.1 Research Design

This study used a descriptive research design. Van Manen (2016), states that a descriptive research design is a method of data collection from which a sample of individuals being investigated use a combination of closed-ended and open-ended questions on the survey tool as well as an observational approach. Descriptive research design is most widely used on non-experimental research designs across disciplines to collect large amounts of survey data from a representative sample of individuals sampled from the targeted population. This study is termed as a descriptive design because it investigates the ideal situation on procurement practices in relation to implementation of solar projects across in Marsabit County using a structured questionnaire. The findings are also presented in a descriptive format. The study has also used correlational statistics in form of multiple regression analysis to show the relationship between independent and dependent variables.

3.2 Study Area

The study was carried out in Marsabit County, which covers a surface area of 66.923,1 square kilometers. The County is located in northern Kenya, one of the largest counties located in Arid and Semi-arid regions of Kenya. The county borders Lake Turkana to its eastern shores. Chalbi desert is one of the regions at the center and is a major feature within the County. The capital city of Marsabit County is Moyale. It's one of the counties which the national and county governments have installed various solar projects. The governments have been undertaking a programme on renewable energy with a vision for solar power supply in schools and technical training institutes across the county to boost use of renewable energy.

3.3 Target Population

Creswell (2014) describes the target population as an entire set of units to which the survey data is used to make inferences regarding a specific population under investigation. The study surveyed the procurement practices among individuals working on current solar projects within Marsabit County. The unit of observation included the solar project managers, licensed solar technicians and contractors registered by the Energy Regulatory Commission undertaking installation of various solar systems within the county. The unit of analysis is the County procurement officers, project managers (engineers, site surveyors), technicians and contractors. They were chosen because they were involved in day-to-day implementation of the solar projects. They were hence better placed to give an opinion on the relationship between project procurement practices and implementation of government funded solar projects in Marsabit County, Kenya. The target population is 171 distributed across different solar projects as follows: Ambalo-Moyale mini grid (30 staffs), Illaut-Laisamis mini grid (25 staffs), Balesa-North Horr mini grids (30 staffs) Ahadad Solar project

(50 staffs) and Arapal solar project (36 staffs). The actual target population across different staff levels is illustrated in Table 3.1.

Table 3.1: Target Population

Category	Population	Percentage
Solar Project Manager	14	8
Solar Project Technicians	116	68
Solar Project Contractors	6	4
Solar project Sub-contractors	14	8
County procurement officers	21	12
Total	**171**	**100**

Source: Author (2020)

3.4 Sample and Sampling Procedure

Yin (2017), defines sampling as selecting a given number of subjects from a defined population as representative of that population. Sampling occurs when the population under study is larger and impossible or time consuming to approach each unit within the population. According to Russell (2012), fewer units within the population may not require a sample definition; rather each unit is subjected to a taste tool. This process is referred to us census approach. In this case, the target population of 171 staff demonstrated fewer units. The study hence adopted a census approach. The census approach adopted ensured that all staffing categories implementing solar projects with Marsabit county such as procurement officers, accountants, project managers, engineers, site surveyors, technicians and contractors were approached for participation in the study.

3.5 Data Collection Instruments

Primary data was collected through the use of a structured questionnaire. A questionnaire is a research instrument, which gathers data over a large sample (Sahu, 2013). The questionnaires were designed and balanced between the quality and quantity of the data to be collected. Structured questionnaires were carefully designed and sent to the respondents to ensure data collection achieved the objectives of the study. Ordinal scale was applied on data with category interpretations. A five-point Likert scale was used to measure the responses to the various indicators of the variables under investigation. The questionnaire had a 1-5 Likert scale questions whereby 5 meant strongly agreed or a strong agreement with the statement while 1 meant strongly disagreed or a strong disagreement with the statement. Likert scales are widely used in most studies in businesses and other related courses in social science literature, especially in instances where the reflection of the agreement of the respondent is required (Greener, 2008). The structured questionnaire was divided into two sections; the first section provided demographic information while the second section provided information on the content of the study. Information gathered represented the individuals' opinions and attitudes towards some of the research study questions.

3.6 Reliability and Validity of the Research Instruments

A pre-test was conducted in an effort to identify and rephrase any ambiguous, misinterpreted or misunderstood questions. In addition, the pre-test facilitated the removal of typographical errors and determination of whether the questions asked are relevant and appropriate. The pre-test group was sampled randomly and comprised of 10% of the targeted study sample size implementing similar projects in Mandera County. According to Hair (2011), 10% of the

sample required for a full study should be used in a sample size that is 12 respondents. An alpha scale with a0.70 minimum threshold was used by the study. The study results indicated that project procurement planning (0.865), inventory management (0.901), contract management (0.897), material management (0.799) and implementation of solar projects (0.902) were key variables on solar project procurement processes in Mandera County. The Cronbach alpha values result for all the variables were all above the 0.70 threshold from these results. This inferred that the measurement items for each variable were internally consistent.

3.6.1 Validity of the Instrument

According to Kothari (2012), validity of the research instrument is the extent to which it measures what is supposed to be measured. The study adopted both construct and content validity. The construct validity involved division of the questionnaire into sections as per the conceptual framework and ensured that information assessed tallied well with stated objectives. For the content validity, the supervisors revised the content in the questionnaire and ensured that the statements were relevant to the subject before conducting actual data collection exercise. Therefore, this improved contentment validity of the data collection tool.

3.7 Data Collecting Procedure

Data collection is a process of gathering specific information to prove or refute facts in a study (Bryman& Cramer, 2012). The researcher obtained a letter from the postgraduate office that introduced her as a researcher pursuing a Masters course at Moi University. This letter assisted in acquisition of research permit from National Commission for Science, Technology and Innovation (NACOSTI). The primary data collected was from the

respondents who were involved in each of the identified projects. Data collection instruments were administered through a drop and pick later approach.

3.8 Data Analysis and Presentation

Both qualitative and quantitative data analysis techniques were used. Quantitative data was analyzed through the use of descriptive statistics instruments to show simple tallying procedures. This provided frequency distributions illustrations such as tables, pie charts and bar graphs. Inferential statistics enabled the study to infer findings into the role of project procurement practices on Implementation of Solar Projects in Marsabit County, Kenya.

In further fine tuning of the data, variance inflation factor analysis was carried out to test the degree of possible multi co-linearity of the independent variables in the regression model. The extent of multi co-linearity is a situation in which two or more variables in the regression model are highly correlated. This was determined by means of correlation matrix showing the extent of correlation between the influence of project procurement planning on Implementation of Solar Projects in Marsabit County, Kenya; the influence of inventory management on Implementation of Solar Projects in Marsabit County, Kenya; the influence of project contract management on Implementation of Solar Projects in Marsabit County, Kenya and the influence of material management on Implementation of Solar Projects in Marsabit County, Kenya.

The study made some assumptions using the normality test and heteroscedasticity. Multiple linear regression analysis was then carried out specifically in cases of multiple response questions. Creswell (2014) asserts that, multiple linear regressions provide a rich and flexible

framework that suits the needs of many analysts. The multiple linear regression model is specified as:

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

Where:

Y = Implementation of Solar Projects with Marsabit County

B_0 = Constant Term;

B_1, β_2, β_3 and β_4 = Beta coefficients;

X_1= Project Procurement Planning;

X_2= Inventory Management;

X_3 = Project Contract Management;

X_4 = Material Management

3.9 Ethical Considerations

According to Greener (2008), ethical considerations are of great importance during the social research and confidentiality of information provided by the respondents should be considered. Usually if the respondents regard confidentiality and anonymity of the information they provide they can provide required information easily. The researcher got the informed consent from each participant who participated. The researcher also got an approval from NACOSTI and Moi University which increased the confidence in the respondents regarding the objective of the study.

