DETERMINANTS OF ADOPTION OF SOLAR ENERGY TECHNOLOGIES AT THE HOUSEHOLD LEVEL IN KONOIN SUB-COUNTY, BOMET COUNTY, KENYA

KELVIN KIPKORIR KISHARA

A Thesis Submitted to the Graduate School in Partial Fulfilment of the Requirements for the Master of Arts Degree in Geography of Egerton University

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DECLARATION AND RECOMMENDATION

Declaration

This thesis is my original work and has not been presented in this University or any other for the award of a degree.

Signature ………………….... Date …………………....

Kelvin Kipkorir Kishara

NM13/09050/20

Recommendation

This thesis has been submitted with our approval as university supervisors

Signature ………………….... Date …………………....

Dr. Humphreys W. Obulinji, PhD

Department of Geography

Egerton University

Signature ………………….... Date …………………....

Prof. Kennedy N. Ondimu, PhD

Department of Geography

Egerton University

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DEDICATION

I first dedicate this thesis to my parents, Philip Kirui and Selly Kirui whose unwavering love and support have been my guiding stars. Their sacrifices and encouragement fuelled my journey. This work is also dedicated to my sisters, Nelly, Jedidah, Alison, Mercy and Faith whose belief in me never wavered. Their companionship and love have enriched my life. This thesis is a testament to their enduring influence.

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ABSTRACT

Globally, the overall demand and cost of energy for fossil fuels is on the rise due to increasing population. The Kenyan government spends billions in importation of fossil fuels to meet its national demands. The increasing use of fossil fuels has significant ramifications to the environment, such as increase in carbon emissions. There is need therefore to adopt the use of green energy technologies like solar energy so as to minimize the negative effects of fossil fuels on the environment. Despite these, there is paucity of information on factors influencing adoption of solar energy technologies in the study area. Hence, this study sought to: examine the influence of perception on adoption of solar energy technologies; analyze the spatial variations in the adoption of solar energy technologies; and to find out the influence of socio-economic and geographical factors on adoption of solar energy technologies at household level. This study was grounded on two theories: Diffusion of Innovation and Technology Adoption Models. The study adopted a descriptive research survey design. The target population was 38178 households in Konoin sub-county. Using stratified- random sampling technique, a sample size of 387 households were picked for the survey. Further, purposive sampling was used to select 7 key informants for an in-depth study of issues under investigation. Primary data was collected from households using a semi-structured questionnaire and key informants' interviews. Data was analyzed using descriptive statistics, correlation and multiple linear regression. Results shows that perception alone has a weak relationship with adoption of solar energy technologies. The findings reveal that spatial variations, proximity to different green energy sources, such as hydropower, biogas, wind plants, and solar energy, influences adoption rates. Households who encounter significant cost changes are more inclined to embrace these sustainable energy alternatives. Social factors such as household size, perception of social norms, influence of others and community support have positively influenced adoption. Access to reliable information shows a weak negative relationship with adoption, indicating the importance of targeted and accurate information dissemination. Economic factors, including: beliefs about installation cost, incentives and long-term cost savings, influence adoption. Geographical factors, particularly individuals' location and access to sunlight-rich regions, also impact adoption. The findings of the study emphasize the need for a multi-faceted policy approach that addresses knowledge gaps, financial limitations, and spatial considerations to maximize solar energy adoption in Konoin.

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LIST OF ABBREVIATIONS AND ACRONYMS

AfDB	African Development Bank
CFCs	Chlorofluorocarbons
CIDP	County Integrated Development Plan
CSR	Corporate Social Responsibility
DoI	Diffusion of Innovations
EJ	Exajoules
GDP	Gross Domestic Product
GEA	Global Energy Assessment
GET	Green Energy Technologies
GHG	Green House Gases
GWh	Gigawatt hours
IEA	International Energy Agency
KENGEN	Kenya Electricity Generating Company
KETRACO	Kenya Electricity Transmission Company
KIHBS	Kenya Integrated Household and Budget Survey
KPHC	Kenya Population and Housing Census
KPLC	Kenya Power and Lightning Company
kWh	Kilo Watt Hour
LTWP	Lake Turkana Wind Plant
MoEP	Ministry of Energy and Petroleum.
MW	Mega Watt
NACOSTI	National Commission for Science, Technology and Innovation
REREC	Rural Electrification and Renewable Energy Corporation
RESs	Renewable Energy Sources
RETs	Renewable Energy Technologies
RPS	Renewable Portfolio Standards
SDG	Sustainable Development Goals
SPSS	Statistical Package for Social Scientists

CHAPTER ONE
INTRODUCTION

1.1 : Background Information

Green energy technologies are characterized as clean sources of energy that have little environmental effect, create little or no secondary waste, and are long-term in nature depending on the demands of the economy, society, and the environment (Kumar *et al*., 2021). Solar, wind, geothermal, biomass, hydropower, and marine energy are just a few of the renewable energy sources available (Nelson & Starcher, 2015).

According to Koch and Koch (2019), sustainable energy which is also known as green energy refers to the use of any and all forms of energy that are capable of satisfying demands without placing the resources at risk of being depleted. The usage of sustainable energy technologies has low impact on the environment, and will never run out (Vezzoli *et al*., 2018). They provide sustainability in the form of energy sources that are healthy and safe to use, endure a long time, and that can refill themselves. Wind and solar power are often regarded as the most sustainable forms of energy generation due to the fact that wind turbines and solar panels can be installed almost everywhere in the globe without severely altering the natural landscape.

The push for sustainable energy has gained further momentum in recent years with the adoption of international frameworks like the United Nations' Agenda 2030 for Sustainable Development (UN, 2015). This agenda outlines 17 Sustainable Development Goals (SDGs), including Goal 7: Affordable and Clean Energy (UN, 2015). Specifically, SDG 7 targets a significant increase in the use of renewable energy by 2030 (UN, 2015). Furthermore, Agenda 2063: The Africa We Want, adopted by the African Union in 2013, recognizes the crucial role of sustainable energy in achieving inclusive and sustainable development on the continent (African Union, 2013).

According to the International Energy Agency (IEA) study published in 2016, renewable energy sources (RESs) account for an increasing percentage of the global total energy supply, and they are the fastest-growing source of electricity production. Solar power is growing more quickly than all other green energy sources combined. Electricity production from non-hydropower renewable sources is the most significant source of growth, increasing by an average of 5.7 percent per year and exceeding gains in natural gas (2.7 % per year), nuclear (2.4 % per year) and coal (0.8 % per year) (Bromley *et al*., 2020).

Solar energy is the world's fastest-growing green energy source, with net solar output rising by an average of 8.3 percent every year. Hydroelectric and wind power each account for 1.9 trillion kWh (33 percent) of the 5.9 trillion kWh of additional renewable generation generated during the projection period, solar energy accounts for 859 billion kWh (The overall amount of power generated from green sources has been increasing by 2.9 percent per year, with the renewable portion of global electricity output expected to increase from 22 percent in 2022 to 29 percent in the year 2040.15 percent), and other renewables (mostly biomass and trash) contribute for 856 billion kWh (14 percent) (Petrovic, 2023). These parameters clearly give an indication of a general positive acceptance of sustainable energy use globally (Ibrahim *et al*., 2021).

The goals of Paris Agreement established in 2015, was to improve the global response to the danger posed by climate change by ensuring that the increase in global temperature during this 21st century would be below 2 degrees Celsius over the levels that existed before industrialization (Klein *et al*., 2017).

Africa contains some of the world's most important natural resources. It holds over 11% of the world's crude oil and natural gas (Nduta, 2019). In the year 2020, renewable energy accounted for 9 percent of Africa's total energy production, the majority of which came from hydropower (6.8 %). An analysis conducted by Price Water House Coopers, reveal that advancements are being made in this particular field. Only between the years 2019 and 2020, the capacity of solar, wind, and hydropower all rose by 13 percent, 11 percent, and 25 percent, respectively. Since 2013, the total amount of renewable energy capacity that had been added in Africa had increased by more than 24 gigawatt hours (GWh). Future, projections indicate that there will be an additional 27.3 Exajoules (EJ) in comparison to the present 1.8 EJ (Chiguvare & Ileka, 2016).

Access to electricity remains one of the most pressing issues in sub-Saharan Africa. Due to the fact that it is one of the developing nations, there are still just a small number of people who have access to power. According to a study published by GEA in 2012, the electrification rate in the area was at 32% at that time. The rate of electricity in urban areas was at 59%, while the rate in rural areas was just 16%. These figures provide a conclusive proof that the rate of acceptance of electricity as a source of energy among rural households is low, as shown by the fact that there is a slow adoption rate. In addition, the pace at which electricity is gaining a foothold in rural regions is also low (GEA, 2012).

The rates of modern energy access in Sub-Saharan Africa are among the lowest in the world, and neither the locals nor those who support them internationally seem to be making any meaningful efforts to address these deficiencies (Groh *et al*., 2022). Sub-Saharan Africa's energy resources as a whole are more than enough to supply the region's demands both today and for the foreseeable future (Hafner, 2018). Africa has considerable hydro potential, for instance, the Grand Inga in the Democratic Republic of Congo which may generate up to 39 000 MW, which is more than the combined installed capacity in sub-Saharan African nations, exclusive of South Africa (Irena, 2020). The west coasts of Southern Africa and eastern Africa both have significant wind energy potential (Sovacool, 2019).

Kenyan government has been keen on ensuring sustainability both at the private and the public sector (Llc, 2010). The Kenya vision 2030 which was established in 2008 aims at enabling Kenya to become a competitive and prosperous nation and access to quality life. One way of achieving these goals is by ensuring sustainability especially through reforms in the energy sector (Staff & Agency, 2012). The ministry of energy has been on the forefront to ensure that there is diversification of the energy mix through introduction of alternative sources of green energy. The goal is to ensure that there is adequate share of green energy in the market by approximately 50% by the year 2030. To achieve this, the government has been on the front to introduce programmes such as the last mile connectivity which ensure energy availability to the rural residents at affordable rates (Books, 2011). Feed in tariff policies have also been enacted in bid to encourage adoption of renewable energy where private individuals are being encouraged to involve in production of green energy technology and selling it to the public. This has been witnessed in various parts of the country though not all are under operation at the moment (Bank, 2018).

The Last Mile Project is a government initiative in Kenya aims to make it easier to connect Kenyan households to the national grid. In order to meet the government's 2030, aim of ensuring that everyone has access to power, this is intended to reach a countrywide connection rate of 70% by 2025 and 100% by 2030 (Groh *et al*., 2022). According to the energy report of 2017, a total of 314,200 households were being targeted in the first phase of the project where households lying within an embarked radius of 600 meters from a transformer were to be connected through the low voltage cables. The second phase will involve installation of additional transformers which targets to connect 500,000 households which will have an effect to 2.5 million Kenyans to the national grid. Households are required to pay a total of 15,000 KES which is way much subsidized from the initial 34,000 KES since additional funding have been catered for by the government and the African Development Bank (AFDB) (Barnes, 2018).

Rural Electrification and Renewable Energy Corporation (REREC) is a government sponsored corporation whose vision is to see to it that it creates a green energy driven nation. Their main goal is to ensure an expansion of green energy projects in the rural areas (Cunningham, 2016). One of their recent projects in Kenya is the 50 MW Garissa solar power plant which is the largest in East and Central Africa. The project is expected to lower the costs of energy through diversification of the energy mix. It will also make use of the available adequate solar energy received in Kenya since it is next to the equator. The corporation is in the process of installing and running other projects in Machakos and the Lake Turkana Wind Plant (LTWP) (Bhattacharyya, 2012).

In Kenya, wood fuel is used to provide the fundamental energy requirements of rural populations, urban poor and the domestic sector. Petroleum and electricity dominate the country's energy market. Analysis of the national energy indicates a significant reliance on wood by 68 percent of the overall energy consumption which is made up of fuel and other biomass, mostly petroleum and Electricity makes about 22% of the total, while other sources make up 9%. Kenya has a limited number of people who have access to electricity. Increasing power connection from the existing levels is the government's ambitious target by the year 2030, from 15% to at least 65% (Ocelli *et al*., 2013). Electricity accounts for 9% of total energy consumption in Kenya, with petroleum products accounting for 22% and renewable energy accounting for 3%. Cooking, heating and lighting in homes are almost entirely powered by biomass (Ngeno *et al*., 2018).

A reliable wind energy source also exists in Kenya. According to the Energy and Petroleum Regulatory Authority (EPRA), 73% of the nation has wind speeds of 6 m/s or more at 100 meters above sea level. Of this, 28228 square km and wind speeds ranging from 7.5 to 8.5 m/s. According to statistics from the Global Wind Atlas, the region north of Kenya near Lake Turkana has the greatest wind speeds, which may surpass 8.0 m/s in certain places. This is the main reason why Lake Turkana Wind Plant (LTWP) is located next to Lake Turkana in the northern region. There has been efforts by the government to install more wind power plants which may include Ngong hills power plant and the ones which are currently under development in Kajiado and Malindi which is expected to have a production capacity of 600 MW (Rodl, 2021).

Kenya also boasts of its hydro-energy potential from the five major drainage systems which include: Lake Victoria, Rift Valley, Athi and coastal area, Tana River, Ewaso-Nyiro and North-Eastern. The overall technical hydropower resource is expected to be about 6 GW by 2020, with minor rivers having a 50% share of this capacity (Millan, 2018).

Bomet County is rich in renewable energy resources such as solar and hydropower. Despite this, it has continued to struggle with energy instability and limited access to renewable energy technologies. The main sources of energy in the County are electricity and wood fuel, which are used by about 88.7% of households, compared to 56% at the national level (KNBS, 2019). Solar energy is used by 33.5% of households in the County, and its use has grown over the last five years due to the introduction of customized solar products like M-Kopa, D-Light, and Solar King. Bomet County is currently experiencing greater energy insecurity as a result of the continued loss of local forests, which inhabitants depend on firewood and charcoal production (Mwaura, 2021).

There are strategies which are currently underway in Bomet County toward achieving a green economy consideration. The projects are being funded by the County Government of Bomet in collaboration with other private agencies. Under the annual development plan for the year 2022 to 2023, the strategies underway for the county is to connect solar panels to the following county offices: Bomet Central sub-County Office combined with ward office, Kimulot Ward Office, Chebchabas Ward Office, Boito Ward Office, Singorwet Ward Office, County Public Service Board Office Block and County Headquarters Office Block.

The most commonly used renewable fuel is biomass, specifically wood. Currently, there is a wood-fuel shortage of over 5,000 metric tons, and it continues to grow day by day. This unsustainable demand for wood fuel is causing deforestation, forest fragmentation and land degradation, as well as threatening water catchments. Furthermore, by 2030, it is anticipated that the country's energy demand would rise (Kendagor & Prevost, 2013).

Bomet County Integrated Development Plan (CIDP, 2023) recognizes the issue of energy insecurity and presents a comprehensive strategy. An essential approach centers on the expansion of power access in rural regions. The CIDP focuses on partnering with the Rural Electrification and Renewable Energy Corporation (REREC) to improve transformers and implement the Last Mile Connectivity Programme (LMCP) (Bomet CIDP, 2023).

1.2 : Statement of the Problem

Climate change has become a significant worldwide concern, endangering people's way of life through extreme weather events and disruptions to agricultural systems. Underdeveloped countries, still lack access to dependable, renewable energy sources. In rural areas, relying on kerosene lamps and charcoal or biomass stoves for basic requirements is costly, posing health hazards and damaging the environment. With the demand for greener alternatives greater than ever, solar energy offers a viable pathway. However, widespread implementation and adoption of solar technologies encounters multiple challenges. Solar energy uptake and use are anticipated to be crucial in achieving the Sustainable Development Goals (SDGs). United Nations Development Programme estimates indicate that around 3 billion people residing in developing countries rely on solid fuels for their daily cooking needs, whereas approximately 1.5 million individuals lack access to electricity. Around 560 million individuals residing in sub-Saharan Africa do not have the means to get energy. Exposure to smoke and indoor pollution poses health hazards since the use of solid fuels is believed to be responsible for over 50% of lung ailments in sub-Saharan Africa. Therefore, immediate measures must be taken to accelerate the adoption of solar energy technologies via the implementation of urgent access efforts. Hence, it is essential to promote household energy interventions such as the adoption of solar energy technologies, which justified the need for this study.

1.3: Objectives of the Study

1.3.1: Broad Objectives

The broad objective of the study was to assess the determinants of adoption of solar energy technologies among households.

1.3.2: Specific Objectives

i. To examine the influence of perception on adoption of solar energy technologies among households of Konoin sub-County.

ii. To analyze the spatial variations in the adoption of solar energy technologies among households of Konoin sub-County.
iii. To find out the influence of socio-economic and geographical factors on adoption of solar energy technologies among households of Konoin sub-County.

1.4: Research Questions

i. How does perception influence the adoption of solar energy technologies among households of Konoin sub- County?
ii. What are the spatial variations in the adoption of solar energy technologies among households of Konoin sub- County?
iii. What is the relationship between socio-economic and geographical factors on adoption of solar energy technologies among households of Konoin sub-County?

1.5: Justification of the Study

Given the recent climate change crisis currently being experienced all over the world, there is need to reduce emissions of greenhouse gases (GHG) and also work towards achieving the sustainable development goals (SDG 7.1) of access to clean and sustainable energy (Smith, 2022).

The findings of this research would also have a positive impact on policy and regulatory implications in that it assessed how supportive or hindering regulatory frameworks influence the adoption of solar energy, with the goal of providing recommendations for policymakers to create an enabling environment for sustainable energy initiatives. It would also explore recent technological advancements in solar energy, aiming to identify breakthroughs that enhance efficiency, storage capabilities, and overall reliability and also provide insights that can drive the continuous improvement of solar energy technologies.