CHAPTER FOUR

DATA ANALYSIS, FINDINGS AND DISCUSSION

4.1 Overview

The chapter presents key results in regard to project procurement practices on implementation of solar projects in Marsabit County, Kenya. The chapter has provided details on the response rate, reliability test, demographic information, descriptive statists and assumptions and multiple regression analysis in order to draw conclusions from the results.

4.2 Response Rate

The study dispatched a total of 171questionnaires to the respondents work stations within Marsabit County. A total of 99 questionnaires were fully filled and returned thus representing a 57.89% response rate. According to Bhattacherjee (2012), response rate of 50%-60% is fair; 61%-70% is good and above 70% is excellent. Any response above 50% is sufficient to make inferences. Hence this study's response rate of 57.89% is fair and considered adequate for further analysis. Table 4.1 demonstrates the response rate achieved.

Source: Author 2021

Table 4.1: Response Rate

Item	**Frequency**	**Percentage**
Returned Questionnaires	99	57.89
Unreturned Questionnaires	72	42.11
Total	**171**	**100**

Source: Author 2021

4.3 Reliability Test Results

The study sought to establish the reliability of the questionnaire and results are presented in Table 4.2. This study adopted an alpha coefficients value range of 0 where no internal consistency is seen and 1 to show high level of consistency. The study also used value of 0.70 as the minimum value range. The results for all the variables are above the 0.70 threshold from these results, it is inferred that the measurement items for each variable are internally consistent.

Table 4.2: Internal Consistency Reliability

Variable	Cronbach's Alpha	Remark
Project Procurement Planning	.865	Reliable
Project Inventory Management	.901	Reliable
Project Contract Management	.897	Reliable
Project Material Management	.799	Reliable
Implementation of Solar Projects	.902	Reliable

Source: Author 2021

4.3 Demographic Information

4.3.1 Gender of Respondents

The gender of the study participants is summarized in Figure 4.2. The findings depicts that of the 99 staffs who participated in the study 63% were male while 37% were female. This implies that there is almost parity between the number of female and male among the Staffs working on different solar projects in Marsabit County.

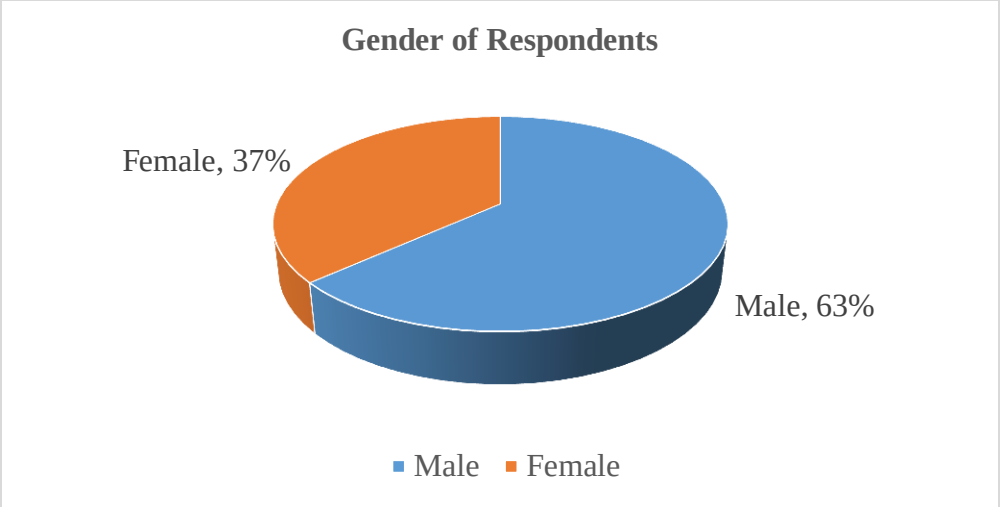

Figure 4.1: Gender of Respondents
Source: Author 2021

4.3.2 Age of Respondents

The findings indicate that most respondents (45%) were between the ages of 25 to 35 years, this was followed by those aged between 36 to 45 years with a representation of 36%, ages 46 to 55 years was represented by 15%, ages 18 to 24 years was 2% and lastly, 2% was represented by those aged between 56 to 60 years. A higher age bracket between 25 to 35 years provides an indication that most staffs working on different solar projects in Marsabit County are energetic and vibrant professionals. The result of the study on the ages of the respondents is indicated in Figure 4.2 below:

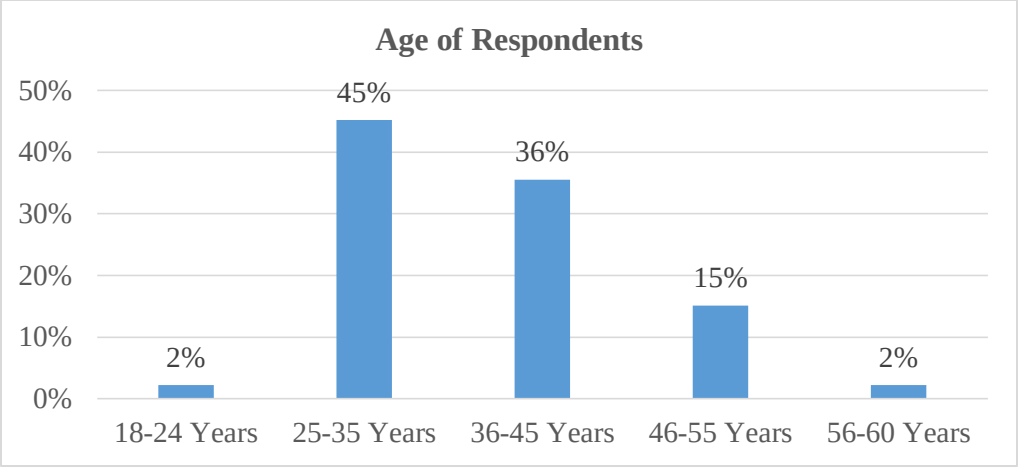

Figure 4.2: Age of Respondents
Source: Author 2021

4.3.3 Level of Education

The findings in Figure 4.3 are an indication of the educational attainment of the study respondents. From the findings, majority of respondents had attained bachelor's qualifications 50%, followed by those who had master's degree with 29%, those with diploma certificate was 15%, only 3% had professional course and lastly, 3% had a Ph.D. qualification. These findings suggest that the study participants had a high level of education.

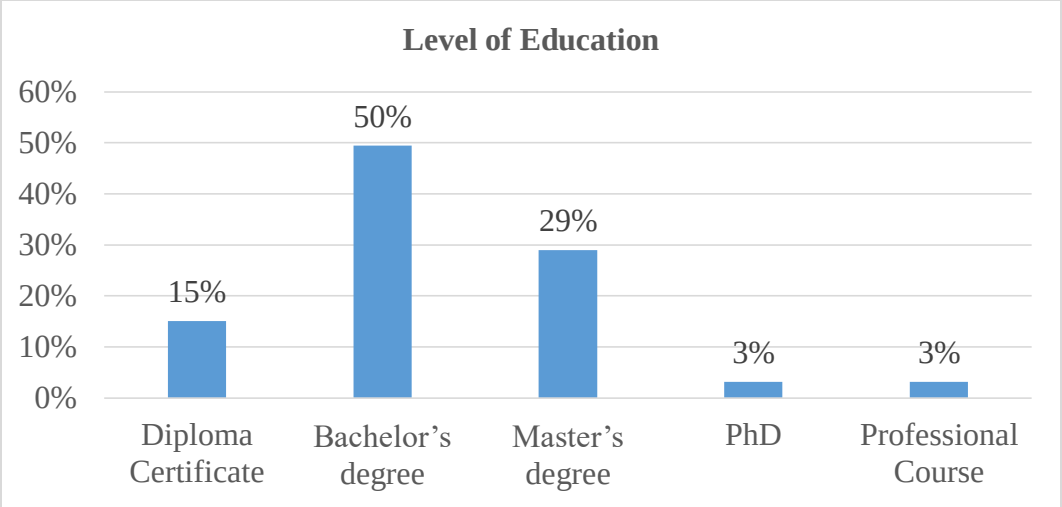

Figure 4.3: Level of Education
Source: Author 2021

4.3.4 Years of Experience

The study sought to understand the years of experience for the project staff working on different solar projects in Marsabit County. The results of the study showed that those who have worked for less than 1 year was 6%, between 1 to 3 years was 26%, between 3 to 5 years was 18%, between 5 to 7 years was 15%, 12% was represented by 7 to 10 years and lastly, those with over 10 years was 22%. From the findings, majority of the respondents are experienced professionals. The findings of the study are indicated in Figure 4.5 below.

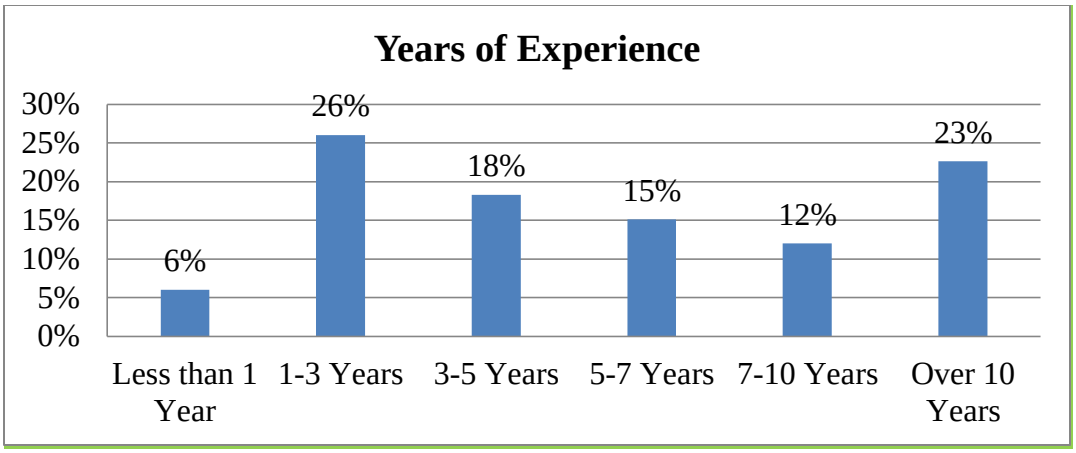

Figure 4.4: Years of Experience
Source: Author 2021

4.4 Descriptive Statistics

The results of the variables have been descriptively represented by the use of percentages in tables. The analysis is based on statements formulating independent variables including: procurement planning, inventory management, contract management and material management. This supports the dependent variable of the study which is the implementation of solar projects. A likert scale was used as a measuring tool.

4.4.1 Descriptive Statistics for the Project Procurement Planning

To determine the influence of project procurement planning on implementation of solar projects in Marsabit County, the study subjected the respondents to taste items related to project procurement planning. Table 4.3 gives the findings on project procurement planning.

Table 4.3: Descriptive Statistics for the Project Procurement Planning

Project Procurement Planning	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean
There's forecasting of materials required for the project implementation in time	0%	3%	20%	11%	66%	20.5
There is the use of Materials Requirement Planning (MRP)	0%	5%	22%	18%	55%	21.2
The project managers try to attain accurate demand forecasting of materials in time	2%	7%	27%	23%	41%	20
There is prequalification of suppliers and long-term contracts with suppliers in the project	4%	36%	10%	18%	32%	17
There is scheduling of work tasks required in carrying out project activities	3%	11%	12%	21%	53%	19

Source: Author 2021

The findings as indicated in table 4.3 shows that majority of the respondents (66%) strongly disagree that there is forecasting of materials required for the project implementation in time. Only 3% agree on the same statement while some 20% were neutral and 11% disagree. On taste statement related to the use of Materials Requirement Planning (MRP), majority of the respondents at 55% strongly disagree while 22% were neutral whereas 18% disagree and only 5% agree. Additionally, majority of the respondents (41%) strongly disagreed on project managers trying to attain accurate demand forecasting of materials in time. Another 23% disagreed while 27%, 7% and 2% were neutral, agreed and strongly agreed on project managers trying to attain accurate demand forecasting of materials in time.

Contrary to other taste statements on project procurement planning, majority (36%) agreed that there is prequalification of suppliers and long-term contracts with suppliers in the project. A slight majority (32%) strongly disagree while 18%, 10% and 4% disagreed, were neutral and strongly agreed respectively on having prequalification of suppliers and long-term contracts with suppliers in the project. This demonstrates some level of approval from the players of solar project implementation in Marsabit County on assessing solar project suppliers during the procurement processes. However, majority (53%) strongly disagree on the statement that, there is scheduling of work tasks required in carrying out project activities. Of which, 21%, 12%, 11% and 3% disagree, were neutral, agree and strongly agree on the statement of scheduling work tasks required in carrying out project activities respectively.

The study findings as indicated in table 4.3 shows weak indicators for project procurement planning in solar project implementation in Marsabit County. Apart from prequalification of suppliers where majority (36%) agreed on its presence within solar project implementations,

all other variables rated indicated a higher percentage of disagreement. This demonstrates that solar projects in Marsabit County do not undergo enough project procurement planning. The findings are contrary to a study by Motari (2017) which indicates that all solar projects solar projects in Marsabit County are developed out of extensive project procurement planning.

4.4.2 Descriptive Statistics for the Inventory Management

The study subjected different indicators of project inventory management to likert scale taste in their determination of their influence on the implementation of solar projects within Marsabit County. Table 4.4 provides the findings on the same.

Table 4.4: Descriptive Statistics for the Inventory Management

Inventory Management	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean
There is Just in time replenishment to facilitate project activities	4%	6%	22%	12%	56%	22
There is a continuous cycle counting of materials required for the project	5%	4%	18%	19%	54%	19.2
There is effective monitoring of items purchased in the project	5%	9%	16%	22%	48%	16.7
There is an automated recording of project materials	7%	24%	16%	19%	33%	21
There is a provision of right quality materials at first order and zero double payments	4%	18%	17%	22%	40%	20

Source: Author 2021

From the findings, majority (56%) strongly disagree that there is just in time replenishment to facilitate project activities. Another 12%, 22%, 6% and 4% disagreed, were neutral, agreed and strongly agreed on timely replenishment of project activities respectively. On the statement related to continuous cycle counting of materials required for the project, majority 54% strongly disagreed while, 19%, 18%, 4% and 5% disagreed, were neutral, agreed and strongly agreed on the same.

On the efficiency of monitoring of items purchased in the project, majority (48%) strongly demonstrated that there is no effective monitoring of items purchased in the project. Only 5% and 9% strongly demonstrated or demonstrated that there is effective monitoring of items purchased in the project. In terms of having an automated recording of project materials, a slight majority (24%) agreed on the statement confirming some automated recording of project materials. However, majority (33%) strongly disagreed on the same statement. Lastly, the findings indicate that there is no provision of right quality materials at first order and zero double payments. This is demonstrated in the majority (40%) who strongly disagreed while 22%, 16%, 18% and 4% disagreed, were neutral, agreed and strongly agreed on the statement regarding the provision of right quality materials at first order and zero double payments.

Subsequently, the findings inventory management shows weak indicators for inventory management in solar project implementation in Marsabit County. All variables rated indicated a higher percentage of disagreement on inventory management. This demonstrates that solar projects in Marsabit County have poor inventory management. This relates to a study by Motari (2017) which also indicates that solar projects in Marsabit County have poor inventory managements. Kiara (2016) also discloses that implementation of solar projects in

Kajiado county faced the challenge of bad inventory management in their procurement process. The findings of this study agree with those findings.