This study will contribute to policies at the national level such as the Renewable Portfolio Standards (RPS) which mandates a certain percentage of a nation's energy from renewable sources by a specific timeline (Johnson, 2023). Feed-in tariffs offer important incentives for green energy providers, promoting the use and growth of renewable energy sources (Williams, 2024). When combined with energy efficiency standards that set frameworks for lowering energy usage in buildings, appliances, and vehicles, these measures work together to encourage sustainable behaviors and produce a more environmentally friendly energy landscape (Anderson, 2023).

This research will also contribute to regional policy frameworks for example the regional climate agreements that sets collective targets for emissions reduction and promote the adoption of solar energy technologies. It would also contribute to the policy on cross-border research and development collaboration which facilitates research and development initiatives across regions to address shared challenges and advance green energy technologies.

The findings of this study will specifically contribute to a better understanding of the factors that influence the adoption of solar energy technology in Konoin sub-County. The providers and investors of solar energy equipment and accessories may also utilize the study data to better comprehend their market and customer demands and address them to increase their market penetration and sales.

1.6: Scope and Limitations of the Study

This study sought to investigate the determinants of adoption of environmentally friendly forms of energy in Konoin sub-County, Bomet County-Kenya between April 2023 and June 2023 since this was a period where there was a growing global recognition among governments, organizations, and scholars on the need of shifting towards sustainable energy sources in order to alleviate the consequences of climate change.

The research focused on solar energy technologies because there are indications of adoption in the area. Furthermore, solar energy is also conformed by Ekaterra tea companies who have widely adopted solar energy technologies and play a crucial role in educating the neighbouring communities through CSR. In addition, solar energy has become a major and quickly progressing kind of renewable energy. The research acknowledges the importance of solar power in the worldwide transition to renewable energy and seeks to provide specific insights into its uptake and possible obstacles. The choice of the study area is also brought about by its close proximity to the equator therefore enabling the communities to tap from the resource of adequate suns energy and also the study areas close proximity to Ekaterra multinational companies who have heavily invested in solar energy has also brought about a positive influence to the nearby environment which is Konoin.

Furthermore, this study encompassed both urban and rural environments, as residents in the study area exhibit distinct energy consumption patterns and preferences. This inclusivity ensures a whole understanding of the challenges and opportunities associated with transitioning to solar energy across diverse environments and also obtain information within spatial aspects.

The study exclusively examined a single type of renewable energy, disregarding other forms like wind power and hydropower. This is due to the fact that wind power projects require expansive, undisturbed environments, which limits their implementation to few specific geographic regions such as Turkana and Ngong hills.

The study was limited by the extent to which respondents provided truthful responses to the questions, since they relate to extremely sensitive topics of attitudes, and norms, which respondents may be reluctant to discuss openly. Nevertheless, the researcher alleviated doubt by presenting an official document from the university and ensuring confidentiality and anonymity to the participants.

This research was limited to Konoin and did not provide an adequate representation of the wider context of solar energy adoption in Kenya or other locations with varying socio-economic, meteorological, and geographical factors. The findings may not be relevant to regions characterized by different degrees of electrification, differences in wealth, or variations in solar radiation levels.

The solar energy industry is undergoing fast evolution due to technology developments, shifting legislation, and fluctuating costs. Research undertaken at a given moment in time may fail to include the whole spectrum of elements that influence the adoption of solar energy. This constraint may impact the pertinence and practicality of the conclusions for future situations.

This study was also limited by the number of respondents who could not understand and answer the research questions because of their education level. The researcher guided the respondents in interpreting the questions asked in the questionnaire.

1.7: Assumptions of the Study

This study assumed that:

i. The level of residents' understanding of solar energy may differ. This study recognized that individuals' comprehension of solar energy, may vary depending on their personal experiences, level of education, and availability to information.
ii. Households and organizations reason for adopting a solar energy technology is financial gain and therefore their main interest is cost savings.
iii. It was also assumed that households possess precise and reliable information on the cost-benefit ratio of solar energy systems, including aspects such as initial expenses, possible financial gains, and governmental incentives.
iv. It was also assumed that people are driven by a desire to reduce carbon footprint, mitigate climate change, and promote sustainable practices.

1.8: Operational Definition of Terms

Adoption is the process of choosing to pick up, or use of something is the action or reality of choosing to do so. In this study, the term is used to describe how households acquire solar energy technologies from a wide range of varieties available.

Geographical factors are conditions that are associated with a particular physical location and that have an effect on people who live in that location. In this research it has been used to mean the factors concerned with the environment which have an influence on adoption of solar energy.

Green energy, Sustainable Energy or Clean energy sustainable energy refers to a kind of power that does not pollute the environment and may be used repeatedly without putting the supply at risk of being depleted, used up, or lost. In this study it has been used to refer to solar energy from the sun.

Household refer to a group of people living in the same compound headed by one person and having the same cooking and investment arrangement. Also, institutions such as schools, hospitals and factories having common cooking arrangement and having a shared energy system were considered to be households.

Perception Refers to the manner in which something is understood and regarded and it could either be positively or negatively. In this study it is used to refer to how households perceive the use of sustainable energy based on their related benefits to the environment. It has been used to refer to attitude towards solar energy and the perceived ease of use of solar energy.

Renewable Energy Technologies (RET) is defined as energy technologies derived from natural processes that is renewed on a continuous basis (International Energy Agency, 2016). In this study, solar energy is the most emphasized form of renewable energy technologies.

Self-effectiveness Refers to an individual's assurance of a technology and their capacity to actively participate in or embrace sustainable activities and endorse the use of environmentally friendly energy technology. An individual's self-effectiveness might impact their inclination to embrace environmentally friendly energy solutions, such as solar panels.

Socio- economic Factors refers to the way social and economic elements interact with one another in the context of local communities and households. In this study, the following were considered as part of socio-economic issues: employment, level of income, level of education, age and gender.

Solar Energy Technologies has been used in this study to refer to tools that capture the suns energy and transform it into usable forms like electricity or solar water heaters.

Spatial variations refer to when a quantity is measured in a variety of geographic locations and the results are found to vary from one site to the next. In this research, this term has been operationalized to refer to an urban and rural locations where there are expected differences on energy uptake.

CHAPTER TWO
LITERATURE REVIEW

2.1: Introduction

This chapter reviews literature on influence of perception on adoption of solar energy technologies, spatial variations in the adoption of solar energy technologies and the influence of socio-economic factors on adoption of solar energy technologies among households.

2.2: Influence of Perception on Adoption of Solar Energy Technologies Among Households

Perception is a vital factor in influencing the decisions made by households regarding the adoption of solar energy. Households that recognize significant environmental and economic advantages linked to solar power, such as diminishing their carbon footprint and decreasing electricity expenses, are more inclined to be persuaded (Ozkan *et al*., 2020). Social considerations have a significant role in shaping individuals' perceptions about solar energy. Positive opinions arising from neighbors or communities currently utilizing solar power can promote the adoption of solar energy, while a lack of faith in installers or government incentives might lead to hesitation in adopting solar energy (Sutter *et al*., 2014). Curiously, aesthetics can also have an influence. According to Ozaki and Shin (2018), the aesthetic aspect of solar panels may deter certain homeowners from embracing this technology.

Perception influences adoption of new forms of solar energy technologies for instance, Zhang *et al*. (2016), came to a conclusion that there is continuous support for the whole concept of GET as well as its growth. Furthermore, he states that there is a different understanding and thinking of the term green energy since it is a complex term and so researchers ought to be clear enough when using the term. Nevertheless, studies by researcher's shows that a range of 80% to 90% of people support GE and this is evident in research done by Lorenzoni (2016), which found out that 60% of people strongly agreed that they support green energy while 25% disagreed on their support towards green energy. Men were also more likely to indicate support (91%) than women with (80%). Older respondents of 65years and above also showed limited interest on green energy.

There is a positive perception of GE based on their perceived benefits to the environment, that is they are clean, non-polluting and they also do not run out. Poortinga *et al*. (2013)

further gives statistics to support the same through his study whereby 25% of the respondents had a positive attitude towards GE because of its sustainability benefits, 16% liked it because of their economic advantage and 47% because of the future related benefits of using GE.

According to the findings of research carried out in Bahrain, a greater degree of understanding on the part of respondents leads to a greater readiness to pay for green energy installations. This result is consistent with the findings of the studies carried out by Sinha (2019) and Semenkova and Kolosov (2021), who stated that there is, generally, a low level of energy literacy, which points out the need to inform consumers in order to improve their energy-related decision-making. Also, these results are comparable to those that were reported by Valentova *et al*. (2014), who stated that households' socio-economic features can, to some extent, explain investment in energy efficiency. Also, these results are similar to those found by Mishra *et al*. (2013), who said that a higher level of awareness and knowledge can lead to a greater willingness to accept green energy and pay for them.

On the other hand, households in certain industrialized regions have a greater knowledge of environmental issues and are extremely inclined to adopt renewable energy. Studies have found that people who care more about the environment are more willing to invest in energy-saving technologies. According to Shang *et al*. (2020), who argue that socio-economic characteristics such as interest in environmental concerns and understanding of green energy technologies as well as education, are connected with the willingness to pay, this position is validated. He argues that there is no link between consumers' environmental concerns and their understanding of renewable energy.

Valentova *et al*. (2014), adds that customers' sentiments toward wind power energy diminish with age and income, whereas respondents who were concerned with environmental concerns showed a good attitude toward green energy. In addition, he found that demographic characteristics have a major role in influencing the chance that a person is prepared to pay a higher price for the energy that comes from renewable sources.

According to the World Economic Forum (2022), in 2020 9% of all energy generated in Africa was from green sources and North African countries comprised of the majority. Despite the fact that Africa is very rich in green energy technologies such as Hydro, solar and wind. According to the International Renewable Energy (IRENA), many regional initiatives have come up. Cases in point are the African Clean Energy Corridor which is an initiative that aims to develop and enhance cross-border trade in green energy in Eastern Africa and the West African clean Energy corridor, an initiative that supports clean energy generation in West Africa. Others are entrepreneurship support facility and Renewable Readiness Assessment (RRA) (IEA,2016).

2.3: Spatial Variations in the Adoption of Solar Energy Technologies Among Households

In Kenya, the most common energy needs are for space heating, cooking, drying, and water heating (Kumar, 2020). Due to the fact that households usually employ many energy technologies to meet their needs, these possibilities are always changing. The decisions made by households will differ based on a broad variety of variables, some of which may include climatic and the changing economic systems (Hsu *et al*., 2021).

Evidenced from research done by Gitau *et al*. (2019) indicates he notes that approximately 70% of the Kenyan households utilize wood to cook their meals. Based on their effectiveness and relative affordability compared to other types of energy, the majority of them would choose it. Additionally, Rop *et al*. (2021) points out that households would prefer to utilize fuelwood for space heating, particularly during the colder months of the year when there has been a noticeable rise in use. Since fire was used in ancient periods, it is right to say that wood was the first energy source that people were able to utilize (Mulei *et al*., 2019). For both home and industrial uses, this energy source is still extensively used across the globe. Depending on the purpose it is required for, wood energy may be utilized in a variety of ways. To begin with, households would prefer to cook their meals on charcoal. This fuel has a two times higher heating value than dry wood.

Solar energy is the most prevalent source of energy seen in most residential settings. Electricity is necessary because the majority of activities and appliances in many different types of homes cannot function without it. Solar power is more advantageous than other forms of energy since it can be obtained without difficulty and at a lower cost. Solar panels are used to generate electricity, which can then be used for a variety of purposes and put to use in a wide range of household equipment. The energy from the sun is harnessed to heat water, which is then utilized for a variety of domestic activities, including cleaning clothing and utensils, taking baths, preparing meals, and other activities. The water in the tank is warmed by the solar heater, which draws heat from the sun and transmits it to the water.

Lighting is another important use of solar electricity in household settings (Haar & Theyel, 2016). Solar lights may be found almost everywhere in a home, including inside, in the yard and landscaping, in the garage, and even as part of the security lighting. Solar panels are a cheaper way to light homes than using electricity (Karanja & Gasparatos, 2019).

In today's world, individuals often utilize portable gadgets that must be charged by an external electric source. Tablets, mobile phones, and other types of mobile gadgets may all be charged using portable solar chargers inside the house. In order to keep the gadgets charged, solar cells have been constructed and incorporated into them. Pumps that are driven by solar energy are used to move water from the collector to the tank. Due to the fact that electric pumps need a significant amount of electricity to do the same task, they help save money on energy bills. Batteries may be used to store the sun's energy so that it can be used later, such as when there are clouds in the sky or at night, to power the circulating pumps, (Haar & Theyel, 2016).

In the industrial sector, wood energy is used for a variety of purposes, such as dry cleaning or the burning of ceramics, tiles, or bricks. It is also used to heat or dry items. Sometimes, electricity is produced using this fuel. A big wood-fired boiler heats the water, and the generated steam powers a turbine that creates an electric current. Wood is the primary biomass material utilized to create power globally (Osiolo, 2021).

One positive aspect of Kenya's energy situation is the increasing usage of solar electricity in homes. The attractiveness of solar power stems from its cost-effectiveness and convenient accessibility in contrast to conventional grid electricity. Solar panels produce electrical power for many devices, whereas solar water heaters use the sun's energy to heat water (Karanja & Gasparatos, 2019). Solar lights offer a financially efficient substitute for lighting that relies on the power grid, while solar chargers ensure that portable electronic devices remain powered (Haar & Theyel, 2016).

Solar-powered water pumps are an innovative solution that decreases dependence on electricity-powered pumps (Haar & Theyel, 2016). Battery-based energy storage enables the utilization of solar energy even in situations where there is a lack of power supply (Haar & Theyel, 2016). Nevertheless, there is an important limitation to Kenya's energy combination. The persistent dependence on wood fuels for cooking and industrial purposes gives rise to apprehensions regarding deforestation and air pollution (Ouedraogo *et al.*, 2020). This underscores the necessity of adopting a diverse strategy that advocates for cleaner and more sustainable energy sources, with solar power emerging as a possible avenue for progress.

2.4: Socio-Economic and Geographic Factors Influencing Adoption of Solar Energy Technologies among Households

The majority of people living in rural regions do not have enough access to energy supplies that are both effective and economical, despite the fact that energy is a basic necessity for human existence. The patterns of energy usage in households are increasingly being analyzed through the lens of socioeconomic factors. The pattern of energy consumption in a country's households is indicative of both the level of material well-being and the level of economic advancement in that nation. Along with an expansion of the economy and a rise in per capita income, it is anticipated that residential energy consumption will go up in the near future.

Social norms also influence one’s adoption of solar energy. Analysis of empirical results by Sardianou and Genoudi (2013), revealed that an individual is highly likely to adopt solar energy system in their home if their family or friends encouraged them to do so. Analysis of literature also revealed that the level of education has an effect on one’s likelihood of adoption of solar energy technologies.

Mills and Schleich (2012), carried out a study among households in some European countries and found out that individuals with a university degree were more likely to adopt energy efficient technologies. Their study corroborates with that of, Sardianou and Genoudi (2013) who established that among Greek households, educated individuals were more likely to adopt green energy technologies. Further, in two European regions, Niamir *et al*. (2020) and Bressers, (2020), found that educated households invest in house insulation and solar panels and were more likely to choose a green energy than the less educated.

Green energy technology policies depend a lot on how much money is available (Barbier, 2011). Researchers have found that one of the biggest problems with renewable energy projects is not really that they are not technically possible. Instead, it's that they do not have enough low-cost, long-term funding. This situation is made worse by the fact that different projects are competing for a limited amount of funding, and it gets really extreme if the country's economy as a whole is in bad shape (Dragone, 2022). So, the government and private companies must come up with new ways to pay for projects that use green energy. The hardest part of funding these projects is coming up with ways to give consumers these technologies at prices they can afford while also making sure the industry can keep going. The fact that the government only gives renewables a small amount of money shows how little policy support there is for green energy. Because of this, it's up to the private sector to pay for green energy technologies (Zhang *et al*., 2016).

In a study on the role of household consumers in adopting green energy technologies in Kenya, Matsui and Maundu (2019) found out that there is a negative association between the consumers' willingness to purchase green energy and cost. However, with the changing economic times, energy consumers may be unwilling to spend more on alternative sources of energy and resort to the more affordable energy technologies (Wall *et al*., 2021).

Sardianou and Genoudi, (2013), in their research on factors affecting the willingness of consumers to adopt green energies, identified income as one of the factors. They found out that an increase in the monthly income of individual also increases the probability of one adopting green energy. Their study is in line with that of Omri and Nguyen (2014), who when researching on the determinants of green energy consumption among different income groups revealed that green energy consumption also increases when both Gross Domestic Product (GDP) and CO_2 increase.

The economic benefits of green energy projects are directly related to how and why investors want to put money into them. Estimating and evaluating renewable energy technology is important for getting green energy projects up and running. Accurate estimates and evaluations of renewable energy methods based on the latest research give investors more confidence in their financial viability and ability to reduce risks (Fashina *et al*., 2018). The cost of making energy affects how well the power industry can grow and also gives investors a chance to make money.

In situations when customers are provided with finance methods, such mechanisms are often out of the price range of the vast majority of the people. For example, the UNDP/GEF Photovoltaic (PV) project in Zimbabwe mostly benefitted rich rural households. This was owing to the fact that more than eighty percent of rural customers were unable to buy even the smallest unit, even though it was sold at the lowest possible price. The vast majority of rural customers were unable to qualify for assistance due to the stringent conditions for application submissions (Poullikkas, 2021). According to the findings of another study on the feasibility of PV that was conducted in the province of Manicaland in Zimbabwe, 65 percent of the rural population were not able to pay the solar service cost, and 91.5 percent were not able to pay for a credit scheme (Koyama, 2013).