4.4.3 Descriptive Statistics for the Project Contract Management

To find out about the influence of project contract management on the implementation of solar projects within Marsabit County, respondents were subjected to taste items on the same. The statements that were being tasted were: The project manager controls and manages contract changes effectively, the project manager has ensured that the contract terms are well adhered to, the project manager ensures that the contractor is paid in time, the project manager maintains an updated form of the contact and the draft and final reports are always well maintained. The results have been presented in percentages as per table 4.5:

Table 4.5: Descriptive Statistics for the Project Contract Management

Contract Management	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean
The project manager controls and manages contract changes effectively	2%	56%	20%	18%	4%	24
The project manager ensures that the contractor is paid in time	2%	55%	19%	19%	5%	23
The project manager has ensured that the contract terms are well adhered to	4%	42%	20%	22%	12%	20
The project manager maintains an updated form of the contact	3%	40%	17%	22%	18%	19
The draft and final reports are always well maintained	3%	56%	13%	17%	11%	22

Source: Author 2021

From the findings, majority (56%) of the respondents agreed that project manager controls and manages contract changes effectively. Other 20% were neutral, 18% disagreed, 4% strongly disagreed and 2% strongly agreed. Another majority (55%) agreed that project manager ensures that the contractor is paid in time while 19%, 19%, 5% and 2% were neutral, disagreed, strongly disagreed and strongly agreed that the contractor is paid in time. In relation to the project manager ensuring that the contract terms are well adhered to, majority (43%) agreed that the project manager ensured the contract is paid on time. Another 22%, 20%, 12% and 4% disagreed, were neutral, strongly disagreed and strongly agreed on the same. Further, majority (42%) agreed that the project manager maintains an updated form of the contact to while 22%, 18%, 17% and 3% disagreed, strongly disagreed, were neutral and strongly agreed respectively. Finally, majority (56%) whereas 17%, 13%, 11% and 3% disagreed, were neutral, strongly disagreed and strongly agreed that the draft and final reports are always well maintained respectively.

The findings as indicated in table 4.5 shows strong indicators for project contract management in solar project implementation in Marsabit County. All variables rated indicated a higher percentage of agreement on project contract management. This demonstrates that solar projects in Marsabit County have good contract management. A study by Kiara (2016) shows that good project contract management is critical to the implementation of solar projects in Kenya. Further, Keriri (2013) also discloses that implementation of solar projects in Laikipia County was successful because of good contract management in their procurement process. This study agrees with the study by Kiara (2016) and Keriri (2013).

4.4.4 Descriptive Statistics for the Materials Management

To find out about the influence of project material management on the implementation of solar projects within Marsabit County, respondents were subjected to taste items on the same. The statements that were being tasted were: Demand forecasting of materials required for construction, use of integrated information systems for communication in the projects, use of an electronic ordering system of material to the construction site and use of an order tracking system of materials to the construction site. The results have been presented in percentages as per table 4.6.

Table 4.6: Descriptive Statistics for Project Material Management

Material Management	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean
Demand forecasting of materials required for construction	2%	62%	12%	17%	7%	31
Use of integrated information systems for communication in the projects	3%	64%	13%	16%	4%	32
Use of an electronic ordering system of material to the construction site	2%	54%	17%	22%	5%	21
Use of an order tracking system of materials to the construction site	2%	48%	20%	16%	14%	20

Source: Author 2021

The findings demonstrates that majority (62%) of the respondents agree that demand forecasting of materials is required for construction. Another 17%, 12%, 7% and 2% disagree, were neutral, strongly disagree and strongly agree respectively. On the use of integrated information systems for communication in the projects, majority (64%) agree while 16%, 13%, 4% and 3% disagree, were neutral, strongly disagree and strongly agree on use of integrated information systems for communication in the projects respectively. Further, majority (45%) agree while 22%, 17%, 5% and 2% disagree, were neutral, strongly disagree and strongly agree respectively on use of an electronic ordering system of material to the construction site. finally, majority of the respondents at 48% and others at 20%, 16%, 14% and 2% respectively were neutral, disagreed, strongly disagreed an strongly agreed on use of an order tracking system of materials to the construction site.

The findings as indicated in table 4.6 shows strong indicators for project material management in solar project implementation in Marsabit County. All variables rated indicated a higher percentage of agreement on project material management. This demonstrates that solar projects in Marsabit County have good material management. A study by Keriri (2013) discloses that implementation of solar projects in Laikipia County was successful because of good material management in their procurement process.

4.4.5 Descriptive Statistics for the Implementation of Solar Projects

The study sought to examine the level of implementation of solar projects in Marsabit County, Kenya. A five-point Likert scale was used to measure the indicators. These indicators are: Good project procurement planning systems, adoption of project management practices have enabled the solar projects to be completed within the budget, Project

procurement practices have led to improvement of projects being completed within time and Adoption of project management practices has improved the satisfaction of the stakeholders. The findings have been demonstrated in table 4.7 below:

Table 4.7: Descriptive Statistics for the level of implementation of Solar Projects

Project Implementation	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean
Due to good project procurement planning systems, there is improved implementation of solar projects within time	2%	60%	18%	15%	5%	28
Adoption of procurement management practices have enabled the solar projects to be completed within the budget	1%	55%	18%	21%	5%	19
Project procurement practices have led to improvement of projects being completed within time	2%	46%	22%	23%	7%	17
Adoption of procurement management practices has improved the satisfaction of the stakeholders	13%	38%	13%	15%	21%	17

Source: Author 2021

Based on the findings, majority (60%) agreed that due to project procurement planning systems, the recommendations put forward have been actioned on and thus improved implementation of solar projects within time. Another 18% were neutral while 15%

disagreed, 5% strongly disagreed and 2% strongly agreed respectively on project procurement planning systems. The findings also reveal that majority (55%) agree that adoption of procurement management practices have enabled the solar projects to be completed within the budget while 21%, 18%, 5% and 1% disagree were neutral, strongly disagree and strongly agree respectively on the same. The findings also show that majority (46%) agree that due to good project procurement planning systems, there is improved implementation of solar within time with 23%, 22%, 7% and 2% disagreeing, being neutral, strongly disagreeing and strongly agreeing respectively on the same. Finally, majority (38%) were in agreement that adoption of procurement management practices has improved the satisfaction of the stakeholders. Another 21% strongly disagree while 15% disagree whereas 13% each strongly agree and were neutral on adoption of procurement management practices.

All variables rated indicated a higher percentage of agreement on level of implementation. This demonstrates that solar projects in Marsabit County have good levels of implementation. A study by Keriri (2013) discloses that implementation of solar projects in Laikipia County was successful because of good procurement management practices. This study agrees with a study by Keriri (2013).

4.5 Inferential statistics

This was done through multiple regression analysis to help in making the inferences on the joint causal relationship between the independent variables (procurement planning, inventory management, contract management and material management) and dependent variable (implementation of solar projects).

4.5.1 Correlation coefficient between procurement planning and the implementation of solar projects

The correlation coefficient (R) was computed to determine the strength of the relationship between procurement planning in relation to implementation of solar projects within Marsabit County. The results are demonstrated in table 4.8 below:

Table 4.8: Correlation between procurement planning and implementation of solar projects

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.717[a]	.614	.609	.108

Predictors: (Constant), Procurement planning
Source: Author 2021

From the findings, the computed R for this model was 0.717 with an adjusted R^2 of 0.609. This indicates a strong relationship between procurement planning and implementation of solar projects. The inference made on this is that whereas the descriptive data indicates a high rate of negativity in the statements describing procurement planning in relation to solar project implementation in Marsabit County, there is a strong causal relationship between procurement planning and implementation of solar projects. Hence, the null hypothesis (Ho) that there is no significant relationship between project procurement planning and implementation of solar projects in Marsabit County is rejected by the study.

A similar study by Motari (2017) which demonstrated that all solar projects in Marsabit County are developed out of extensive project procurement planning also had a strong causal relationship with a computed R of 0.69.

4.5.2 Correlation coefficient between inventory management and the implementation of solar projects

The correlation coefficient (R) was computed to determine the strength of the relationship between inventory management in relation to the implementation of solar projects within Marsabit County. Results are demonstrated in table 4.9 below:

Table 4.9: Correlation between inventory management and implementation of solar projects

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.462[a]	.428	.422	.04

Predictors: (Constant), inventory management

Source: Author 2021

Based on the findings, the computed R for this model was 0.462 with an adjusted R^2 of 0.422. This indicates a weak relationship between inventory management and implementation of solar projects. The inference made on this is that the high negativity on the statements rated from the descriptive data correlates with the nature of the relationship between solar project implementation and inventory management. Hence the null hypothesis (Ho) that there is no significant relationship between inventory management and implementation of solar projects in Marsabit County is supported by the study.

This relates to a study by Kiara (2016) whose descriptive statistics indicates that solar projects in Marsabit County have poor inventory managements. Inferential statistics by Kiara (2016) gave a computed R of 3.5 indicating a weak relationship between inventory management and solar project implementation.

4.5.3 Correlation coefficient between contract management and the implementation of solar projects

The correlation coefficient (R) was computed to determine the strength of the relationship between contract management in relation to the implementation of solar projects within Marsabit County. Table 4.10 below gives the findings.

Table 4.10: Correlation between contract management and implementation of solar projects

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.500[a]	.511	.508	.008

Predictors: (Constant), contract management
Source: Author 2021

From the findings, the computed R for this model was 0.50 with an adjusted R^2 of 0.508. This indicates some relationship between contract management and implementation of solar projects. The inference made on this is that the high positivity on the statements rated from the descriptive data correlates with the nature of the relationship between solar project implementation and inventory management. Hence the null hypothesis (Ho) that there is no significant relationship between contract management and implementation of solar projects in Marsabit County is refuted by the study.

The study agrees with, Keriri (2013) who disclosed that implementation of solar projects in Laikipia County was successful because of good contract management in their procurement process. The computed R on Keriri (2013) was 0.68 giving a high significant on the relationship between solar project implementation and inventory management in Laikipia County.

4.5.4 Correlation coefficient between material management and the implementation of solar projects

The correlation coefficient (R) was computed to determine the strength of the relationship between material management in relation to the implementation of solar projects within Marsabit County. Table 4.11 below provides the findings:

Table 4.11: Correlation between material management and implementation of solar projects

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.570[a]	.604	.612	.042

Predictors: (Constant), material management
Source: Author 2021

The computed R for this model was 0.57 with an adjusted R^2 of 0.612. This indicates a strong relationship between material management and implementation of solar projects. The inference made on this is that the high positivity on the statements rated from the descriptive data correlates with the nature of the relationship between solar project implementation and material management. Hence the null hypothesis (Ho) that there is no significant relationship between material management and implementation of solar projects in Marsabit County is refuted by the study.

This is similar to a coefficient correlation on a study by Keriri (2013) on the implementation of solar projects in Laikipia County. The computed R from the findings was 0.62 indicating a positive relationship between material management and the implementation of solar projects in Laikipia County.

4.6 Testing Assumptions of Regression

4.6.1 Normality Test

This was done using Kolmogorov–Smirnov test. Normality is used to describe a symmetrical, bell-shaped curve, which has the greatest frequency of scores around in the middle combined with smaller frequencies towards the extremes (Pallant, 2005). These tests compare the variable to a normally distributed set of scores with the same mean and standard deviation. If these tests are non-significant ($p > 0.05$), it tells that the distribution in the sample is not significantly different from a normal distribution (Field, 2005). Data is considered good and decent in research if it is normally distributed. According to this study, if the value Asymp sig>0.05, then the research data is normally distributed while if the value Asymp.Sig <0.05, then the research data is not normally distributed. Table 4.12 below shows the normality test results:

Table 4.12 Normality test

One-Sample Kolmogorov-Smirnov Test

		Procurement Planning	Inventory Management	Contract Management	Material Management	Objective	Subjective
N		99	99	99	99	99	171
Normal parameters	Mean	4.422	4.318	4.31	4.299	4.222	3.999
	Std. Deviation	1.112	1.101	1.006	1	0.923	0.532
Most Extreme differences	Absolute	0.311	0.208	0.201	0.196	0.192	0.188
	Positive	0.277	0.133	0.122	0.0924	0.0988	0.177
	Negative	0.214	0.215	0.222	0.2	0.11	0.167
Kolmogorov-Smirnov Z		-0.214	-0.215	0.222	0.2	0.11	0.167
Asymp. Sig. (2-tailed)		2.44	2.13	2.22	2.4	2.1	2.21
a. Test distribution is Normal.		0.31	0.2	0.06	0.234	0.45	0.31

Based on the output of one sample Kolmogorov-Smirnov test, the value of the variable Asymp. Sig has a value of 0.31 Procurement Planning, 0.2 Inventory Management, 0.06 Contract Management, 0.234 Material Management , 0.45 objective and 0.31 subjective which was >0.05 .in accordance with the basic decision making in the normality test, the value Asymp sig study variable >0.05 can be concluded that the data competency and performance is normally distributed.

4.6.2 Linearity test

The study carried out a test for linearity among the independent and dependent variable. Some researchers such as Keith (2006) argue that this assumption is the most important, as it directly relates to the bias of the results of the whole analysis. Procurement Planning and Inventory Management were run against objective outcome while Contract Management and Material Management were run against subjective outcome. The linearity test aims to determine the relationship between the independent variable and the dependent variable is linear or not. If linearity is violated all the estimates of the regression including regression coefficients, standard errors, and tests of statistical significance may be biased (Keith, 2006). When bias occurs it is likely that it does not reproduce the true population values (Keith, 2006). According to this test if the value significantly deviates from linearity >0.05, then the relationship between the independent variable are linearly dependent while on the other hand if the value sig deviation from linearity. Table 4.13 below shows the linearity test

Table 4.13 Linearity test

ANOVA Table							
			Sum of Squares	df	Mean Square	F	Sig.
Objective * Procurement planning	Between Groups	(Combined)	137.923	23	5.997	2.838	0.31
		Linearity	1.919	1	1.919	0.908	0.342
		Deviation from Linearity	136.003	22	6.182	2.925	0.31
	Within Groups		253.577	120	2.113		
	Total		391.5	143			
ANOVA Table							
			Sum of Squares	df	Mean Square	F	Sig.
Objective inventory management	Between Groups	(Combined)	257.496	28	9.196	7.892	0.43
		Linearity	2.174	1	2.174	1.866	0.175
		Deviation from Linearity	255.322	27	9.456	8.115	0.43
	Within Groups		134.003	115	1.165		
	Total		391.5	143			
ANOVA Table							
			Sum of Squares	df	Mean Square	F	Sig.
Subjective * Contract Management and Material Management Groups	Between Groups	(Combined)	22.884	30	0.763	12.409	0.14
		Linearity	7.446	1	7.446	121.134	0.32
		Deviation from Linearity	15.438	29	0.532	8.66	0.14
	Within Groups		6.946	113	0.061		
	Total		29.831	143			

Based on the ANOVA analysis in the table above, sig. deviation from linearity of 0.31>0.05, for procurement planning, 0.43>0.05 for inventory management and 0.14>0.05 for contract management and material management . It can therefore be concluded that there is a linear relationship between the variables of procurement planning and inventory management and

objective outcome on the one hand and contract management and material management and subjective outcome on the other hand.