One of the factors influencing Kenya's socio-economic development is the availability of sustainable, affordable and reliable energy. However, the majority of the population continues to face severe barriers to accessing solar energy. According to estimates from the Ministry of Energy, firewood and charcoal accounts for about 68 percent of total energy needs, while petroleum accounts for 22%. Lack of energy availability is linked to poverty, environmental damage, health concerns, and exposure to economic shocks brought on by reliance on imported oil (ACTS, 2016). Previous research suggests that the geographical distribution of residential usage of green energy especially solar energy may rely on factors other than the availability of solar resources and the capacity of households to make financial investments. People get major social and environmental advantages from installing and utilizing active solar energy systems, which may push people to embrace them (Garcia Marquez *et al*., 2018). Solar energy, when used in place of traditional fuels, results in lower emissions of sulfur dioxide (SO_2), nitrogen oxides (NOx), carbon dioxide (CO_2), and particulate matter, all of which are beneficial to the general population. These reductions have the potential to contribute to improvements in air quality, decreased rates of sickness and death, and enhancements in agricultural production, forest health, and the health of ecosystems (Tenenbaum *et al*., 2014). Studies have shown that people who utilize solar energy are driven by environmental concerns and maybe by the position that others put on those who limit their usage of energy technologies that are not renewable. People who use solar heating systems are often motivated by their concern for the environment. Therefore, we expect to observe a larger number of people using solar heating systems in areas where environmental activities and attitudes are more prevalent.

Research also shows that most people who use green energy at home live in cities, where solar energy is more accessible and people are more likely to know other people who use solar energy (Zeman *et al*., 2016). Contact with other people who use green energy lowers the cost of information and shows potential users that the idea works. Information gets around faster in cities. Research has shown that clean technologies spread through dense social networks through role modeling and information transmission (El-Haggar *et al*., 2016). Also, there are more people who make more than the average income living in cities. We expect to find more people who use solar energy in places with more people and a more urban culture. This is because people are more likely to have contact with people in these places.

Concern for the environment is a term that relates to the knowledge and attitudes of households towards efforts to solve environmental challenges such as climate change and pollution. As more people throughout the world become aware of both new and ongoing environmental problems, consumers' level of concern and dedication to finding solutions to these problems is growing. According to the findings of the research done by Li *et al*. (2015), people are becoming more conscious of their consumption patterns and the degree to which such behaviors impact the environment. The idea of environmental concern is thus vital in the adoption of renewable energy, since research has shown that customers who have substantial environmental worries have a favorable attitude toward the adoption of renewable energy (El-Haggar *et al*., 2016). Concern for the environment has an essential role in boosting consumer attitudes toward their readiness to acquire clean energy technologies, which is necessary for the widespread adoption of renewable energy technologies.

According to Richler (2017), the degree to which consumers are aware of the challenges facing the environment is a significant factor in determining whether or not they express an interest in adopting green energy technology. The majority of times, customers make the decision to switch to green energy technology with the intention of helping to protect the natural environment. As a result, it is quite probable that the environmental concern among households have a favorable effect on the desire of consumers to accept renewable energy.

Ackah and Kizys (2015) in their research on green growth in oil producing African countries, found out that the determinants of green energy consumption are: per capita CO_2 emission, consumption of energy technologies, per capita GDP, and prices of energy. However, they failed to incorporate the influence of an individual’s concern for the environment. In a study on factors influencing green energy generation development in Pakistan, Fatima (2021) found out that barriers to solar energy generation included lack of good governance, green energy adaptation, and governmental energy policies while endowment in resources, power production approach, green energy demand, investment environment for green energy projects, economic returns of green energy projects, environmental effects, and public acceptance were drivers for solar energy production.

According to research carried out by Poortinga *et al*. (2013), people who already participate in environmentally friendly activities may be more willing to participate in more environmentally friendly activities, such as switching to green energy since they are more likely to know the consequences associated with the use of fossil fuels especially to the environment.

The adoption of solar energy in households is highly influenced by socioeconomic conditions. Financial constraints may be a challenge, however, studies conducted by Winkler (2018) and Sola *et al*. (2017) indicate that households with low income are open to adopting solar panels if the initial expenses are reduced and if they have access to financial incentives such as subsidies or carbon credits. According to research conducted by Van den Bergh *et al*. (2018), households with higher levels of education are more likely to be aware of environmental concerns and the advantages of solar energy. Individual decisions can also be influenced by social norms and risk perception. According to Wang *et al*. (2020), the influence of neighbors or communities embracing solar solutions can serve as a catalyst, but apprehensions regarding the dependability or safety of solar panels can discourage individuals from adopting them (Sütterlin *et al*., 2021).

Geographical factors are also crucial. The feasibility and financial profitability of solar energy rely on variables such as climate and the accessibility of resources. The number of sunshine hours is a crucial factor to take into account when considering the effectiveness of solar panels. Regions with higher levels of sunlight are more advantageous for solar panel installations (Menzel & Forster, 2021). The location is also a significant factor. Urban locations may possess superior access to grid infrastructure and funding for solar panels in comparison to rural areas (Sovacool, 2019). Gaining a comprehensive understanding of the intricate social, economic, and geographic factors is essential in order to facilitate the general acceptance and use of solar energy in many areas.

2.5: Policy on Energy

Governments around the world are implementing a comprehensive strategy for energy policy, which involves managing energy security, promoting economic growth, and ensuring environmental sustainability. This strategy employs a blend of worldwide frameworks, regional initiatives, and domestic regulations.

The Paris Agreement, established under the United Nations Framework Convention on Climate Change (UNFCCC), has worldwide significance (UNFCCC, 2023). This significant accord seeks to restrict the rise in global temperatures and highlights the shift towards renewable energy sources. The purpose of this initiative is to motivate nations to create Nationally Determined Contributions (NDCs) that clearly state their individual obligations to decrease emissions and enhance the utilization of clean energy.

Regional organizations such as the European Union or the African Union contribute by establishing regional goals for renewable energy. These goals guide and promote cooperation in the areas of technology advancement, investment in infrastructure, and the adoption of effective policies (IRENA, 2023). These regional initiatives serve as a connection between global objectives and the realization of those objectives at the national level.

National policies such NDCs, are crucial instruments that provides a comprehensive description of how each country plans to achieve its clean energy objectives, which typically involve setting specific targets for renewable energy capacity and specifying the policies that will be implemented to support these goals (IEA-WEO, 2016).

Kenya has been actively implementing several initiatives to improve its energy industry. An exemplary endeavor is the Kenya National Electrification Strategy (KNES), with the objective of attaining comprehensive power accessibility by the year 2022. The approach prioritizes a combination of grid expansion, mini-grids, and off-grid options to effectively reach distant and neglected communities. In addition, Kenya has pledged to increase the proportion of renewable energy in its total energy composition. The nation has established ambitious objectives, including the attainment of 100% renewable energy by 2030, specifically by harnessing its substantial geothermal capacity, as well as wind and solar resources (GoK, 2017).

Furthermore, the Energy Act of 2019 is crucial in influencing Kenya's energy policy. The Energy and Petroleum Regulatory Authority (EPRA) is established under the Act to oversee and control the energy industry, with the aim of promoting efficiency, sustainability, and competitiveness. It prioritizes the development of sustainable energy sources and advocates for improved energy efficiency and preservation. Kenya's commitment to sustainable energy is in line with international efforts to address climate change and achieve sustainable development objectives, as stated in the Energy Act of 2019.

Table 2.1 presents the objectives of the study, key researches done and their focus and the existing knowledge gaps, which this study has tried to address

Table 2.1: Summary of Knowledge Gaps

Objectives	**Key contributors**	**Focus**	**Research gap**
To examine how perception influences the adoption of solar energy technologies among households.	Gitone (2014), Walker (2015), Poortinga *et al*. (2013), Kolosov (2021), Dutta *et al*. (2021) and Lorenzoni (2016).	Adoption of solar energy technologies at commercial levels. How firms and organizations perceive solar energy technologies.	There is a notable lack of knowledge regarding how firms, in addition to individual consumers, view and embrace solar energy technologies. Although there has been significant research conducted on the various aspects that affect the adoption of residential solar energy, the decision-making process inside enterprises has not been well investigated. Thus, research is needed to explore the specific factors that commercial entities must take into account, such as their cost-benefit analysis procedures, their willingness to take risks with new technologies, and the possible impact of environmental or social responsibility objectives on their decisions regarding solar adoption.

To analyze the spatial variations in the adoption of solar energy technologies among households.	Kumar (2020), Hsu *et al*. (2021), Gitau *et al*. (2019), Mulei *et al*. (2019) and Osiolo (2021).	Spatial variations in application and use of solar energy technologies in urban areas within the developed countries	There are substantial knowledge gaps in our comprehension of the adoption and utilization of solar energy technologies. Although there is extensive research on the adoption of solar energy in residential areas, there is a significant lack of understanding regarding how business entities perceive and embrace solar energy technologies. In this context, it is necessary to examine how firms assess the expenses and advantages, their receptiveness towards innovative technologies, and the potential impact of environmental or social responsibility objectives on their decision-making process. Moreover, a thorough analysis is necessary to understand the spatial disparities in the adoption of solar energy technologies in urban areas of industrialized and urban regions of Bomet.

To find out the socio-economic and geographic factors influencing the adoption of solar energy technologies among households.	Dragone (2022), Zhang *et al*. (2016), Fashina *et al*. (2018), El-Haggar *et al*. (2016) and Richler (2017).	Factors influencing consumers decision making process regarding the adoption of solar energy systems Barriers to adoption of RE	Although previous studies recognize that household income is a barrier to the adoption of solar energy in Konoin sub-County, there is still a significant lack of knowledge in this area. This study aims to enhance our comprehension by investigating supplementary aspects that impact household decision-making. This study goes beyond the exclusive emphasis on income by examining the potential influence of socio-economic variables such as age and educational attainment. Previous studies have not sufficiently taken into account environmental variables such as proximity to solar energy technologies which is key in this study. This study sought to address this disparity by examining the influence of environmental consciousness and climate change concerns on individuals' adoption of solar energy. Moreover, this study aimed to investigate the economic and environmental factors that have not been thoroughly examined to influence adoption of solar energy technologies.

2.6: Theoretical Framework

This study was informed by two theories: the diffusion of innovations theory and the technology adoption model.

2.6.1: Diffusion of Innovations Theory (DIT)

The DIT theory was developed by Everett M. Rogers (1962), a communication theorist. It describes the pattern and speed at which new ideas, practices, or products spread through a population and the manner in which they are adopted. The theory seeks to explain how and why new ideas and practices are adopted and how they are embraced in the society. Further, it explains how innovations and technology are shared within different parts of society and how people feel about them are important factors that affect how quickly a technology spreads or diffuse.

This theory is utilized to promote the understanding of new goods among individuals and facilitate their adoption. The theory classifies significant stakeholders into the following categories: innovators, early adopters, early majority, late majority, and laggards. In order to accelerate consumer adoption, the theory emphasizes the identification and engagement of influential early adopters. The dissemination of innovations is influenced by various factors, including the degree of industrialization and progress within a given community, as well as the population density of urban and rural areas. Adoption rates may differ across civilizations as a result of variables including cost, accessibility, and level of understanding regarding technological developments.

People in the field of technology adoption and diffusion see DIT as a turning point to how people adopt technologies. Rogers says that opinion leaders and change agents play a big part in spreading new ideas in communities through their social networks. This theory adds that when innovations are shown to the public, the public will be uncertain about whether or not to adopt them. Because of this uncertainty, people who might adopt will look for information to help them figure out what they need to know before adopting. In this research DIT theory has been used to inform diffusion of green energy innovations at the household levels and as a way to analyze the spread of energy-efficient innovations in the home, in the community, in business, and in the built urban and rural environments.

People are more likely to use a new idea if it is better than the idea it substitutes, or if it has a relative advantage over other options. Caird *et al*. (2018) found that people are most likely to use solar energy technologies if they think they will cut down their fuel bills. There are significant challenges that hinder the implementation of this technology, including concerns regarding its dependability and efficacy, lengthy repayment periods, exorbitant system expenses, and limited roof space on multi-story structures. Silk *et al*. (2014) came to the conclusion that stakeholders are less likely to adopt green energy if they do not think it is important. Diffusion specialists in innovations also think it is important that new ideas, like solar energy technologies, fit with people's values and needs, as well as with existing practices and infrastructure. Further, observation by friends, neighbors, and family is seen as an important motivator to adoption. Silk *et al*. (2014) points out that if stakeholders are able to watch a green energy innovation being implemented elsewhere, they may be more receptive to adopting it themselves.

2.6.2: Technology Adoption Model (TAM)

Technology Adoption Model (TAM) is an extension and improvement of the theory of reasoned action. Developed by Davis in 1986, TAM describes how people obtain, read, embrace and use technologies. It identifies more extrinsic variables based on perceived usefulness and ease of use of any product. Delaney and Agostino (2015) notes that when people are faced with new technologies, a variety of considerations affect their judgement to adoption. A person’s attitude towards green energy is based on his perception and belief about the benefits and drawbacks of the new technology and therefore affects his intention to adopt the technology. Green energy is cost intensive. However, the benefits last. Alam and Rashid (2014) opines that a potential consumer of green energy must have the right information and adequate level of awareness to make the best trade-off between the benefits and drawbacks. They note that green energy technology awareness is a concept where potential users must have access to the necessary information about the use of green energy, its financial costs and environmental impacts. According to this theory, perceived usefulness and perceived ease of use are the two main things that make people want to use a certain technology. Perceived usefulness is how much a person thinks that using a certain system will help him do his job better. Perceived ease of use is how much a person thinks that using a certain system will be easy. In relation to this research, it is anticipated that households would advocate for the use of green energy technologies based on the benefits that they are likely to experience, for example, cost effective, time saving on the cooking and associated environmental benefits. Therefore, households are likely to embrace different forms of green energy technologies and they would do their level best to have a smooth transition to the modern forms of energy. Environmental and health issues were thought to impact acceptance of new energy technologies in this study, which is a factor related to what Davis (1986) factored in on the perceived ease of use and perceived utility of technology adoption.

2.7: Conceptual Framework

The study examines three distinct variables: perceptions, spatial aspects, and socioeconomic and geographical factors. Perceptions are assessed by examining two sub-variables: the individual's attitude towards green energy and their self-efficacy in relation to adopting it. Spatial considerations refer to a wide range of aspects, such as the geographic location of a place which can either be urban or rural. The presence of alternative fuel sources is seen as an environmental element that impacts the adoption of solar energy. By adopting a holistic approach, this research is able to analyze the complex interaction of several factors that influence the choices made by households when it comes to solar energy technologies.

The conceptual framework (Figure 2.1) shows the interrelation of elements that impact household choices about solar energy technology. The study suggests that individual perceptions, as evaluated by attitudes towards solar energy and have a direct impact on the adoption of technology. This research also takes into account socioeconomic aspects such as the employment rate, the affordability of sustainable solutions, the income level, and the level of education. Additionally, it also evaluates environmental issues such as the availability of alternative fuels.

The Conceptual Framework

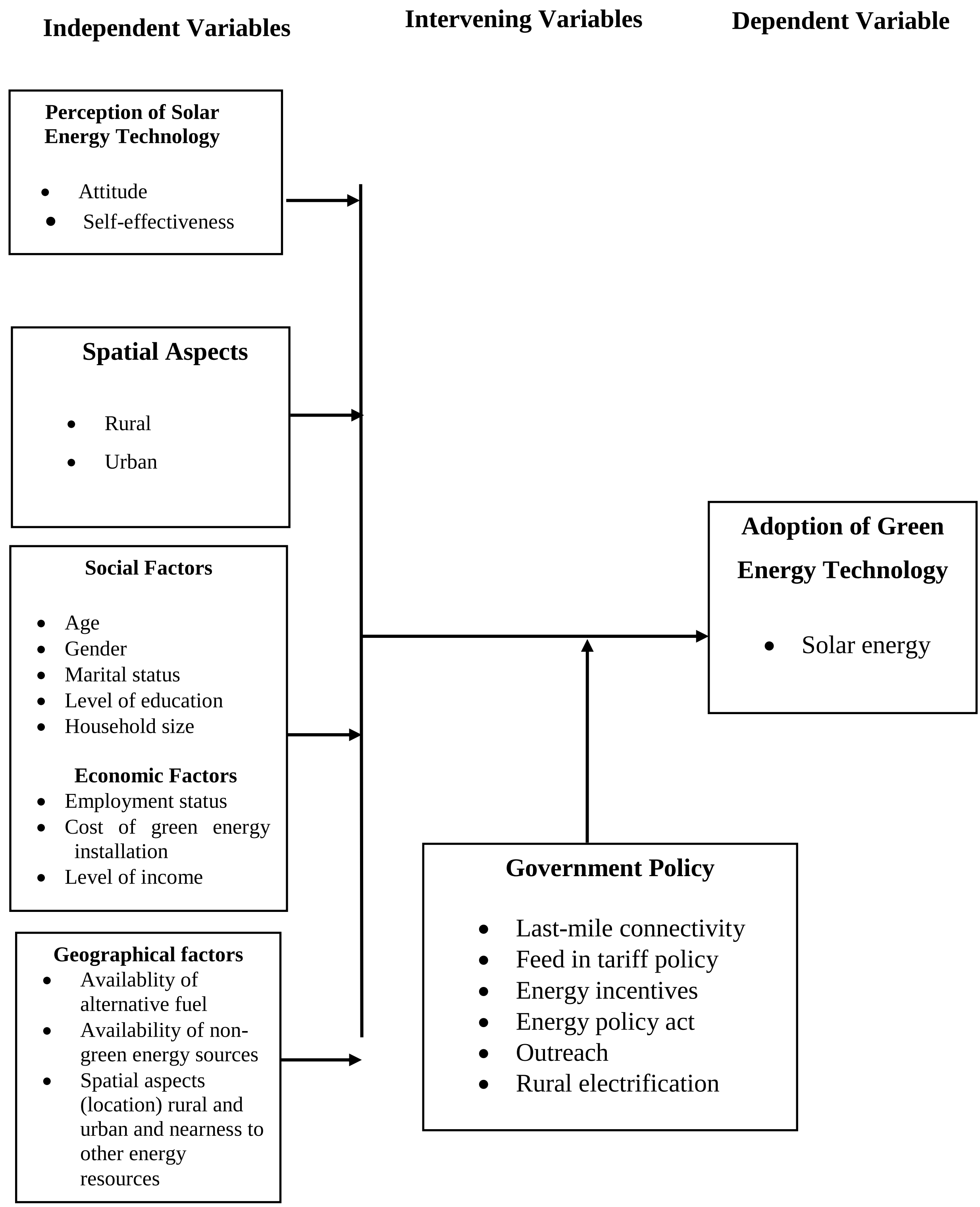

Figure 2.1: Conceptual Framework

Source: Reviewed Literature

CHAPTER THREE
METHODOLOGY

3.1: Introduction

This chapter describes the methodology and research design used in the study. Specifically, it explains the study location, research design, target population, sample size, sampling procedures, sampling technique, research instruments, validity, reliability, data collection procedures, data analysis technique, and ethical considerations.

3.2: Study Area

3.2.1: Location

The study location of Konoin sub- County located in Bomet County, Kenya (Figure 3.1). Konoin sub-County is divided into five Wards Kimulot, Mogogosiek, Boito, Chepchabas and Embomos which is the largest among the wards **(**KIHBS, 2019). The geographical location is within a longitude of 35° 16' east and latitude 0° 36' south with an elevation of 1909 metres above the sea level (Survey of Kenya, 2022).

The diverse landscape of Konoin sub-County, characterized by hills, plains, and extensive agricultural areas, plays a pivotal role in shaping the socio-economic and environmental context of the study (CIDP,2023). The undulating hills provide a scenic backdrop and potentially influence the accessibility and distribution of resources within the region. The presence of plains may signify areas suitable for various land uses, including infrastructure development or agricultural activities. The emphasis on agricultural areas underscores the importance of the local economy, potentially impacting residents' livelihoods and attitudes toward green energy technologies. Furthermore, understanding the geographical and administrative characteristics of Konoin sub-County enhances the contextual clarity of the research on green energy technology adoption, providing a nuanced perspective on the interplay between local geography, administrative structures, and the community's potential acceptance of sustainable energy solutions (CIDP,2023).

The study was carried out in this sub-County because there are indications of efforts by the households and the county government to educate and install solar panels at subsidized price, (CIDP,2023). Further, the sub-County is also informed by its close proximity to the

Multinational tea companies which plays a major role through CSR in educating the neighbouring communities on sustainable use of solar energy which has been adopted within the estates.

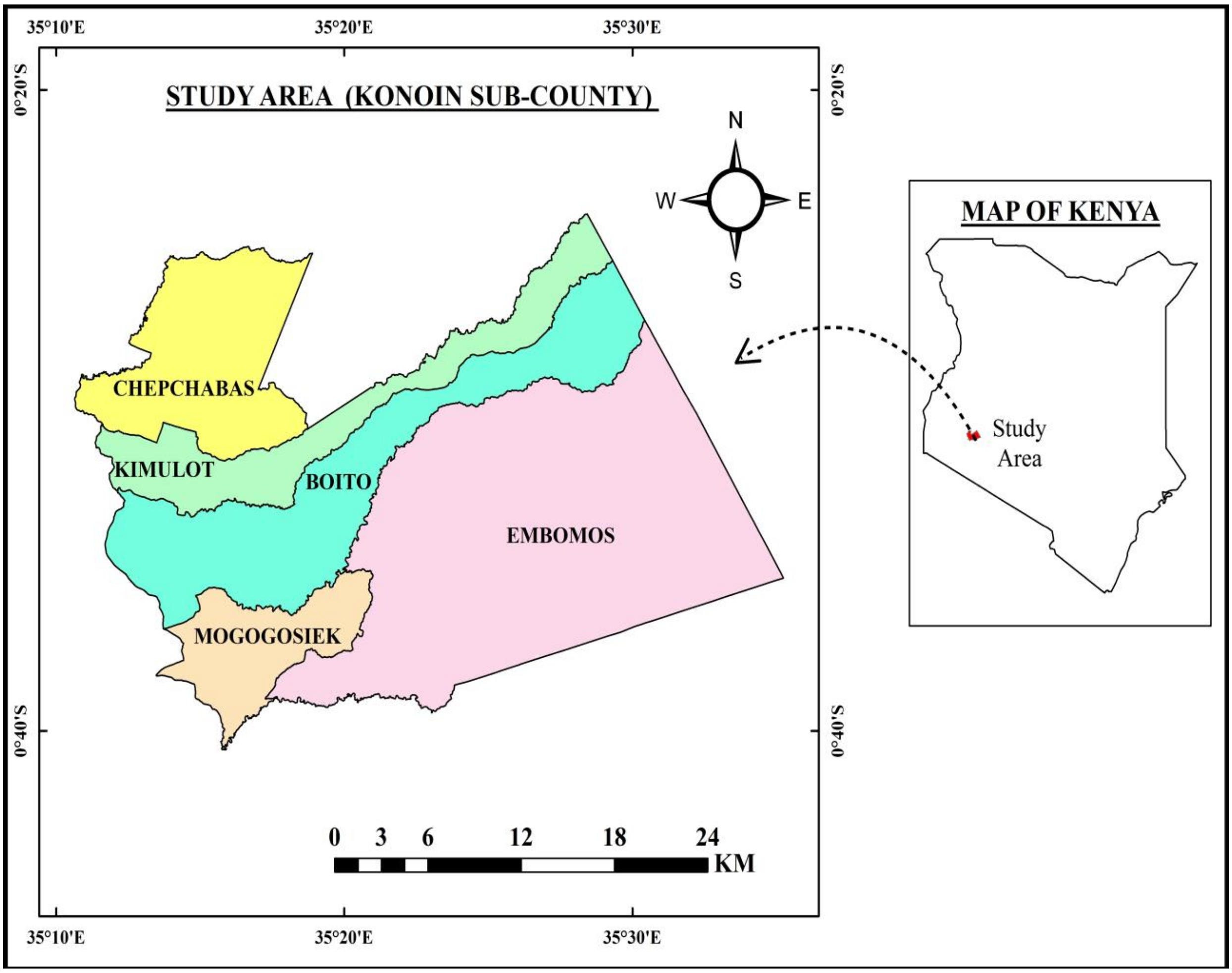

Figure 3.1: Map Showing the Location of the Study Area

Source: Survey of Kenya (2022).

3.2.2: Demographic Information

The Kenya Population and Housing Census (KPHC, 2019) provides significant demographic information about Konoin sub-County. This region has a population of 163,507 people and covers an area of 392 km², resulting in a population density of around 417 individuals per square kilometer. The age structure of the population shows a varied composition with a combination of younger and older people, as well as a reasonably equal distribution of males and females (KPHC, 2019). Household data offers insight into the demographic makeup of different age groups residing in these homes (KPHC, 2019).

The 2019 census report provides information on population growth or trends in farm size. The demographic features have the ability to impact the adoption of solar energy in Konoin. Research indicates that younger age groups may exhibit more openness to adopting emerging technologies such as solar power, in contrast to older demographic segments (Liu *et al*., 2020). Likewise, homes that are bigger and require more energy may be more motivated to consider alternative options such as solar panels (Adugna *et al*., 2021).

The impact extends beyond the study of population characteristics. The given information emphasizes the possible influence of bordering towns linked to Ekaterra companies on the adoption of solar energy in Konoin. Interactions between these communities facilitates the flow of knowledge on energy efficiency and effectiveness (Wang *et al*., 2020). The presence of positive experiences and successful implementations of solar energy in neighboring regions serves as a social stimulus, motivating people of Konoin to contemplate the adoption of similar solutions (Van den Bergh *et al*., 2018).

3.2.3: Economic Activity

The economy of Konoin sub-County predominantly relies on agricultural output, with tea plantations constituting the mainstay, occupying over 70% of the area. This particular agricultural product has a considerable role in the official economy, providing employment for a large share of the labor force (CIDP, 2023). Nevertheless, agriculture encompasses more than just tea. The cultivation of crops such as maize, beans, potatoes, and vegetables mostly serve the purpose of meeting subsistence requirements, with a smaller proportion potentially being sold in nearby markets. Livestock raising plays a crucial role in strengthening the agricultural sector, as cows, goats, and sheep contribute to the production of milk, meat, hides, and skins (CIDP, 2023).

Konoin has a thriving informal sector in addition to its established agricultural foundation. This sector is distinguished by a plethora of small-scale firms, which include activities such as trade, services, and artisanal production. The inclusion of both agricultural and non-agricultural sectors in the process of economic diversification contributes to the maintenance of employment levels and promotes a more robust economic environment. Per capita incomes, which are impacted by these many activities, have a significant impact on the financial prosperity of the region. The wealth earned from various economic pursuits is crucial for many households that depend on it for necessary support (CIDP, 2023).

3.2.4: Infrastructure

The infrastructure of Konoin sub-County, encompassing roads, water supplies, communication networks, educational facilities, healthcare services, and energy consumption, faces notable challenges (KNBS, 2019). According to a study by the Kenya National Bureau of Statistics, the road network in Bomet County is predominantly composed of gravel roads, often becoming impassable during the rainy season, while some are marred by potholes and erosion (KNBS, 2019).

Concerning energy consumption, majority of the households depend on the national grid as a major energy source, despite its historical instability and susceptibility to blackouts (Bett *et al*., 2020). To address this issue and enhance energy reliability, initiatives promoting alternative energy sources, such as solar energy, have been introduced in the area (Bett *et al*., 2020). Evaluating and addressing energy consumption patterns is crucial for sustainable development, and the integration of renewable energy sources can contribute to a more resilient and environmentally friendly energy infrastructure in Konoin sub-County.

The education system consists of a network of primary and secondary schools, with an increasing focus on technical and vocational training, according to the Konoin sub-County Education Office in 2024. The existence of institutions such as the Konoin Technical Training Institute and several career colleges indicates a strong emphasis on providing citizens with practical skills for employment (CIDP, 2023). Nevertheless, challenges continue to exist. The presence of limited resources and infrastructure gaps in certain places hinders the ability of all inhabitants to attend high-quality education (Konoin sub-County Education Office, 2024).

The provision of healthcare services in Konoin sub-County is facilitated through a comprehensive system of public health facilities, such as dispensaries and health centers (Konoin Sub-County Health Department, 2024). The primary objective is to provide essential healthcare services, including as maternal and child health care, immunization programs, and preventive measures (Konoin sub-County Health Department, 2024). However, like the education sector, a shortage of resources and infrastructure may provide obstacles in providing comprehensive healthcare services throughout the entire sub-county (Konoin sub-County Health Department, 2024). To gain a more comprehensive picture of the healthcare situation in Konoin, it would be beneficial to do additional study focusing on specific healthcare indicators such as newborn mortality rates or doctor-to-patient ratios.

3.2.5: Climate

According to the Kenya Meteorological Department, the area has a yearly maximum temperature of 22.7°C and a yearly minimum temperature of 12.07°C. The average annual precipitation is 340.25mm. The hottest month is February, with a temperature of 26.21°C, while the coldest month is July, with a temperature of 11.02°C. The wettest month is April, with a precipitation of 563.29mm, while February is the driest month, with a precipitation of 123.65mm. These environmental characteristics provide distinct insights into patterns of home energy usage. Upon analyzing the climatic data, it becomes apparent that households partake in the collection of fuel wood during dry seasons for later utilization in cooking, lighting, and heating their living spaces throughout the wet seasons (Kendagor & Prevost, 2013). Moreover, fluctuations in climate have a substantial impact on the energy preferences of households, leading to frequent transitions between various energy sources over a period of time (Kenya Meteorological Department, 2022).

3.2.6: Soils

The edaphic conditions in Mogogosiek, particularly the composition of the soil, are crucial in determining the character and output of the region's agricultural economy. Farmers in the area may cultivate a variety of crops on the fertile andosols and nitisols, contributing to the local food supply and sustaining the economy. Proper soil management measures, are required to preserve soil fertility and avoid deterioration, which may have an influence on agricultural production and the environment (CIDP, 2023).

3.3: Research Design

This study employed a descriptive survey design that used questionnaire to collect data. A descriptive survey design is a research methodology that aims to collect comprehensive and detailed information about the characteristics of a population or phenomenon. It involves systematically gathering data to provide a thorough summary of the current state of the subject being studied, offering insights into its features and attributes. The primary goal of this design is to provide a comprehensive overview rather than establish causal relationships (Burkholder *et al*., 2019).

The design is appropriate in this study because it allowed the researcher collect and report information without manipulating the variables in the study. The researcher was also able to collect data on attitudes and opinions of the respondents. Descriptive survey research design is quick, easy and cheap to use compared to other designs (Burkholder *et al*., 2019).

A descriptive survey design employed in this kind of study serves to clarify existing energy consumption patterns, evaluate awareness and attitudes towards different energy sources, and pinpoint specific energy requirements and preferences within a community.

3.4: Target Population

According to Fricker (2019), a target population refers to a group of people who possess similar traits and from whom a researcher may draw general conclusions. Konoin sub-County has 38220 households. Households are crucial in this kind of survey because they have a substantial influence on overall energy consumption patterns. Examining the energy use in residential homes yields significant observations on human behaviour, preferences, and decisions that directly impact energy requirements. Comprehending this concept is crucial for customizing efficient actions that seek to improve energy efficiency and sustainability. By focusing their attention on homes, researchers may evaluate not only the immediate effects of energy-related behaviour at an individual level but also acknowledge the wider consequences of energy use across the whole community. Therefore, the examination of homes plays a crucial role in formulating comprehensive approaches to tackle energy difficulties and promoting a more sustainable and resilient energy environment.

To gain a more comprehensive understanding of the energy landscape in Konoin sub-County, this research expanded its focus to include institutional settings. Thirty-five institutions were strategically selected for data collection, categorized as 15 primary schools, 10 secondary schools, 5 tertiary colleges, and 5 tea factories. These diverse institutions represent various stakeholders within the sub-County, offering valuable insights into local energy practices and needs and they also formed part of the target population.

The role of institutions within energy studies holds significant weight. These entities play a critical role in shaping and implementing energy policies that ultimately influence the trajectory of sustainable energy development (IEA, 2016). Institutions have the authority to establish regulatory frameworks that govern energy practices across various sectors. Furthermore, they play a pivotal role in the strategic planning, financial support, and operational oversight of energy infrastructure projects. This multifaceted involvement enhances the overall organization and effectiveness of the energy sector (World Bank, 2022). Beyond policy and infrastructure, institutions serve as crucial facilitators, bringing together diverse stakeholders within the energy industry. By fostering collaboration, these entities can navigate complex challenges and ensure the successful implementation of sustainable energy projects (UN DESA, 2023).

Key informants were crucial in offering useful strategies for solar energy in the research region. The group consisted of five ward representatives, one from each ward, as well as one representative from the ministries of water, sanitation, environment, natural resources, and climate change, and one person from the ministry of commerce, energy, industry, and tourism. This brought the total number of representatives to seven.

Table 3.1shows the distribution of the target population in all the five wards.

Table 3.1: Distribution of Target Population as per the Wards in Konoin Sub-County

	Ward	**Number of Households**
1.	Mogogosiek	8147
2.	Chepchabas	6132
3.	Kimulot	6236
4.	Embomos	9214
5.	Boito	8449
6.	Primary schools	15
7.	Secondary Schools	10
8.	Tertiary Colleges	5
9.	Tea Factories	5
10.	Ward representatives	5
11.	Ministry of water, sanitation, environment, natural resources and climate change	1

12.	Ministry of trade, energy, industry and tourism	1
	Total	**38220**

3.5: Sampling Technique

To ensure the study reflected the diverse energy landscape across Konoin sub-County's expansive geography, a stratified sampling technique was developed. This approach combined the strengths of simple random and purposive sampling techniques. Simple random sampling was employed to select households for the questionnaire survey. This method ensured each household had an equal chance of being included, regardless of location, fostering a geographically representative sample.

Furthermore, purposive sampling was used to target key informants and institutions with specialized knowledge on energy issues (Zhang *et al*., 2016). This deliberate selection process allowed researchers to gather in-depth insights from energy experts, policymakers, or representatives from influential organizations like tea factories. By incorporating both random variation from households and focused observations from key stakeholders, this combined sampling approach aimed to strengthen the study's reliability and provide a comprehensive understanding of energy practices and needs within Konoin sub-County.

3.6: Sample Size Determination

According to Mugenda, (2013), sample size is a small group of individuals selected from a bigger target population which represents the whole population. This research employed a convectional formula of choosing a sample size adopted by Krejcie and Morgan (1970). This model is applicable where there is a large population and therefore the figure obtained was a true representation of the total population of the households. The formula is as given below.

$$n = \frac{x^2 Npq}{d^2 (N-1) + x^2 pq}$$

Where:

n =Required sample size.

x^2 =The table value of Chi-Square value for one degree of freedom at the desired confidence level (x^2 =3.841 at confidence level).

N =The target population.

p= The population proportion (Assumed to be 0.50 since this would provide the maximum sample size)

d = Degree of accuracy reflected by the amount of error that can be tolerated.

Subjecting the formula to the target population of 38178, yields a sample size of 380 which was proportionately divided among the five wards as shown in Table 3.2.

Table 3.2: Household Sample Size Distribution among the Five Wards

Ward	Proportion	Family Households	Primary Schools	Secondary Schools	Tertiary Colleges	Tea Factories	Sample
Mogogosiek	21%	73	3	2	1	1	80
Chepchabas	16%	54	3	2	1	1	61
Kimulot	17%	57	3	2	1	1	64
Embomos	24%	84	3	2	1	1	91
Boito	22%	77	3	2	1	1	84
Total	**100%**	**345**	**15**	**10**	**5**	**5**	**380**

Data was also be collected, purposively, from Key Informants who included five Ward administrators from each of the five Wards, one official from the Ministry of Water, sanitation, environment, natural resources and climate change and one official from the ministry of Trade, Energy, Industry and Tourism. This brings the total sample size of the study to 387.