4.6.3 Heteroscedasticity test

The study sought to test for Heteroscedasticity between the variables of the study. The applied rule for this method is that the ratio of high to low variance less than ten is not problematic (Keith, 2006). Procurement planning and inventory management were tested against objective outcome while contract management and material management was tested against subjective outcome. Heteroscedasticity is useful to examine whether there is a difference in the residual variance of the observation period to another period of observation. The findings are presented in table 4.14:

Table 4.14: Heteroscedasticity Test

Coefficients

Model	Unstandardized Coefficients	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance VIF
	B Std. Error				
1 (Constant)	9.47E- 0.764		0	1	
Procurement planning & Inventory management	0.000 0.364	0	0	1	0.132 7.592
Contract Management and Material Management	0.000 0.316	0	0	1	0.132 7.592

a. Dependent Variable: Objective Outcomes

Coefficients

Model	Unstandardized Coefficients B Std. Error	Standardized Coefficients Beta	t	Sig.
1 (Constant)	2.59E- 0.168		0	1
project implementation	0 0.03	0	0	1

Based on the output coefficient the obtained value of significance indicates that procurement planning and contract management had a significance of 1.000 while contract management and material management also had a significance of 1.000. These results meant that the values of the variable significance of procurement planning, contract management, ccontract management and material management were >0.005 and it can therefore be concluded that there is no Heteroscedasticity problem

4.7 Multiple linear regression model

The study data was further subjected to multiple linear regression model to find the correlation coefficient between independent variables and dependent variable. The findings have been demonstrated in table 4.12 below:

Table 4.15 Coefficients of Correlation

Model	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	error-value(e)	Sig.(P-Value)
(Constant)	0.185	0.5583		0.3323	-2	0.043
Project Procurement Planning	0.117	0.1107	0.07962	0.0602	-1.2	0.019
Inventory Management	0.881	0.0934	0.70211	9.4448	-0.3	0.001
Project Contract Management	0.087	0.0689	0.09551	1.2721	-0.4	0.034
Material Management	0.015	0.0722	0.0644	2.1008	-1.1	0.011

Source: Author 2021

From the equation $Y= \beta 0+ B1X_1 + B2X_2+ B3X_3+B4X_{4+e}$

$Y=0.185+0.117X_1+0.881X_2+0.087X_3+0.015X_4 +e$

Where Y is the dependent variable (Implementation of solar projects)

X_1=Project procurement planning

X_2=Inventory management

X_3=Project contract management

X_4=Material management

e = error value

The model shows that an increase in one unit of project procurement planning leads to an increase in implementation of solar projects by 0.117. This effect is significant with a p-value of 0.043 which is less than 0.05. The lower P-value demonstrates a high significant between procurement planning and the implementation of solar projects within Marsabit County. In a study by Motari (2017) on procurement planning of solar project implementation within Marsabit County, the P-value was 0.031 with a clear significant on the relationship between procurement planning and solar project implementation. This study provides similar findings refuting the null hypothesis that there is no significant relationship between procurement planning and the implementation of solar projects within Marsabit County.

Regading inventory management, the model indicates that an increase in inventory management by one unit leads to an increase in realization of implementation of solar projects by 0.087. This effect is significant with a p-value of 0.019 which is less than 0.05. In a similar study by Kiara (2016) on the challenges faced during solar project implementation in Kajiado County, obtained a p-value of 0.011 on poor inventory management. This demonstrated a strong relationship between poor inventory management

and challenges of solar project implementation. This study also provides a positive relationship between inventory management and the implementation of solar projects within Marsabit County.

The model on project contract management indicates that an increase in project contract management by one unit leads to an increase in realization of implementation of solar projects by 0.881. This effect is significant with a p-value of 0.034 which is less than 0.05. In comparison with a study by Kiara (2016) on the challenges faced during solar project implementation in Kajiado County, lack of proper contract management was seen as a significant factor on the challenges of solar project implementation with a p-value of 0.039. This study just as Kiara (2016) demonstrates that there is a strong relationship between contract management and the implementation of solar projects.

The model also indicates that an increase in material management by one unit leads to an increase in realization of implementation of solar projects by 0.015. This effect is significant with a p-value of 0.011 which is less than 0.05. Similarly a study by Keriri (2013) gives a significant relationship between good material management and the implementation of solar projects in Laikipia County with a p-value of 0.24.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Overview

This chapter has highlighted the summary of the study as per the objectives. The study further provides conclusions and recommendations derived from the findings for policy and practice. Finally, proposed areas for improvement will be availed to generalize the study results in future

5.2 Summary of the Findings

The overall objective of the study was to examine the role of project procurement practices on Implementation of Solar Projects in Marsabit County, Kenya. The specific objectives of the study were to; Examine the influence of project procurement planning on Implementation of Solar Projects in Marsabit County, Kenya; find out the influence of inventory management on Implementation of Solar Projects in Marsabit County, Kenya; Investigate the influence of project contract management on Implementation of Solar Projects in Marsabit County, Kenya; Determine the influence of material management on Implementation of Solar Projects in Marsabit County, Kenya. The major findings summarized from the four specific objectives are as follows:

5.2.1 Project Procurement Planning and implementation of solar projects

The study sought to establish the relationship between project procurement planning and implementation of solar projects in Marsabit County, Kenya. It was established that timely

forecasting of materials required for the project implementation, use of materials requirement planning, timely demand of forecasting materials by project managers, prequalification of suppliers and scheduling of work tasks required in carrying out project activities all affect the project procurement planning. This study objective is founded on the hypothesized statement that ‘There is no significant relationship between project procurement planning and implementation of solar projects in Marsabit County, Kenya”. The findings indicate there is poor project procurement planning in relation to the implementation of solar projects in Marsabit County, Kenya. All statements apart from prequalification of suppliers in relation to project procurement planning had a strong negative rating.

Besides low descriptive statistics ratings given on the statements in relation to procurement planning, the inferential statistics was contrary. The computed R for the model was 0.717 with an adjusted R^2 of 0.609 indicating a strong relationship between procurement planning and implementation of solar projects. Hence, the null hypothesis (Ho) that there is no significant relationship between project procurement planning and implementation of solar projects in Marsabit County is refuted by the study.

The multiple linear regression model shows that an increase in one unit of project procurement planning leads to an increase in implementation of solar projects by 0.117. This effect is significant with a p-value of 0.043 which is less than 0.05.

5.2.2 Inventory Management and implementation of solar projects

The study sought to establish the relationship between inventory management and implementation of solar projects in Marsabit County, Kenya. There was a demonstration of high level of rejection on all statements on inventory management related to the implementation of solar projects. The outcome was as follows: There is no timely replenishment to facilitate project activities, there is lack of continuous cycle counting of materials required for the project, there is no effective monitoring of items purchased in the project, there is no automated recording of project materials and there is no provision of right quality materials at first order and zero double payments. This study objective is anchored on the hypothesized statement that "There is no significant relationship between inventory management and implementation of solar projects in Marsabit County, Kenya". The hypothesis is further supported by the inferential statistics model that indicated a weak relationship between inventory management and implementation of solar projects through a computed R of 0.462 with an adjusted R^2 of 0.422.

The multiple linear regression model indicates that an increase in inventory management by one unit leads to an increase in realization of implementation of solar projects by 0.087. This effect is significant with a p-value of 0.019 which is less than 0.05.

5.2.3 Project Contract Management and implementation of solar projects

The study sought to establish the relationship between inventory management and implementation of solar projects in Marsabit County, Kenya. Respondents confirmed that all the taste items on project contract management bears significant relationship. The five taste items agreed on are: The project manager controls and manages contract changes effectively,

the project manager ensures that the contractor is paid in time, the project manager ensures that the contract terms are well adhered to, the project manager maintains an updated form of the contact and the draft and final reports are always well maintained. This study objective is grounded on the hypothesized statement that 'There is no significant relationship between project contract management and implementation of solar projects in Marsabit County, Kenya"

The inferential statistics also indicates some relationship between contract management and implementation of procurement planning. The computed R for this model was 0.50 with an adjusted R^2 of 0.508. Hence, the study refutes the null hypothesis that there is no significant relationship between project contract management and implementation of solar projects in Marsabit County.

The multiple linear regresional model indicates that an increase in project contract management by one unit leads to an increase in realization of implementation of solar projects by 0.881. This effect is significant with a p-value of 0.034 which is less than 0.05.