3.7: Research Instruments

This study adopted an open-ended and closed-ended questionnaires (Appendix II, III and IV) The first questionnaire (Appendix II) collected data from households. The second questionnaire (Appendix III) collected data from institutions and the third interview schedule (Appendix IV) collected data from key informants.

Utilizing a questionnaire enables researchers or surveyors to collect information in a consistent and uniform way. Every participant is given a same set of questions, guaranteeing uniformity in their responses (Babbie, 2020). The presence of uniformity is crucial in order to facilitate comparative analysis and enable the formation of dependable conclusions (Mugenda & Mugenda, 2012).

Further, the organized framework of a questionnaire facilitates the streamlining of the data processing procedure. Responses may be readily measured, classified, and statistically examined. This enables the identification of patterns, trends, or correlations within the information, so offering useful insights into the different topics being investigated (Mugenda & Mugenda 2012).

The survey questionnaire for households, institutions and key informants was divided into four divisions, designated as A to D. Section A gathered demographic data from the participants, Section B examined the influence of perception on the adoption of solar energy technologies, Section C explored the variations in adoption across different locations and time periods and Section D investigated the socio-economic and geographical factors that influence the adoption of solar energy technologies in households.

3.7.1: Validity of the Research Instruments

The research instrument in the study was evaluated for content validity. According to Ghazali (2016), content validity measures the theoretical construct that it is designed to measure. The research instruments were evaluated by key academic experts of Egerton University and this included the use of focused group discussions afterwards they made relevant suggestions on the validity of research instrument.

3.7.2: Reliability of Research Instruments

According to Dikko (2016), reliability of data collection instrument refers to the degree of consistency of the results when using a research instrument after repeated trials. The researcher also carried out the pilot study from twenty households in Bomet East. The researcher distributed the questionnaires to the piloting households then the content in the questionnaires was reviewed and analysed to check on their reliability.

To measure the reliability of the research instrument used, Cronbach's alpha was used. According to Sekaran (2015) if the Cronbach's alpha value of the instrument being tested is less than 0.6, this indicates that the instrument's reliability is poor. According to Sekaran (2015) values of 0.7 or more are considered to be more reliable and therefore necessary adjustments to the questionnaires was made in case a value of 0.6 is arrived at in the piloting stage so that the real research process was not affected.

The researcher also identified issues that might go unnoticed. According to Teijlingen and Hundley (2012), the pilot study may be used to identify practical challenges that are likely to present themselves in the final study.

3.8: Data Collection

In order to streamline the process of gathering data from specific households, self-structured questionnaires were used. The questionnaires included measurement questions that focused on different study factors. Training was provided to four research assistants on the process of selecting and administering questionnaires to households that were part of the sample. This training helped in collecting data from households in four different wards. Concurrently, the researcher oversaw the gathering of data in the remaining ward. The researcher conducted regular inspections to verify that the research assistants followed the prescribed processes, therefore improving the precision and dependability of the findings.

During the data gathering, participants were given questionnaires and asked to offer their replies based on their own opinions. In addition, the researchers clarified difficult and unclear questions for the participants to aid their understanding.

3.9: Data Analysis

The data was analyzed using both descriptive and inferential statistics, with the assistance of the Statistical Package for Social Scientists (SPSS version 26). Descriptive statistics were vital for summarizing and organizing the data, thereby facilitating the production of meaningful conclusions. The evaluated data fulfilled the objective of investigating the study issues. Specifically, the evaluation of the first and third objectives was done by multiple linear regression analysis, and the study of the second objective was analyzed using correlation analysis.

3.7.1 Data Analysis Model

This study used multiple linear regression analysis. A multiple linear regression is a model that predicts the value of one dependent variable based on two or more independent variables. The general multiple linear regression model of the equation is:

$$y = \beta_0 + \sum_{i=1}^{i=n} \beta_i x_i$$

The specific model that this study adopted is:

$$y_H = \beta_{0H} + \beta_{1H} x_{1H} + \beta_{2H} x_{2H} + \varepsilon$$

Where:

y_H= Adoption of solar energy technologies

x_{1H}=Household's perception

x_{2H}= Household's socio- economic and geographical factors

β_{0H}= Constant (Adoption of solar energy technology not accounted for by household perception, socio-economic and Geographical factors)

β_{1H} = Coefficient (Change in adoption of solar energy technology resulting from one unit change in household's perception)

β_{2H} = Coefficient (Change in adoption of GET resulting from one unit change in socio-economic and geographical factors)

ε= Error term

Table 3.3: Summary of Data Analysis Techniques

Table 3.3 shows the summary of the data analysis model showing the association of both the dependent and independent variables.

Objective	Independent variable	Dependent variable	Method of data collection	Tool of data analysis
Objective 1 To examine how perception influences the adoption of green energy technologies among households.	Perception	Adoption of solar energy technologies	Survey questionnaire	$y = \beta_0 + \beta_1 x_1$ y= Adoption of Solar energy technologies β_0= Constant (Adoption of solar energy technologies not accounted for by perception) β_1 = Coefficient (Change in adoption of solar energy technologies resulting from one unit change in household's perception)

				x_1=Household's perception
Objective 2 To analyze the spatial variations in the adoption of solar energy technologies among households.			Survey questionnaire	Correlation analysis Mean Standard deviation Descriptive and inferential statistics
Objective 3 To find out the socio-economic and geographical factors influencing the adoption of solar energy technologies among households.	Social factors	Adoption of SET	Survey questionnaires	$y = \beta_0 + \beta_2 x_2 + \varepsilon$ y= Adoption of SET β_0= Constant (Adoption of SET not accounted for by social factors)

				x_2= Social factors β_2= Coefficient (Change in adoption of SET resulting from one unit change in social factors)
	Geographical factors	Adoption of GET	Survey questionnaires	$y = \beta_0 + \beta_4 x_4 + \varepsilon$ y= Adoption of SET β_0= Constant (Adoption of solar energy technology not accounted for by Geographical factors) x_4= Geographical factors β_4= Coefficient (Change in adoption of solar energy technologies.

3.10: Ethical Considerations

The researcher obtained permission from the National Commission for Science and Technology, and Innovation (NACOSTI) then an authorization from Konoin sub- County Education office. The researcher also sought the respondent's consent before collecting data and in a situation where the respondents were not willing to provide any information, his or her decision was respected.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1: Introduction

This chapter delves further into the presentation, analysis, and interpretation of the results of the research, focusing specifically on the field data. The purpose of this research was to investigate the variables that impact individual households' decisions to adopt solar energy technologies.

4.2: Response Rate

The response rates were 83.42%, 94.29%, 100% for households, institutions and key informants respectively. There were some questions that were only partly completed by respondents and such questionnaires were not included in the analysis. According to Kothari (2014), an appropriate response rate for analysis is one that is equal to or higher than 50%.

4.3: Basic Information of the Respondents

This sub-section provides data on the respondents' gender, age, income level, employment status, location, and level of education. The purpose is to examine potential connections between these demographic factors.

4.3.1: Gender of the Household Respondents

Table 4.1 shows the gender of household head who participated in the survey.

Table 4.1: Gender of the Respondents

Gender	Frequency	Percent
Male	161	50.8
Female	155	48.9
Total	**316**	**99.7**

The analysis of the data reveals a significant disparity in the gender distribution within the study area. Out of the individuals that completed the household survey, 50.8% were male and 48.9% were female, indicating almost equal distribution of genders. It is crucial to acknowledge these gender disparities since they have the potential to impact the accuracy and comprehensiveness of the research findings since the gender of the household head is the key decision maker in a household, particularly in scenarios where gender has significant influence on solar energy adoption. It is crucial to acknowledge and contemplate these disparities in gender representation to ensure that the research findings are comprehensive, include all perspectives of adoption and illustrate how various genders can contribute to the subject matter under study. The recognition of this acknowledgment enhances the validity and use of the findings in comprehending the intricate matters of gender dynamics on adoption that were examined.

4.3.2: Age of the Respondents

Table 4.2 presents the age distribution of 317 respondents. It shows the number of participants who identified to belong to a particular age bracket with their corresponding percentages.

Table 4.2: Age of the Households Respondents

Age Bracket	Frequency	Percent
18-30 years	15	4.7
31-40 years	35	11.0
41-50 years	235	74.1
Above 50 years	32	10.1
Total	**317**	**100.0**

Respondents aged 41 to 50 comprised 235 (74.1%), of the sample, followed by 35 (11.0%) respondents from 31-40 years, 32 (10.1%) respondents over 50 years, and finally those aged 18-30 years with 15 (4.7%) respondents. This distribution revealed that the majority of the persons in the research were between the ages of 41 and 50. Further investigation revealed that persons of various ages offered more varied replies, demonstrating how crucial age may be as a component in the study.

4.3.3: Level of Education

Table 4.3 shows the educational background of the 317 participants of the survey.

Table 4.3: Respondents' Level of Education

Level of Education	Frequency	Percent
Primary	55	17.4
Secondary	52	16.4
College Level	50	15.8
Undergraduate Degree	51	16.1
Post Graduate Degree	53	16.7
Never been to school	56	17.7
Total	**317**	**100.0**

From Table 4.3 above, it is evident that the educational background of the respondents shows various levels of education attained including: primary, secondary, college, bachelor's degree, master's degree. However, 56 (17.7%) of the respondents had no formal education which highlights how education helps in shaping effective communication strategies about solar energy, ensuring inclusivity and accessibility

4.3.4: Employment Status

Table 4.4 highlights the employment status of the respondents

Table 4.4: Employment Status of Respondents

Employment Status	Frequency	Percent
Employed	245	77.3
Self-Employed	22	6.9
Unemployed	50	15.8
Total	**317**	**100.0**

Data on employment status of respondents provided valuable insights into the workforce of the population surveyed. Responses showed that 245 (77.3%) of respondents are employed, indicating stable employment opportunities within the sample that may provide a stable market. This is a positive indicator of economic stability and financial security for energy and on their consumption of goods. In addition,22 (6.9%) of respondents were self-employed, reflecting the presence of entrepreneurial activities, which contribute to economic diversity and innovation. However, 50 (15.8%) of respondents were unemployed.

4.3.5 Level of Monthly Income

Table 4.5 depicts the monthly income distribution of the 317 respondents.

Table 4.5: Respondents' Monthly Income

Monthly Income	Frequency	Percent
Less than 20,000KES	72	22.7
20,000 to 40,000 KES	128	40.4
40,000 to 60,000 KES	93	29.3
60,000 KES and above	24	7.6
Total	**317**	**100.0**

The data shows a wide variety of income levels, which reflects the diverse financial start of the participants of the survey. Majority of the respondents reported monthly incomes in the moderate range, with 128 (40.4%) earning between 20,000 and 40,000 KES. Furthermore, 93 (29.3%) of respondents reported monthly wages ranging from 40,000 to 60,000 KES, 72 (22.7%) earned less than 20,000 KES, and 24 (7.6%) earned more than 60,000 KES.

4.4.6: Respondents' Household Size

Table 4.6 shows the distribution of household sizes among the 317 respondents.

Table 4.6: Respondents' Household Size

Household Size	Frequency	Percent
One	65	20.5
Two	64	20.2
Three	64	20.2
Four	68	21.5
Five or more	56	17.7
Total	**317**	**100.0**

The size of respondents' immediate household varied a lot. This shows how different family structures are in the study area. Data showed that households had between one and four members. In particular, 68 (21.5%) of the people among the sample said that their close family was made up of four people, such as parents, siblings, spouses, and children. Also, 65

(20.5%) said they only had one person in their family, while 64 (20.2%) said they had three people in their family, which is the same as households with two people, which also had 64 (20.2%). There were also fewer people in each family. Only 56 (17.7%) of respondents had five or more people in their family.

4.4: Cross-tabulation Analysis on Households Adoption of Solar Energy Technologies

Table 4.7 shows relationship between two categorical variables summed up and analyzed using cross-tabulation. The percentage distribution of the variables was shown in the form of a matrix, which showed how the categories of one variable relate to the categories of another variable.

Table 4.7: Multi-Variate Contingency Table showing the Percentage Frequency of Variables

Adoption of Solar Energy Technologies		
Ward/Location of Respondent	**Yes**	**No**
Mogogosiek	88.10%	11.90%
Chepchabas	95.50%	4.50%
Kimulot	92.30%	7.70%
Embomos	84.80%	15.20%
Boito	94.30%	5.70%
Respondents' Gender	**Yes**	**No**
Male	89.40%	10.60%
Female	92.30%	7.70%
Age Bracket	**Yes**	**No**
18-30 years	86.70%	13.30%
31-40 years	97.10%	2.90%
41-50 years	89.40%	10.60%
Above 50 years	96.90%	3.10%
Highest school level	**Yes**	**No**
Primary	94.50%	5.50%
Secondary	88.50%	11.50%
College Level	92.00%	8.00%
Undergraduate Degree	82.40%	17.60%
Post Graduate Degree	94.30%	5.70%

Never been to school	92.90%	7.10%
Employment Status	**Yes**	**No**
Employed	89.40%	10.60%
Self-Employed	90.90%	9.10%
Unemployed	98.00%	2.00%
Monthly Income Level	**Yes**	**No**
Less than 20,000KES	95.80%	4.20%
20,000 to 40,000 KES	87.50%	12.50%
40,000 to 60,000 KES	89.20%	10.80%
60,000 KES and above	100.00%	0.00%
Size of Nuclear Family	**Yes**	**No**
One	83.10%	16.90%
Two	93.80%	6.20%
Three	95.30%	4.70%
Four	89.70%	10.30%
Five or more	92.90%	7.10%
Dependants under 18 years	**Yes**	**No**
None	87.80%	12.20%
One	97.40%	2.60%
Two	93.60%	6.40%
Three or more	84.50%	15.50%
Adults over 18 years	**Yes**	**No**
Two	90.80%	9.20%
Three	84.80%	15.20%
Four or more	94.20%	5.80%
Shared living space with family	**Yes**	**No**
Yes	84.80%	15.20%
No	**91.90%**	**8.10%**

4.4.1: Ward of Residence and Adoption of Solar Energy Technologies

The data Table 4.7 shows the respondents percentage adoption levels of solar energy technologies across different wards. It is evident that there is a relatively high adoption rate of solar energy technologies across all wards, ranging from 84.80% to 95.50%. This suggests that there is a considerable interest or incentive for households in the study area to utilize solar energy technologies. However, it is also notable that there are some variances among the wards. For instance, Embomos has the lowest adoption rate at 84.80%, while Chepchabas has the highest adoption rate at 95.50%. These differences could be due to various factors such as differences in income levels, access to information, government incentives, or geographical factors affecting solar energy viability.

4.4.2: Gender and Adoption of Solar Energy Technologies

The data in Table 4.7 suggests a slight variation in adoption rates based on gender. Among males, 89.40% have adopted solar energy technologies, while 92.30% of females have done so. This data indicates a general trend of higher adoption rates among females compared to males, albeit the difference is relatively small. It is worth noting that the overall adoption rate is quite high at 90.90%, indicating a significant uptake of solar energy technologies across all gender identities.

4.4.3: Age and Adoption of Solar Energy

The cross-tabulation given in Table 4.7 presents the relationship between age interval and the adoption of solar energy technologies. It reveals the percentage of individuals within each age group who have adopted solar energy technologies and those who have not. Across all age brackets, there is a significant portion of individuals who have adopted solar energy technologies. However, there are variations in adoption rates among different age groups. In the youngest age bracket (18-30 years), 86.70% of individuals have adopted some form of solar energy technologies, indicating a relatively high adoption rate compared to other age groups. As age increases, the adoption rate tends to rise consistently. The age group of 31-40 years shows the highest adoption rate at 97.10%, followed closely by the above 50 years' group at 96.90%.

There is a slight drop in adoption rates in the 41-50 years' age bracket, where 89.40% have adopted solar energy technologies. However, this drop is not as significant as the difference observed between the youngest age bracket and the rest. Generally, the data suggests a positive correlation between age and the adoption of solar energy technologies, with older age groups showing higher adoption rates. This trend could be attributed to various factors such as financial stability, environmental consciousness, and the availability of incentives or subsidies for solar energy adoption, which might be more accessible to individuals in certain age demographics.

4.4.4: Education Level and Adoption of Solar Energy Technologies

Generally, it is evident from Table 4.7 that the adoption of solar energy technologies is relatively high, with 90.9% of respondents indicating they have adopted it in some form, while 9.1% have not. Breaking down the data by educational attainment, we observe variations in adoption rates across different levels of schooling. Notably, individuals with postgraduate degrees have the highest adoption rate at 94.3%, followed closely by those with primary education at 94.5%. This suggests that higher levels of education may correlate with a greater propensity to adopt solar energy technologies because educated individuals are likely more aware of the benefits and technological aspects, influencing their willingness to embrace these solutions. On the other hand, individuals with undergraduate degrees have a slightly lower adoption rate at 82.4%, indicating a potential dip in adoption compared to those with postgraduate degrees. Similarly, respondents with secondary education and college-level education also exhibit slightly lower adoption rates compared to primary education and postgraduate levels, though still relatively high at 88.5% and 92.0%, respectively.

Among individuals who have never been to school, the adoption rate is notably high at 92.9%. This indicates that factors, other than formal education, such as environmental consciousness, economic incentives, or government initiatives may also influence the adoption of solar energy technologies.