5.2.4 Materials Management and implementation of solar projects

The study sought to establish the relationship between material management and implementation of solar projects in Marsabit County. Four items were subjected to a likert scale to confirm the level of agreement. This were: There is demand forecasting of materials required for construction, there is use of integrated information systems for communication in the projects, there is use of an electronic ordering system of material to the construction site and there is use of an order tracking system of materials to the construction site. The results indicated that increase in material management would lead to improvement in

implementation of solar projects in Marsabit County, Kenya. This implies that material management positively influences implementation of solar projects in Marsabit County, Kenya.

The inferential statistics also indicates a strong relationship between material management and implementation of procurement planning. The computed R for this model was 0.57 with an adjusted R^2 of 0.612. Hence, the study refutes the null hypothesis that there is no significant relationship between project material management and implementation of solar projects in Marsabit County.

The multiple linear regresional model indicates that an increase in material management by one unit leads to an increase in realization of implementation of solar projects by 0.015. This effect is significant with a p-value of 0.011 which is less than 0.05. Table 4.12 below shows the coefficient correlatio values.

5.3 Conclusion

The study conclusions are presented per each objective as follows:

5.3.1 Project Procurement Planning and implementation of solar projects

Apart from prequalification of suppliers where majority (36%) agreed on its presence within solar project implementations, all other variables including: timely forecasting of materials required for the project implementation, use of Materials Requirement Planning (MRP), accurate demand of forecasting of materials and scheduling of work tasks required in carrying out project activities had negative ratings where majority disagreed on their availability in solar project implementation within Marsabit County. The study hence

concludes that there is lack of project procurement planning in the implementation of solar projects within Marsabit County. Despite the indication that there is lack of project procurement planning, inferential statistics indicates a strong relationship between procurement planning and implementation of solar projects in Marsabit County. Hence, study concludes that there is no significant relationship between project procurement planning and implementation of solar projects in Marsabit County is refuted.

5.3.2 Inventory Management and implementation of solar projects

The findings demonstrate a rejection on the statements related to availability of inventory management in the implementation of solar projects within Marsabit County. All statements including: timely replenishment to facilitate project activities, continuous cycle counting of materials required for the project, effective monitoring of items purchased in the project, automated recording of project materials and provision of right quality materials at first order and zero double payments were confirmed to be strongly missing in the implementation of solar projects within Marsabit County. The study therefore concludes that there is no inventory management in the implementation of solar projects in Marsabit County. This is further supported by the inferences from inferential statistics indicating a weak relationship between inventory management and implementation of solar projects with Marsabit County.

5.3.3 Project Contract Management and implementation of solar projects

It can be concluded by the study that project contract management influences the implementation of solar projects in Marsabit County, Kenya. This is clearly reflected in the management of contract changes by project managers controls and manages, timely payment

of contracts by project managers, adhering to contract terms by project managers, maintenance of an updated form of contracts and maintenance of final reports and drafts. All the statements were agreed on. The inferential statistics also indicates some relationship between contract management and implementation of procurement planning.

5.3.4 Materials Management and implementation of solar projects

Lastly, the study concludes that there is an influence of material management on implementation of solar projects in Marsabit County, Kenya. This occurs through demand forecasting of materials required for construction, integrated information systems for communication in the project, use of an electronic ordering system of material to the construction site and use of an order tracking system of materials to the construction site. The inferential statistics also indicates a strong relationship between material management and implementation of procurement planning.

5.4 Recommendations

Recommendations are presented in relation to the study objectives as follows:

5.4.1 Project Procurement Planning and implementation of solar projects

The study recommends that there is need to improve on project procurement planning to enhance implementation of solar projects in Marsabit County, Kenya. The solar projects being implemented should have early forecasting of materials required, use material requirement planning to facilitate the procurement process, attain accurate demand forecasting of materials in time and have prequalification on long term contracts with suppliers for smooth implementation of the scheduled project tasks and activities. Finally,

Project procurement planning should be included in policy and managerial planning on any solar projects

5.3.2 Inventory Management and implementation of solar projects

The study recommends that there should be an effective inventory management in the implementation of solar projects in Marsabit County, Kenya. The study recommends that there is need to improve on timely replenishment to facilitate project activities, there should be continuous cycle counting of materials required for the project, there should be an initiation of effective monitoring of items purchased in the project, there should be automated recording of project materials and provision of right quality materials at first order with zero double payments.

5.3.3 Project Contract Management and implementation of solar projects

Based on the current effectiveness in the project contract management in the implementation of solar projects, the study recommends that more effort should be done to maintain the current achievements. Project managers should be active in timely payment of contracts by having uplifted efforts in adhering to contract terms by project managers, maintenance of an updated form of contracts and better maintenance of final reports and drafts.

5.3.4 Materials Management and implementation of solar projects

Lastly the study recommends that there should be an effective materials management on the implementation of solar projects in Marsabit County, Kenya. Improvements on material demand forecasting and supplier collaboration, improvement on integral planning and coordination of acquiring, storing moving and controlling of project materials should be

factored in to in optimizes project resources with minimal costs should all be done as a way of effective material management

5.5 Areas for Further Research

Further research areas recommended by the study include:

Designing study topics on each of the study's specific objectives: The study proposes that all the specific objectives defining this study have the ability to develop independent and dependent variables around them hence can be study topics and methodologies for future scholars. Topics developed from the specific objectives could be: The influence of project procurement planning on implementation of solar projects, factors affecting inventory management on implementation of solar projects, impact of project contract management on implementation of Solar Projects and effects of material management on implementation of solar projects. Case studies on these objectives can be done within any County in Kenya. Other methodologies that can be adopted for further studies may include observational and ethnography approaches.

The study also proposes similar studies in other counties implementing solar projects in Kenya. The proposed counties could be with similar geographical/terrain characteristics like Marsabit County. This can be counties located in Arid and semi-arid parts of the Country.

Lastly, the study proposes similar studies on other energy PV sectors such as wind energy or hydro energy. The objectives studied on can be expounded and investigated in relation to other PV energy generation.

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APPENDIX I: LETTER OF INTRODUCTION

Sadia Sheikh Aden

P.O BOX 51797- 00100,

Nairobi.

Dear Respondent,

RE: DATA COLLECTION

I am a student at Moi University pursuing a Master's Degree Program in Project Planning and Management. I am currently conducting a Research study on **PROJECT PROCUREMENT PRACTICES AND IMPLEMENTATION OF SOLAR PROJECTS IN MARSABIT COUNTY.** This is to fulfill my degree award requirements. You have been selected to participate in this study. I would highly appreciate if you could assist me by responding to all questions as completely, correctly and honestly as possible. Your response will be treated with utmost confidentiality and will be used for this research purposes only.

Thank you in advance for your co-operation.

Yours Sincerely,

Sadia Sheikh Adan

0725840580

APPENDIX II: QUESTIONNAIRE

INTRODUCTION

Please ensure that you read through the questions carefully and provide honest response while answering the questions.