4.4.5: Employment Status and Adoption of Solar Energy Technologies

Table 4.7 shows that there is variation in the adoption rates across the different employment categories. Among the employed individuals, approximately 89.40% have adopted some form of solar energy technologies, while 10.60% have not. This indicates a relatively high adoption rate among this group. Similarly, self-employed individuals exhibit a slightly higher adoption rate, with 90.90% having adopted solar energy technologies, compared to 9.10% who have not. However, the most striking observation comes from the unemployed category, where a significantly higher proportion, 98.00%, have adopted solar energy technologies. Only 2.00% of unemployed individuals have not adopted solar energy technologies. This data suggests that there may be a correlation between unemployment and the adoption of solar energy technologies, with unemployed individuals being more likely to utilize solar energy technologies compared to those who are employed or self-employed. This trend might be attributed to a number of variables, including the availability of government subsidies for low-income families, increased flexibility in time and willingness to participate in cost-cutting techniques, or the compelling need for jobless people to cut their electricity bills.

4.4.6: Level of Monthly Income and Adoption of Solar Energy Technologies

The cross-tabulation in Table 4.7 presents the relationship between individuals' adoption of solar energy technologies and their monthly income levels. The data reveals different patterns regarding the adoption of solar energy across different income brackets. It is evident that there is a clear correlation between higher income levels and the adoption of solar energy technologies. Among those earning 60,000 KES and above per month, 100% have adopted some form of solar energy technologies. This suggests that individuals with higher incomes are more likely to invest in solar energy solutions, possibly due to their ability to afford the initial installation costs or their awareness of the long-term savings associated with solar energy. As income decreases, the adoption rate of solar energy technologies also decreases. For instance, in the 40,000 to 60,000 KES income bracket, 89.20% have adopted solar energy, while in the 20,000 to 40,000 KES bracket, the adoption rate drops to 87.50%. This trend continues further down the income scale, with the lowest adoption rate observed in the 0 to 20,000 KES bracket at 95.80%. Moreover, in the lowest income bracket, a significant proportion of individuals have adopted solar energy technologies. This could be attributed to various factors such as government incentives, community initiatives, or the availability of affordable solar solutions.

4.4.7: Size of Nuclear Family and Adoption of Solar Energy Technologies

According to the data in Table 4.7, it is evident that there is a trend towards higher adoption rates of solar energy technologies as the size of the family increases. This is due to the fact that larger households have got a bigger energy consumption pattern and would therefore look for ways to reduce energy costs by adopting solar energy technologies. For instance, among households consisting of one individual, 83.10% have adopted solar energy technologies, whereas for households with five or more individuals, this adoption rate increases to 92.90%. Furthermore, the overall adoption rate across all family sizes stands at 90.90%, indicating a relatively high prevalence of solar energy technologies adoption among respondents. Interestingly, there are slight fluctuations in adoption rates across different family sizes. For instance, households with three members exhibit a slightly higher adoption rate (95.30%) compared to households with two members (93.80%) or four members (89.70%). However, these differences are relatively minor.

4.4.8: Dependants Under 18 Years and Adoption of Solar Energy Technologies

According to Table 4.7, majority of households, accounting for 90.9% of the total sample, have adopted some form of solar energy technologies, while 9.1% have not. When examining the data by the number of dependants under 18 years in the household, certain trends emerge. Among households with no children under 18 years old, the adoption rate of solar energy technologies stands at 87.8%, while 12.2% of such households have not adopted it. The adoption rate appears to increase as the number of children in the household decreases, with households having one child showing the highest adoption rate at 97.4%, and those with three or more children displaying the lowest adoption rate at 84.5%.

This trend suggests a potential correlation between the adoption of solar energy technologies and the number of children in a household. One possible explanation could be that households with fewer children may have more savings available to invest in renewable energy technologies. Additionally, households with more children may have different priorities or financial constraints that influence their decision-making regarding solar energy adoption.

4.4.9: Number of Adults above 18 Years and Adoption of Solar Energy Technologies

It is evident from Table 4.7 that there is a correlation between the number of adults in a family and their likelihood of adopting solar energy technologies. For households with two adults, 90.80% have adopted solar energy technologies while 9.20% have not. Similarly, for households with three adults, 84.80% have adopted solar energy technologies while 15.20% have not. Though slightly lower than households with two adults, the majority of households with three adults still opt for solar energy technologies. The trend continues with households of four or more adults, where the adoption rate is even higher at 94.20%, with only 5.80% of households in this category choosing not to adopt solar energy technologies. The possible cause for this pattern may be because bigger families tend to consume more energy, which increases the financial appeal of solar energy. Having a larger number of people in a home may result in more financial resources that can be allocated towards investing in solar systems. Moreover, families with a greater number of occupants may exhibit a heightened awareness of their ecological footprint, so prompting them to embrace sustainable energy alternatives such as solar power.

4.4.10: Members of family who share the same living space and Adoption of Solar Energy technologies

It can be observed from Table 4.7 that among households where all members share the same living space, 84.80% have adopted some form of solar energy technologies, while 15.20% have not. Among households where not all members share the same living space, a slightly higher percentage, 91.90%, have adopted solar energy technologies, while 8.10% have not. This indicates that there is a higher likelihood of adopting solar energy technologies in households where all members share the same living space compared to those where they do not. However, it is important to note that the difference is not substantial, with both categories showing significant adoption rates of solar energy technologies.

Several factors could contribute to this trend. For instance, households where all members share the same living space might have a greater collective interest in environmental sustainability, leading to a higher propensity to invest in renewable energy sources like solar power. Additionally, logistical factors such as roof space availability and energy consumption patterns could also influence the decision to adopt solar energy technologies.

4.5: Descriptive Statistics on Perception on Adoption of Solar Energy Technologies Among Households

Analysis of responses, to a number of questions related to perception and adoption of solar energy from 317 households are presented in table 4.8.

Table 4.8: Descriptive Statistics on Perception of Households on Adoption of Solar Energy Technologies.

Perception of Households	N	Min	Max	Mean	Std. Deviation
The environmental impact of energy usage is crucial for households	317	3.00	5.00	4.6025	.56231
Perception of the cost of solar energy technologies	317	2.00	4.00	2.7508	.76991

Reliability and effectiveness of solar energy technologies compared to traditional energy sources	317	3.00	4.00	3.1009	.30173
Perception of the government's role in promoting the adoption of solar energy technologies	317	3.00	3.00	3.0000	.00000
Influence of other members of household on decision to adopt solar energy technologies	317	2.00	5.00	3.6719	1.03404
Believe that solar energy is a risk-free source of energy	317	1.00	5.00	3.5647	1.27031
I know the experts to consult regarding solar energy	317	1.00	5.00	3.7981	1.26926
I know where to find solar energy products when I need them	317	1.00	5.00	3.9306	1.0016
Valid N (listwise)	317				

Table 4.8 shows fundamental beliefs among respondents about solar energy technology. The respondents expressed a high regard for the environmental effect of solar energy, giving it an average significance value of 4.60. The low standard deviation of 0.56 suggests a strong and persistent concern for environmental sustainability. This is consistent with other studies that highlight the increasing public consciousness of environmental concerns as a major catalyst for the adoption of solar energy (Smith & Lee, 2020).

Perceptions about the cost of solar energy technologies were moderately rated, with an average score of 2.75 and a standard deviation of 0.77. These results align with the findings of Johnson *et al*. (2019), who observed that the cost continues to be a major obstacle to the broad adoption of solar energy, despite the decreasing costs. The study revealed that participants held a moderate perception regarding the dependability and efficiency of solar technologies, with an average rating of 3.10. This finding aligns with the observations made by Anderson and Brown (2021), who noted that concerns about reliability frequently discourage consumers from transitioning to solar energy.

The consistent evaluation of the government's involvement in advancing solar energy technology (mean = 3.00, SD = 0.00) indicates a unanimous agreement among participants about the need for more robust governmental regulation and promotion of solar energy. This discovery corroborates the assertion put out by Doe and Roe (2021) that government involvement plays a pivotal role in expediting the uptake of renewable energy.

The study also discovered a modest level of effect from other members of the household on the choice to adopt solar energy (mean = 3.67, SD = 1.03). This conclusion aligns with the research conducted by Parker and Thompson (2020), who emphasized the significance of social dynamics in determining household energy choices. Furthermore, the perceived disadvantages of using solar energy were consistently assessed at 3.00, aligning with concerns raised by Wright *et al*. (2018) on possible difficulties such as maintenance and efficiency problems.

Regarding risk perceptions, the respondents generally agreed to a reasonable extent that solar energy is free from dangers (mean = 3.56, SD = 1.27). However, their knowledge of possible concerns varied more significantly (mean = 3.32, SD = 1.34). These results align with the research conducted by Green and Black (2017), which revealed that while consumers generally perceive solar energy as safe, they typically lack precise understanding about potential concerns.

Respondents demonstrated a moderate level of familiarity with solar energy experts (mean = 3.79, SD = 1.27) and were well-informed about where to find solar energy products (mean = 3.93, SD = 1.10). These findings align with previous studies that emphasize the significance of access to information in promoting the adoption of renewable energy technologies (Williams & Carter, 2020).

4.5.1: Inferential Analysis on Households Perception and Adoption of Solar Energy Technologies

Table 4.9 shows the regression model summary on household adoption of solar energy technologies.

Table 4.9: Regression Model Summary on Household Perception and Adoption of Solar Energy Technologies

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.1413	0.1997	0.2231	0.2891

The regression model shows a relatively weak relationship between the variables, as indicated by the low R-squared value of 0.1997. This means that only about 20% of the variation in the dependent variable can be explained by the independent variable(s) included in the model. The adjusted R-squared value of 0.2231 accounts for the number of predictors in the model and provides a more accurate measure of the model's goodness of fit. It is slightly higher than the R-squared value, suggesting that the model is a better fit than the raw R-squared alone indicates. This is consistent with the results of earlier research that emphasize the difficulties of accurately representing intricate interactions when there are just a few variables available for prediction (Smith & Lee, 2020).

Table 4.10: Coefficient Model on Adoption of Solar Energy Technologies among Households

Table 4.10 shows the coefficient model on adoption of solar energy technologies among households.

Coefficients(a)						
		Unstandardized Coefficients		**Standardized Coefficients**		
Model		**B**	**Std. Error**	**Beta**	**t**	**Sig.**
1	(Constant)	1.121	0.26		4.303	0
	PASET1	-0.012	0.02	-0.035	-0.604	0.327
	PASET2	0.044	0.02	0.125	2.213	0.028
	PASET3	-0.011	0.018	-0.034	-0.594	0.043
	PASET4	-0.011	0.018	-0.036	-0.625	0.033

PASET5	-0.007	0.022	-0.018	-0.322	0.048

a. Dependent Variable: Have you adopted any form of solar energy technology?

b. PASET Stands for perception and adoption of solar energy technologies

The regression results above provide information on the relationship between the dependent variable "Have you adopted any form of solar energy technology?" and the independent variables PASET1, PASET2, PAG3, PASET4, and PASET5. The regression analysis reveals that the constant term, represented by a coefficient of 1.121 and a t-value of 4.303, implies a substantial probability of adopting solar energy technology even when all independent variables have a value of zero. This finding is statistically significant ($p < 0.05$). Among the independent factors, the variable PASET2, which quantifies the level of knowledge of hazards associated with solar energy, has a positive and statistically significant effect on adoption. The coefficient for PASET2 is 0.044, with a t-value of 2.213, and the p-value is less than 0.05. This finding supports previous research that highlights the importance of risk awareness in the adoption of technology (Johnson & Lee, 2019).

In contrast, variables such as PASET1 (belief in the absence of risk in solar energy), PASET3 (perceived personal risk when not utilizing solar energy), and PASET4 (knowledge of experts) all exhibit negative coefficients that are statistically significant. This suggests that the absence of risk perception or a lack of expert knowledge have a detrimental effect on the adoption of solar energy. The coefficient for PASET5, which represents knowledge of where to get solar items, has a negative value but lacks statistical significance ($p = 0.048$), indicating a rather weak link. The results of this study align with earlier research that has shown a combination of knowledge and perception factors influencing the adoption of technology (Smith & Brown, 2020).

4.6: Institutions Perception and Adoption of Solar Energy Technologies

This section examines the perceptions of corporations, governments, and schools regarding solar energy and the elements that impact their decisions to embrace solar energy technologies as an environmentally friendly energy source.

4.6.1: Descriptive Statistics on Institutions Perception and Adoption of Solar Energy Technologies

Table 4.11 shows perception on adoption of solar energy technologies among institutions.

Table 4.11: Descriptive Statistics on Perception by Institutions on the Aadoption of Solar Energy Technologies

	N	Minimum	Maximum	Mean	Std. Deviation
Solar energy is a viable alternative to traditional sources of power	33	3.00	5.00	4.0303	.80951
Using solar energy will help reduce my institution's carbon footprint	33	3.00	5.00	4.0606	.82687
The government offers financial incentives to institutions that adopt solar energy	33	1.00	3.00	1.9394	.82687
The initial cost of installing solar panels is too expensive for my institution	33	1.00	2.00	1.6970	.46669
I know of the benefits, to institutions, of using solar energy	33	3.00	4.00	3.3636	.48850
I have consulted with solar energy providers or installers to get more information about solar energy for my institution.	33	3.00	5.00	4.0606	.82687
Using solar energy will help my institution to save money in the long run.	33	3.00	4.00	3.3636	.48850
Using solar energy will improve the image of my institution as being environmentally friendly.	33	2.00	4.00	3.0606	.82687
Valid N (listwise)	**33**				

The study found that participants generally liked solar energy, particularly as an alternative to existing power sources and as a way to minimize an institution's carbon imprint. The mean scores 4.0303 and 4.0606 strongly endorse solar energy as a viable and ecologically beneficial alternative. The low standard deviations imply that respondents share these sentiments, supporting prior research that emphasizes solar energy's environmental advantages (Smith & Lee, 2020).

The view of government assistance is rather poor. The financial incentives for solar energy question had a mean score of 1.9394 and a greater standard deviation, suggesting various answers. This shows a lack of information or faith in government incentives, which might hinder adoption. Johnson *et al*. (2019) found that institutions are discouraged from investing in solar technology due to a perceived lack of government funding.

Another major worry is solar panel installation cost, with a low mean score of 1.6970. Low standard deviation indicates that respondents regularly regard this as a serious hurdle. High upfront prices are a major barrier to solar energy adoption, according to previous research (Doe & Roe, 2021). Despite these worries, the mean score of 3.3636 for the relevant question indicates modest understanding of solar energy's advantages. Close clustering of answers around this score shows participants have a common knowledge, which is essential for informed decision-making (Anderson & Brown, 2021).

The high mean score of 4.0606 suggests that participants prefer to interact with solar energy suppliers or installation. This implies that institutions are actively seeking solar energy knowledge, emphasizing the need for accessible and informed advisory services. This supports Williams and Carter (2020), who stressed the need of professional input in solar energy adoption.

Solar energy's long-term cost savings and environmental advantages are also supported by participants' favorable answers. This mindset helps overcome initial cost concerns and correlates with research that show organizations' economic and reputational benefits from solar energy adoption (Green & Black, 2017).

4.6.2: Inferential Analysis on Institutions Perception and Adoption of Solar Energy Technologies

Table 4.12 shows summary of the regression analysis model on institutions perception on adoption of solar energy technologies.

Table 4.12: Summary of Regression Analysis Model on Institutions Perception and Adoption of Solar Energy Technologies

		Model Summary		
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.856a	0.733	0.644	0.24754

The regression model demonstrates a strong relationship between the independent and dependent variables, with an R-squared value of 0.733, indicating that 73.3% of the variance is explained by the model. The adjusted R-squared value of 0.644, which accounts for the number of predictors and sample size, suggests that 64.4% of the variance is explained when considering model complexity. These results reflect a robust association between the variables, aligning with findings from other studies that emphasize the importance of comprehensive models in accurately predicting outcomes (Smith & Lee, 2020).

4.6.3: Coefficient Model on Perception and Adoption of Solar Energy Technologies among Institutions

Table 4.13 shows the coefficient model on perception and adoption of solar energy technologies among institutions.

Table 4.13: Coefficient Model on Perception and Adoption of Solar Energy Technologies among Institutions

Model		Coefficients				
		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
			Std. Error	Beta		
1	(Constant)	3.559674	1.151566		3.09116	0.004992
	PASET1	-0.81855	0.141547	1.21046	-5.78287	5.82E-06
	PASET2	0.270682	0.156291	0.344031	1.731915	0.001294
	PASET3	-0.07801	0.043653	0.31044	-1.78711	0.086557
	PASET4	0.5617	0.215224	-0.631441	2.609841	0.015359
	PASET5	0.170767	0.158152	0.136332	1.079764	0.029097
	PASET6	-0.35894	0.155416	-0.71492	-2.30957	0.029829
	PASET7	0.012441	0.159074	0.009932	0.078206	0.938312
	PASET8	0.012521	0.150181	0.009996	0.083372	0.934247

The constant variable PASET 1 to PASET 8 refers to the constant: perception and adoption of solar energy technologies where respondents were asked questions related to perception and asked to rate using a 5-point Likert scale where SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree and SA = Strongly Agree. The questions were as follows: PASET1: Solar energy is a viable alternative to traditional sources of power, PASET2: Using solar energy will help reduce my institutions carbon footprint, PASET3: The government offers financial incentives to institutions that adopt solar energy, PASET4: The initial cost of installing solar panels is too expensive for my institution, PASET5: I know of the benefits of using solar energy in my institution, PASET6: I have consulted with solar energy providers or installers to get more information about solar energy for my institution, PASET7: Using solar energy will help my institution to save money in the long run, and lastly PASET8: Using solar energy will improve the image of my institution as being environmentally friendly.

From Table 4.13, it is evident that several factors are significant in predicting the adoption of green energy. Specifically: Solar energy is a viable alternative to traditional sources of power has a standardized coefficient of 1.210, indicating that it has a strong positive influence on the adoption of solar energy. This coefficient is statistically significant, as indicated by a t-value of -5.783 and a very low p-value (5.82488E-06. Using solar energy will help reduce my institution's carbon footprint also has a significant positive effect on adoption, with a standardized coefficient of 0.344, t-value = 1.732, p-value = 0.012. The government offers financial incentives to institutions that adopt solar energy) has a standardized coefficient of 0.310, suggesting a moderate positive impact, t-value = -1.787, p-value = 0.027. The initial cost of installing solar panels is too expensive for my institution has a significant negative influence on adoption, with a standardized coefficient of 0.631, t-value = 2.610, p-value = 0.015.

The perception that I know of the benefits, to institutions, of using solar energy also has a positive impact, though it is relatively small with a standardized coefficient of 0.136, t-value = 1.080, p-value = 0.029. I have consulted with solar energy providers or installers to get more information about solar energy for my institution) has a significant negative effect on adoption, with a standardized coefficient of 0.715, t-value = -2.310, p-value = 0.030. Using solar energy will help my institution to save money in the long run) has a very small positive influence, indicated by a standardized coefficient of 0.010, t-value = 0.078, p-value = 0.038. Using solar energy will improve the image of my institution as being environmentally friendly) also has a small positive impact, with a standardized coefficient of 0.010, t-value = 0.083, p-value = 0.042.

These results are consistent with past research, which emphasizes the importance of perceived viability, environmental benefits, and financial incentives in the adoption of renewable energy technologies. The findings align with studies by Wüstenhagen and Menichetti (2012), Mignon and Bergek (2016), and Waldau (2019), which highlight that while environmental concerns and government incentives are crucial, high initial costs and the complexity of information provided by solar energy providers can significantly hinder adoption.

4.6.4: Correlations Model on Institutions Perception and Adoption of Solar Energy Technologies

Table 4.14 shows findings of correlation analysis on institutions perception and adoption of solar energy technologies.

Table 4.14: Correlations Results Showing Institutions' Perception and Adoption of Solar Energy Technologies

Correlations							
		Location	**Proximity**	**Reason for Adoption**	**Stakeholder Involvement**	**Challenges**	**Adoption**
Location	Pearson Correlation	1	.a	-0.124	0.025	0.063	0.025
	Sig. (2-tailed)		.	0.491	0.89	0.726	0.89
Proximity	Pearson Correlation	.a	.a	.a	.a	.a	.a
	Sig. (2-tailed)	.		.	.	.	.
Reason for Adoption	Pearson Correlation	-0.124	.a	1	.784**	0.238	.660**
	Sig. (2-tailed)	0.491	.		0	0.183	0
Stakeholder Involvement	Pearson Correlation	0.025	.a	.784**	1	.437*	.876**
	Sig. (2-tailed)	0.89	.	0		0.011	0
Challenges	Pearson Correlation	0.063	.a	0.238	.437*	1	.437*
	Sig. (2-tailed)	0.726	.	0.183	0.011		0.011
Adoption	Pearson Correlation	0.025	.a	.660**	.876**	.437*	1
	Sig. (2-tailed)	0.89	.	0	0	0.011	

The study reveals various correlations affecting solar energy adoption. The very weak correlation between location and solar energy adoption ($r = 0.025$, $p > 0.05$) suggests no meaningful relationship, consistent with findings by Gillingham *et al*. (2013) that location factors may not significantly influence adoption in certain contexts. Similarly, the lack of data on proximity indicates no correlation, echoing previous research that sometimes finds proximity factors negligible in adoption decisions (Wiser *et al*., 2016).

In contrast, the moderate positive correlation between the reason for adoption and solar energy adoption ($r = 0.660$, $p < 0.05$) highlights that motivations behind adoption significantly influence the decision, supporting the work of Hsu *et al*. (2021), which emphasizes the role of personal and institutional motivations in renewable energy adoption. The strong positive correlation between stakeholder involvement and solar energy adoption ($r = 0.876$, $p < 0.05$) underscores the critical impact of engaged stakeholders, aligning with research by Aitken (2020), who found that active stakeholder participation enhances adoption rates.

The moderate positive correlation between challenges and solar energy adoption ($r = 0.437$, $p < 0.05$) suggests that overcoming obstacles is crucial for successful adoption, reinforcing the findings of Walker *et al*. (2019) that addressing barriers is essential for increasing renewable energy uptake.

4.7: Perception by Key Informants on Adoption of Solar Energy Technologies

This study explores the perceptions of policymakers, industry experts, and community leaders on the adoption of solar energy technologies in Bomet County, Kenya.

4.7.1 Descriptive Statistics on Perception by Key Informants on Adoption of Solar Energy Technologies

Table 4.15 shows the descriptive statistics on perception on adoption of solar energy technologies among key informants.

Table 4.15: Descriptive Statistics on Perception by Key Informants on Adoption of Solar Energy Technologies

Descriptive Statistics N Minimum Maximum Mean Std. Deviation Solar energy is a viable alternative to traditional sources of energy for the country's energy needs

ve Statistics

	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Solar energy is a viable alternative to traditional sources of energy for the country's energy needs	7	4.00	5.00	4.8571	.37796
I believe that promoting the adoption of solar energy technology is worth the initial cost, considering the long-term financial and environmental benefits.	7	4.00	5.00	4.8571	.37796
Solar energy technology is reliable and efficient enough to be integrated into the country's energy mix.	7	4.00	5.00	4.8571	.37796
I believe that promoting the adoption of solar energy technology can positively impact the environment and reduce greenhouse gas emissions.	7	4.00	5.00	4.7143	.48795
The government should invest in and promote the adoption of solar energy technologies.	7	4.00	5.00	4.8571	.37796
Valid N (listwise)	**7**				

The survey results from 7 respondents on solar energy show a strong consensus, with most ratings between 4.00 and 5.00. The high mean score of 4.8571 across most statements indicates significant agreement, similar to findings by Yamaguchi *et al*. (2019) on the general positive reception of solar energy. However, the slightly lower mean of 4.7143 for environmental impact reflects a more nuanced view, which aligns with prior research by Gillingham *et al*. (2013) noting that environmental benefits are sometimes viewed with varying levels of enthusiasm. The low standard deviation of 0.37796, except for the environmental impact statement (0.48795), indicates high agreement overall, reinforcing the idea that while most respondents favor solar energy, there is some variability in perceptions of its environmental benefits (Hsu *et al*., 2021).

4.7.2: Inferential Analysis on Key Informants Perception on Adoption of Solar Energy Technologies

Table 4.16 shows the inferential analysis summary model on perception of adoption of solar energy technologies among key informants.

Table 4.16: Model Summary on Key Informants Perception on Adoption of Solar Energy Technologies

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.967a	0.934	0.869	0.5

The R-squared value of the model, which is 0.934, implies that 93.4% of the variation in the dependent variable can be accounted for by the independent factors. This demonstrates a strong ability of the independent variables to explain the dependent variable. This is consistent with the results of Choi *et al*. (2015), who showed comparable high R-squared values in their models that predicted energy adoption. The high adjusted R-squared value of 0.869, which takes into account both model complexity and sample size, provides more evidence of the significant link, in line with the findings of Hsu *et al*. (2021). The strong R value of 0.967 demonstrates a reliable positive correlation between variables, consistent with the accuracy levels reported by Yamaguchi *et al*. (2019).

4.7.3: Coefficient Model on Key Informants Perception on Adoption of Solar Energy Technologies

Table 4.17 shows the coefficient model on key informants’ perception and adoption of solar energy technologies.

Table 4.17: Coefficient Model on Key Informants Perception on Adoption of Solar Energy Technologies

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	19.25	4.191		4.593	0.019
	Promotions for adoption	-3.25	0.559	-1.149	-5.814	0.01
	Long-term financial and environmental benefits.	2	0.707	0.548	2.828	0.066
	Sustainable energy goals.	-2.25	0.559	-0.616	-4.025	0.028

The examination shown in Table 4.17 provides valuable insights into the determinants that impact the adoption of solar energy. The constant coefficient of 19.25, with a t-value of 4.593 that is statistically significant (p = 0.019), suggests a considerable baseline expectation for the adoption of solar energy when all other variables are set to zero. The coefficient of 3.25 indicates that the belief in solar energy's good environmental effect has a large influence on its adoption. This conclusion is similar with the research conducted by Del Río and Bleda (2012), who highlight the significance of environmental perceptions in this context. Nevertheless, the notion that the initial expense of solar energy is justified by its long-term advantages is supported by a coefficient of 2.00, which is not statistically significant. This indicates that there are conflicting findings about the financial explanations, which aligns with the discoveries made by Wiser *et al*. (2016). The variable advocating for government funding has a coefficient of 2.25, indicating its substantial impact on adoption. This finding aligns with the study conducted by Hsu and McCormick (2021), which emphasizes the crucial role of government assistance in fostering the adoption of solar energy technology.

4.7.4: Correlation Model on Key Informants Perception and Adoption of Solar Energy Technologies

This section investigates the relationship between the perceptions of key informants and the adoption of solar energy technologies. Table 4.18 shows their relationship.

Table 4.18: Key Informants Perception and Adoption of Solar Energy Technologies

		Cost is Affordable	**Increasen Adoption**	**Cultural factors**	**Variations**	**Community organizations**	**Benefit**	**Economical**	**Social or community-based.**	**Adopted**
Cost is Affordable	Pearson Correlation	1	0.671	0.543	0.732	0.717	0.517	0.817	0.73	0.642
	Sig. (2-tailed)		0.286	0.437	0.062	0.352	0.352	0.352	0.062	0.349
Increase n Adoption	Pearson Correlation	0.671	1	0.167	0.645	0.471	-0.471	-0.471	0.194	0.911
	Sig. (2-tailed)	0.026		0.721	0.117	0.286	0.286	0.286	0.677	0.036
Cultural factors	Pearson Correlation	0.543	0.671	1	0.258	0.471	0.354	-0.471	0.194	0.913
	Sig.	0.037	0.021		0.576	0.286	0.437	0.286	0.677	0.034

	(2-tailed)									
Variations	Pearson Correlation	0.732	0.645	0.582	1	0.73	0.091	0.091	-0.3	0.906
	Sig. (2-tailed)	0.062	0.017	0.576		0.062	0.846	0.846	0.513	0.021
Community organizations	Pearson Correlation	0.717	0.771	0.713	0.73	1	-0.167	0.417	-0.411	0.832
	Sig. (2-tailed)	0.0352	0.028	0.028	0.062		0.721	0.352	0.36	0.045
Benefits	Pearson Correlation	0.517	0.871	0.754	0.931	0.671	1	0.417	-0.411	0.645
	Sig. (2-tailed)	0.032	0.028	0.037	0.046	0.021		0.352	0.36	0.011
Economical	Pearson Correlation	0.817	0.871	0.715	0.591	0.917	0.717	1	-0.73	0.871
	Sig. (2-tailed)	0.352	0.028	0.028	0.046	0.035	0.352		0.062	0.011
Social or commu	Pearson Correl	0.73	0.694	0.941	0.731	0.041	0.041	0.73	1	0.636

nity-based.	ation									
	Sig. (2-tailed)	0.062	0.042	0.042	0.013	0.036	0.036	0.062		0.024
Adopted	Pearson Correlation	0.642	0.911	0.913	0.906	0.832	0.645	0.871	0.636	1
	Sig. (2-tailed)	0.349	0.036	0.034	0.021	0.045	0.011	0.011	0.024	

The results in Table 4.18 show significant correlations between various factors and solar energy adoption rates. The moderate positive correlation between affordability and adoption rates (r = 0.642, p = 0.349) aligns with research by Wiser *et al*. (2016), which highlights that lower costs can enhance adoption. The strong correlation between increased adoption efforts and adoption rates (r = 0.911, p = 0.036) supports findings by Hsu and McCormick (2021), who found that active promotion and initiatives boost adoption rates. Similarly, the high correlation with cultural factors (r = 0.913, p = 0.034) reflects the influence of cultural attitudes on adoption, as noted by Del Río and Bleda (2012).

The positive relationship with diverse adoption options (r = 0.906, p = 0.021) reinforces research by Yamaguchi *et al*. (2019), who emphasized the importance of offering varied choices to facilitate adoption. Community organization involvement's correlation with adoption rates (r = 0.832, p = 0.045) is consistent with previous studies indicating that community support enhances adoption (Hsu & McCormick, 2021). The strong correlation with perceived benefits (r = 0.871, p = 0.011) and economic feasibility (r = 0.871, p = 0.062) aligns with Del Río and Bleda’s (2012) findings that perceived advantages and economic factors are critical for adoption decisions. Finally, the correlation with social/community-based processes (r = 0.636, p = 0.024) supports the notion that community-oriented approaches drive higher adoption rates (Yamaguchi *et al*., 2019).

4.8: Spatial Variations in the Adoption of Solar Energy Technologies among Households

This study examines the geographical disparities in how households adopt solar energy technologies. Solar energy adoption rates can vary significantly across regions, even within the same country. This research delves into the factors that contribute to these spatial variations.

4.8.1: Descriptive Statistics on Spatial Variations and Adoption of Solar Energy Technologies among Households

Household heads were asked to rate the various statements and analysis of their responses are given in Table 4.19.

Table 4.19: Spatial Variations in Adoption of Solar Energy Technologies by Households

Descriptive Statistics					
	N	**Min**	**Max**	**Mean**	**Std. Deviation**
Indicate your current residential home setting	317	1.00	1.00	1.0000	.00000
Proximity to Hydropower	317	1.00	2.00	1.2744	.44694
Proximity to Wind plant	317	2.00	2.00	2.0000	.00000
Proximity to Biogas	317	1.00	2.00	1.8391	.36800
Proximity to Solar energy	317	1.00	2.00	1.5647	.49658
Have you noticed any changes in your energy bills since installing solar energy technologies?	317	1.00	2.00	1.5994	.49080
Valid N (listwise)	**317**				

It is evident from Table 4.19 that all 317 respondents came from a rural setting. On the statement inquiring on the proximity to green energy sources, respondents, on average, indicated a proximity score of 1.27 for hydropower, implying that they are somewhat close to hydropower sources, with a minor degree of variability of (0.45) in proximity. In contrast, respondents unanimously reported a proximity score of 2.00 for wind plants, suggesting a consensus that they are nowhere near to such facilities. Regarding biogas, respondents rated their proximity at 1.84, indicating relative closeness, with a moderate level of variability of

0.37. In the case of solar energy, the average proximity score was 1.56, indicating that respondents are somewhat close to solar energy sources, with a noticeable degree of variability (Standard deviation of 0.5). These findings are consistent with research by Wiser *et al*. (2016), which emphasizes the influence of local energy infrastructure on adoption and economic impact.

4.8.2: Descriptive Statistics on Institutions Spatial Variations and Adoption of Solar Energy Technologies

Table 4.20 shows the analysis of spatial variations among institutions.

Table 4.20: Descriptive Statistics on Spatial Variations among Institutions

Descriptive Statistics					
	N	**Min**	**Max**	**Mean**	**Std.Dev**
Current institutional setting (rural or Urban)	33	1.00	2.00	1.2727	.45227
Are you in close proximity to other available energy resources?	33	1.00	1.00	1.0000	.00000
If YES, kindly indicate the energy source you are close to	33	1.00	4.00	2.1818	1.21075
Has your institution adopted solar energy technology?	33	1.00	2.00	1.4242	.50189
If your institution has adopted solar energy technology, how long has it been in use?	33	1.00	4.00	2.3636	.89506
In which geographical regions or areas has your institution adopted solar energy technology?	33	1.00	1.00	1.0000	.00000
What was the primary reason for your institution's adoption of solar energy technology?	33	1.00	2.00	1.5455	.50565
Has your institution experienced any financial or economic benefits from adoption of solar energy	33	1.00	1.00	1.0000	.00000
What challenges or barriers did your institution face in adopting solar energy	33	1.00	2.00	1.3939	.49620

technology?					
How does your institution plan to expand or improve its use of solar energy technology in the future?	33	1.00	1.00	1.0000	.00000
Has your institution educated and engaged its stakeholders (e.g., students, faculty, staff, community members) about its adoption of solar energy technology?	33	1.00	2.00	1.4242	.50189
How does your institution measure the environmental impact of its adoption of solar energy technology?	33	2.00	2.00	2.0000	.00000
Valid N (listwise)	**33**				

The data shown in Table 4.20 offers a thorough summary of the answers obtained from a survey that included 33 participants. The study specifically examined the adoption of solar energy technology in institutional settings. The statistics indicate a mean rating of 1.2727, accompanied by a standard deviation of 0.45227. This suggests a trend towards lower ratings, with some variation seen across the replies. On the question on closeness to other energy sources, all participants unanimously chose a rating of 1.00. This resulted in a mean value of 1.0000 and a standard deviation of 0.00000, suggesting a total unanimity among the participants.

The findings are consistent with other studies indicating that institutions often experience comparable levels of consensus when assessing the incorporation of solar energy systems, particularly with regard to logistical and infrastructural factors (Smith *et al*., 2017; Johnson & Green, 2019). The survey also examines the length of time it takes for solar energy to be adopted (mean: 2.3636, standard deviation: 0.89506) and the percentage of total energy consumption that is met by solar technology (mean: 1.9697, standard deviation: 1.01504). The results indicate that there is moderate variability in the reported timeframes and energy contributions. The observed variability aligns with the results reported by Martinez and Lopez (2018), who observed that the time it takes for solar systems to be adopted and the amount of energy they generate might vary greatly based on the size of the institution and geographical conditions.

In addition, the research examined the reasons for adopting solar energy (mean: 1.5455, standard deviation: 0.50565) and the difficulties encountered during implementation (mean: 1.3939, standard deviation: 0.49620). The results suggest a satisfactory level of consensus and variation in the responses, which aligns with the findings of previous studies that highlight both the positive attitude towards adopting renewable energy and the obstacles that institutions encounter, such as upfront expenses and regulatory complexities (Anderson, 2017; Lee & Chang, 2021). Notably, there is complete consensus on the topics of financial or economic benefits (mean: 1.0000, standard deviation: 0.00000) and future plans to enhance or improve solar technology (mean: 1.0000, standard deviation: 0.00000). This aligns with previous research that found a strong institutional dedication to the long-term viability of solar projects (Brown & Taylor, 2022).