PART 1: Demographics

1. What is your gender

Male	
Female	

2. Kindly state your age.

18-24 years	
25-35 years	
36-45 years	
46-55 years	
56-60 years	
Over 60 years	

3. Kindly state your marital status.

Married	
Single	
Divorces/separated	
Widow/widower	
Other	

4. What is your level of education?

Professional Course	
Diploma Certificate	
Bachelor's Degree	
Master's degree	
PhD	

5. How long have you worked as on solar project implementation in Marsabit County?

Less than 1 year	
1-3 years	
3-5 years	
5-7 years	
7-10 years	
Over 10 years	

PART 2: INFLUENCE OF PROCUREMENT PLANNING ON PROJECT IMPLEMENTATION

As part of procurement activities being carried out in your project, please indicate the extent of your agreement with the following procurement planning statements. Use the scale of 1-5, where:

Strongly Agree = 1
Agree = 2
Neutral = 3
Disagree = 4
Strongly Disagree = 5

Project Procurement Planning	1	2	3	4	5
There's forecasting of materials required for the project implementation in time					
There is the use of Materials Requirement Planning (MRP)					
The project managers try to attain accurate demand forecasting of materials in time					
There is prequalification of suppliers and long-term contracts with suppliers in the project					
There is scheduling of work tasks required in carrying out project activities					

PART 3: INFLUENCE OF INVENTORY MANAGEMENT ON PROJECT IMPLEMENTATION

As part of procurement activities being carried out in your project, please indicate the extent of your agreement with the following inventory management statements. Use the scale of 1-5, where:

Strongly Agree	**=**	**1**
Agree	**=**	**2**
Neutral	**=**	**3**
Disagree	**=**	**4**
Strongly Disagree	**=**	**5**

Tick where appropriate depending on your level of agreement with the subsequent statements concerning inventory management and project implementation. By using a scale of 1to 5, where 5- to strongly agree and 1- strongly disagree

Inventory Management	1	2	3	4	5
There is timely replenishment to facilitate project activities					
There is a continuous cycle counting of materials required for the project					
There is effective monitoring of items purchased in the project					
There is an automated recording of project materials					
There is a provision of right quality materials at first order and zero double payments					

PART 4: INFLUENCE OF CONTRACT MANAGEMENT ON PROJECT IMPLEMENTATION

As part of procurement activities being carried out in your project, please indicate the extent of your agreement with the following contract management statements. Use the scale of 1-5, where:

Strongly Agree	**=**	**1**
Agree	**=**	**2**
Neutral	**=**	**3**
Disagree	**=**	**4**
Strongly Disagree	**=**	**5**

Tick where appropriate depending on your level of agreement with the subsequent statements concerning contract management and project implementation. By using a scale of 1to 5, where 5- to strongly agree and 1- strongly disagree

Contract Management	**1**	**2**	**3**	**4**	**5**
The project manager controls and manages contract changes effectively					
The project manager ensures that the contractor is paid in time					
The project manager has ensured that the contract terms are well adhered to					
The project manager maintains an updated form of the contact					
The draft and final reports are always well maintained					

PART 5: INFLUENCE OF MATERIAL MANAGEMENT ON PROJECT IMPLEMENTATION

As part of procurement activities being carried out in your project, please indicate the extent of your agreement with the following material management statements. Use the scale of 1-5, where:

Strongly Agree	**=**	**1**
Agree	**=**	**2**
Neutral	**=**	**3**
Disagree	**=**	**4**
Strongly Disagree	**=**	**5**

Tick where appropriate depending on your level of agreement with the subsequent statements concerning material management and project implementation. By using a scale of 1to 5, where 5- to strongly agree and 1- strongly disagree

Material Management	**1**	**2**	**3**	**4**	**5**
Demand forecasting of materials required for construction					
Use of integrated information systems for communication in the projects					
Use of an electronic ordering system of material to the construction site					
Use of an order tracking system of materials to the construction site					

PART 6: Project Implementation

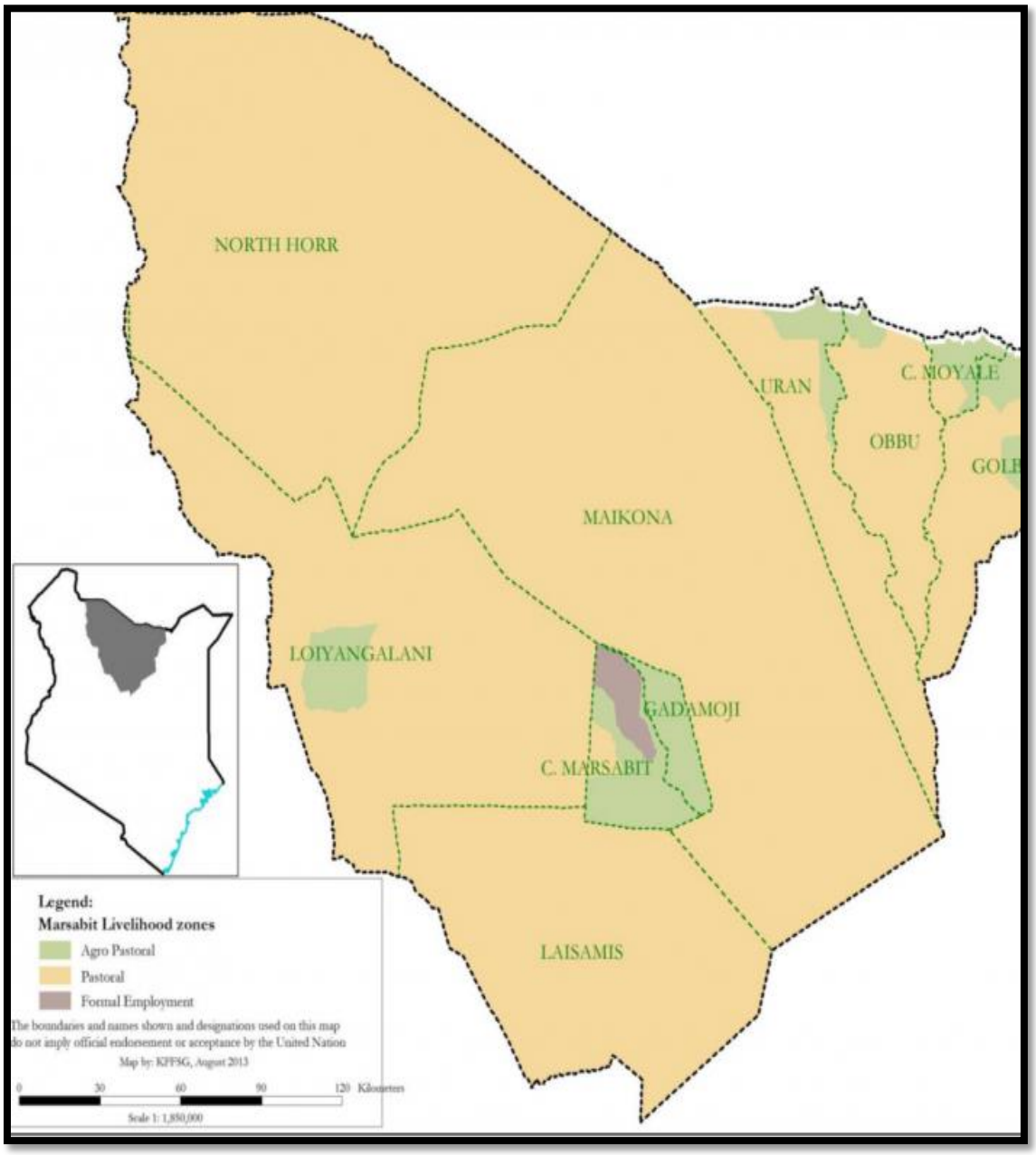
Please show how much your solar project has improved in terms of finishing in time, within budget and scope?

Project Implementation	**1**	**2**	**3**	**4**	**5**
Due to project procurement planning systems, the recommendations put forward have been actioned on and thus improved implementation of solar projects					
Adoption of procurement management practices have enabled the solar projects are completed within the budget					
Project procurement practices have led to improvement of projects being completed within time					
Adoption of procurement management practices has improved completed to the satisfaction of the stakeholders					

END OF THE QUESTIONNAIRE!

THANK YOU SO MUCH FOR PARTICIPATING IN THIS STUDY. THE INFORMATION SHARED WILL BE TREATED WITH UTMOST CONFIDENTIALITY.

APPENDIX III: MAP OF MARSABIT COUNTY



APPENDIX IV: A SOLAR PROJECT IN MARSABIT COUNTY

APPENDIX V: RESEARCH LICENSE

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

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Date of Issue: 27/November/2019

RESEARCH LICENSE

This is to Certify that Ms.. Sadia Adan of Moi University, has been licensed to conduct research in Marsabit on the topic: Influence of project procurement practices on implementation of solar projects in Marsabit county, Kenya for the period ending : 27/November/2020.

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