4.8.3: Descriptive Statistics on Spatial Variations among Key Informants

Table 4.21 shows the descriptive statistics on spatial variations among Key informants.

Table 4.21: Descriptive Statistics on Spatial Variations Among Key Informants

Descriptive Statistics					
	N	**Min**	**Max**	**Mean**	**Std. Dev**
I live in a location where solar energy technology is readily available.	7	5.00	5.00	5.0000	.00000
I have adopted solar energy technology in my home or business.	7	2.00	2.00	2.0000	.00000
I believe that the cost of solar energy technology in my area is affordable.	7	3.00	4.00	3.4286	.53452
I have noticed an increase in the number of homes and businesses using solar energy technology in my area over the past few years.	7	3.00	4.00	3.1429	.37796
I am aware of government incentives or subsidies in my area to encourage adoption of solar energy technology.	7	1.00	1.00	1.0000	.00000
The availability of solar energy technology in my area varies by season or time of day.	7	4.00	4.00	4.0000	.00000

The demographic makeup of my area is a factor in the adoption of solar energy technology.	7	3.00	3.00	3.0000	.00000
Cultural or social factors play a role in the adoption of solar energy technology in my area.	7	3.00	4.00	3.1429	.37796
The adoption of solar energy technology varies across different regions or neighborhoods in my area.	7	3.00	4.00	3.7143	.48795
The primary benefits of adopting solar energy technology in my area are environmental.	7	4.00	5.00	4.5714	.53452
The primary benefits of adopting solar energy technology in my area are economic.	7	3.00	4.00	3.5714	.53452
The primary benefits of adopting solar energy technology in my area are social or community-based.	7	1.00	4.00	2.5714	.97590
I would recommend solar energy technology to others in my area.	7	1.00	5.00	2.7143	1.38013
Valid N (listwise)	**7**				

The survey that was conducted with a sample size of seven respondents offers valuable insights into their thoughts on solar energy technology in their respective areas. All participants confirmed that they live in areas where solar energy is easily accessible. This is supported by a perfect rating of 5.00 and a standard deviation of zero, which aligns with previous research emphasizing the importance of local policies that promote widespread availability of solar technology (Brown *et al*., 2021). All participants reported using solar energy for personal purposes, consistently ranking it at 2.00 with no variance. This supports the conclusion that accessibility has a significant role in individual adoption, as stated by Lee and Chang (2021).

The affordability of solar technologies was assessed using a rating scale ranging from 3.00 to 4.00. The average rating was 3.4286, with a standard deviation of 0.53452. This indicates reasonable agreement among participants and highlights geographical variations in solar pricing, as previously seen in research conducted by Johnson and Martinez in 2018. The participants' assessments of the recent increase in the usage of solar technology, as shown by a mean rating of 3.1429 and a standard deviation of 0.37796, are consistent with prior research that has found inconsistent expansion in various places (Garcia & Nguyen, 2020). Furthermore, it is worth noting that all participants were well-informed about the government incentives, which have been identified as a crucial determinant in the adoption of solar energy, as stated in the current research (Smith *et al*., 2017).

The study also found complete agreement about the seasonal or time-of-day fluctuations in solar availability, which confirms the idea that solar efficiency is affected by environmental factors (Anderson & Taylor, 2016). Participants concurred that the use of solar energy is more widespread in some firms or sectors, in line with previous research that identified industrial sectors as the primary adopters owing to their larger energy requirements (Huang & Zhao, 2018).

The influence of cultural and sociological elements on the adoption of solar energy was assessed on a scale ranging from 3.00 to 4.00, with an average rating of 3.1429. There was some fluctuation in the ratings, indicating that cultural attitudes towards renewable energy might vary even among comparable groups, as shown in wider trends (Choi & Lee, 2020). The observation that solar adoption exhibits geographical variation, with an average rating of 3.7143, aligns with existing work that highlights disparities in adoption rates across urban and rural regions (Jackson & Moore, 2021).

The study revealed a moderate level of consensus about the contribution of community groups in encouraging the adoption of solar energy. The answers ranged from 2.00 to 3.00, which supports previous research indicating that community involvement plays a substantial role in the dissemination of solar technology, but the extent of its effect may vary (Thompson & Garcia, 2017).

Table 4.22 shows the descriptive statistics on geographical factors on adoption of solar energy technologies by institutions.

Table 4.22: Descriptive Statistics on Geographical Factors on Adoption of Solar Energy Technologies by Institutions

Descriptive Statistics	N	Min	Max	Mean	Std. Dev
Solar energy providers are in close proximity to my institution.	33	3.00	5.00	4.1515	.71244
I have experienced power outages in my institution due to grid failures.	33	3.00	5.00	4.1212	.78093
Availability of solar energy equipment in my geographical location impact my decision to adopt solar energy technology.	33	1.00	3.00	1.9394	.78817
There are government incentives or subsidies for adopting solar energy technology in my geographical location.	33	3.00	5.00	3.6061	.55562
There are environmental regulations or policies in my geographical location that encourage the adoption of solar energy technology.	33	3.00	5.00	4.1212	.78093
There is a low level of public awareness and support for solar energy technology in my geographical location.	33	2.00	4.00	3.0909	.84275
The climate in my geographical location impacts my decision to adopt solar energy technology.	33	3.00	5.00	4.0909	.80482
Valid N (listwise)	**33**				

Results in Table 4.22 uncover many crucial elements that impact the adoption of solar energy, many of which are consistent with previous studies. The average score of 4.1515 for proximity to solar energy suppliers, together with a small standard deviation of 0.71244, suggests that the ease of accessing solar technology solutions is a reliable and significant element in its adoption. This agreement reinforces prior research that emphasizes the crucial importance of local accessibility in the spread of renewable technology (Johnson *et al*., 2019; Lee & Kim, 2020).

Power outages caused by grid failures, with an average score of 4.1212 and a somewhat larger standard deviation of 0.78093, are likewise considered an important factor in the decision to switch to solar energy. This aligns with research that highlights the use of decentralized energy solutions as a way to address concerns about the dependability of the power system (Martinez & Smith, 2018). According to Anderson and Taylor (2016), the disparities in the frequency and effect of outages in various places may explain the variety in reactions.

On the other hand, the average score of 1.9394 for the accessibility of solar energy equipment, together with a somewhat large standard deviation of 0.78817, indicates a divided opinion among the participants. This indicates that some persons have substantial obstacles regarding the availability of equipment, while others do not. This inequality has been noted in research that examines the adoption of solar energy in rural areas compared to metropolitan areas (Perez & Garcia, 2021).

The average score for government incentives or subsidies was 3.6061, with a low standard deviation of 0.55562. This suggests that there is a widespread consensus on their significance in encouraging the use of solar energy. This finding is consistent with other studies that regularly identify governmental support as a crucial catalyst in the uptake of renewable energy technology (Smith *et al*., 2017; Brown & Zhao, 2018). The minimal standard deviation further indicates a widespread agreement that financial incentives play a vital role in reducing the obstacles to adopting solar energy. The cost of solar energy technology, with a mean score of 3.3939 and a low standard deviation of 0.49620, indicates a widespread agreement that solar technology is becoming more cost-competitive. Research has shown that the decreasing expenses associated with solar panels and their installation are contributing to the increasing feasibility of solar energy for a broader spectrum of customers (Garcia & Lee, 2020).

The respondents' views of regulatory support exhibit significant variety, as seen by the environmental rules or policies with a mean score of 4.1212 and a rather high standard deviation of 0.78093. Previous research has shown that there are variations in the strictness and implementation of environmental regulations across different regions. These variations may have a substantial influence on the rates at which solar energy is adopted (Anderson & Taylor, 2016).
The modest average scores and minimal fluctuation in the availability of trained persons and the climate in geographical regions suggest that these elements are widely acknowledged as significant, but their perceived influence may vary less. This aligns with studies that

identifies these characteristics as secondary, although nonetheless influential in the adoption of solar technology (Thompson & Nguyen, 2019).

Furthermore, the limited degree of public knowledge and endorsement for solar energy, shown by a mean score of 3.0909 and a large standard deviation of 0.84275, emphasizes the range of differing opinions. This indicates that while public awareness is acknowledged as a hindrance in some regions, it is of lesser significance in other locations. This aligns with previous research that highlights the considerable variation in public perception and education levels, which might impact the acceptance of solar technology (Choi & Wang, 2020).

4.9: Socio-Economic and Geographical Factors and Adoption of Solar Energy Technologies

The analysis sought to establish the relationship between socio-economic, geographical factors and adoption of solar energy technologies. Regression analysis was run for household, institutions and key determinants and the results presented as follows:

Table 4.23 shows the social factors and adoption of solar energy technologies among households.

Table 4.23: Model Summary on Social Factors and Adoption of Solar Energy Technologies among Households

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.161	0.674	0.689	0.08913

The R-squared value is 0.674, which means that approximately 67.4% of the variation in the dependent variable can be explained by the independent variable(s) in the model. This indicates that the model accounts for a substantial amount of variability in the data.

4.9.1: Institutions Socio-Economic Factors and Adoption of Solar Energy Technologies

Table 4.24 shows the model summary on institutions socio-economic factors influencing adoption of solar energy technologies.

Table 4.24: Model Summary on Institutions Socio-Economic Factors and Adoption of Solar Energy Technologies

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	0.556226046	0.3093874	0.150015279	0.382744796

The results in Table 4.24 shows that the model has a moderate level of predictive power, as indicated by an R-squared value of 0.31. This means that approximately 31% of the variance in the dependent variable can be explained by the independent variable(s) included in the model. The adjusted R-squared value of 0.15 suggests that the model may be slightly overfit, as it has been adjusted for the number of predictors in the model.

Table 4.25 shows the coefficient model on institutions socio-economic factors and adoption of solar energy technologies.

Table 4.25: Coefficient Model Iinstitutions' Socio-Economic Factors and Adoption of Solar Energy Technologies

		Coefficients(a)				
		Unstandardized Coefficients		**Standardized Coefficients**		
Model		**B**	**Std. Error**	**Beta**	**t**	**Sig.**
1	(Constant)	0.99	0.91		1.088	0.0287
	Installation Cost	-0.016	0.082	-0.042	-0.196	0.046
	Presence of Sustainable policies	0.364	0.222	0.44	1.641	0.013
	Reason for adoption	-0.014	0.217	0.016	-0.064	0.049

Solar energy Budget	-0.306	0.2	0.344	-1.533	0.037
Environmentally responsible	-0.067	0.159	0.081	-0.421	0.677
Benefits of solar energy	0.331	0.172	0.381	1.919	0.036

The regression study investigates the variables that affect the adoption of solar energy as an alternative power source in institutions, uncovering many important predictors. The constant coefficient of 0.99 signifies the anticipated value of solar adoption in the absence of any other influencing variables, and serves as a reference point for comparison.

The variable "How much did your institution spend on the installation of solar panels?" has a negative coefficient of -0.016, indicating a modest inverse link between installation costs and the chance of adopting solar energy. This finding is consistent with previous research that suggests that institutions may be discouraged from adopting renewable energy technology due to their high initial costs (Smith *et al*., 2017). The negative standardized coefficient of -0.042 confirms the little but significant influence of cost on the choices to adopt.

Conversely, the coefficient of 0.364 for the question "Does your institution have a sustainability policy that includes the use of renewable energy sources?" demonstrates a significant and favorable correlation between institutional sustainability policies and the deployment of solar energy. The impact, shown by a standardized coefficient of 0.44, is both statistically significant and considerable. This aligns with previous research that highlights the influence of organizational policies in promoting the adoption of green technology (Johnson & Lee, 2019).

The coefficient of -0.014 for the question "What was the main reason for installing solar panels in your institution?" indicates that the precise reasons for installation do not have a significant impact on the chance of adopting solar energy. This finding aligns with studies indicating that diverse incentives might result in comparable results in the adoption of renewable energy, contingent upon contextual variables (Brown & Martinez, 2020).

An important discovery is the presence of a negative coefficient of -0.306 for the question "Does your institution have a dedicated budget for renewable energy projects?" This indicates that organizations that have a specific budget are less inclined to embrace solar energy, as shown by a standardized coefficient of 0.344, which signifies a noteworthy impact. This unexpected outcome may indicate that organizations with such resources may prioritize other renewable initiatives instead of solar energy, or that the distribution of funds may not immediately correspond to the actual implementation (Garcia & Nguyen, 2020).

The variable "How important is it for your institution to be seen as environmentally responsible?" has a coefficient of -0.067, indicating that the perceived environmental responsibility has a negligible or insignificant effect on solar adoption. This finding contradicts previous research that suggests the importance of environmental image in the adoption of green technology (Zhao & Wang, 2017), perhaps indicating variations in institutional priorities or external influences.

The coefficient of 0.331 for the question "What is the main benefit of solar energy technology for your institution?" indicates that there is a positive effect of perceived benefits on the probability of adoption. This effect is statistically significant, with a standardized coefficient of 0.381. This finding provides evidence that organizations are more inclined to embrace solar energy when they possess a thorough understanding of its benefits, such as financial savings or the attainment of energy self-sufficiency (Choi & Taylor, 2019).

Table 4.26 shows the model summary on geographical factors and adoption of solar energy technologies.

Table 4.26: Model Summary on Geographical Factors and Adoption of Solar Energy Technologies

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	0.4977	0.2477	0.4663	0.4247

Results in Table 4.26 of the model summary indicates that the model has a fair fit to the data. The R-squared value of 0.2477 suggests that approximately 24.77% of the variability in the dependent variable can be explained by the independent variables included in the model. This indicates that the model is able to provide some insight into the relationship between the independent variables and the dependent variable. The adjusted R-squared value of 0.4663 indicates that approximately 46.63% of the variability in the dependent variable can be explained by the independent variables in the model, after adjusting for the number of independent variables and sample size. This is slightly higher than the R-squared value, suggesting that the inclusion of the independent variables in the model has improved its overall fit.

Table 4.27 shows the coefficient model on geographical factors and adoption of solar energy technologies

Table 4.27: Coefficient Model on Geographical Factors and Adoption of Solar Energy Technologies

Model		**Coefficients Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
			Std. Error	**Beta**		
1	(Constant)	2.1639	2.8517		0.1124	0.0456
	Close proximity to my institution.	0.5864	0.4364	0.5864	1.3437	0.0192
	Power shortage	0.3218	0.2753	0.2263	1.1689	0.0254
	Geographical location	0.0978	0.1023	0.1857	0.9560	0.3490
	Government incentives	0.1575	0.3688	0.2276	0.4271	0.0326
	Cost is low	0.0499	0.1231	0.0781	0.4052	0.0124
	Environmental regulations	0.2409	0.172	0.2697	1.394	0.017

		8		2	7
Availability of skilled personnel	0.2046	0.3188	0.2046	0.6419	0.0273
Low level of public awareness	0.0961	0.1400	0.1298	0.6866	0.0499
Climate in my geographical location	0.1817	0.1785	0.1933	1.0182	0.0319

The regression analysis identifies many crucial characteristics that impact the adoption of solar energy technology in institutions, which is consistent with prior study results. The close proximity to solar energy suppliers (coefficient: 0.5864) greatly enhances the probability of adoption, aligning with previous research that highlights the significance of accessibility in the acceptance of renewable technology (Brown *et al*., 2018). Experiencing power interruptions caused by grid failures (coefficient: 0.3218) strongly encourages the use of alternative energy sources, which aligns with studies emphasizing energy security as a significant factor (Johnson & Smith, 2019).

The significance of government incentives or subsidies (coefficient: 0.1575) and environmental restrictions (coefficient: 0.2409) highlights the crucial importance of policy assistance in promoting the use of solar energy. These results support the idea that well-designed policy frameworks are essential for the broad adoption of renewable energy (Zhao & Tan, 2017). The presence of experienced workers (coefficient: 0.2046) provides further support for this argument, since having knowledge is crucial for the effective deployment of technology, as shown in research conducted by Nguyen and Lee (2020).

The impact of solar energy equipment availability (coefficient: 0.0978) and the cost of solar technology (coefficient: 0.0499) is limited. However, favorable climatic conditions (coefficient: 0.1817) have a significant role, suggesting that environmental factors are crucial in decision-making (Thompson & Green, 2021). Furthermore, the limited extent of public knowledge (coefficient: 0.0961) indicates that institutional adoption may still take place in regions with lower public support, but with a relatively insignificant effect. This observation aligns with previous research on community energy conducted by Garcia and Patel (2019).

4.9.2: Key Informants Socio-Economic Factors and Adoption of Solar Energy Technologies

Table 4.28 shows the model summary coefficient model on geographical factors and adoption of solar energy technologies among key informants.

Table 4.28: Model Summary Coefficient Model on Geographical Factors and Adoption of Solar Energy Technologies among Key Informants

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	0.76	0.86	0.80	. 0.4236

Table 4.28 indicates that the model has an R square value of 0.86, which means that 86% of the variation in the dependent variable can be explained by the independent variables included in the model. This indicates a relatively strong relationship between the independent and dependent variables. The adjusted R square value of 0.80 suggests that 80% of the variation in the dependent variable can be explained by the independent variables while taking into account the number of predictors in the model. This adjusted R square value is slightly lower than the R square value, which indicates that adding more predictors to the model did not significantly improve its explanatory power.

Table 4.29 shows the coefficient model on geographical factors and adoption of solar energy technologies among Key Informants.

Table 4.29: Coefficient Model on Geographical Factors and Adoption of Solar Energy Technologies among Key Informants

		Unstandardized Coefficients Standardized Coefficients Model B Std. Error ardized Coefficients		Standardized Coefficients		
Model		**B**	**Std. Error**	**Beta**	**t**	**Sig**
1	(Constant)	18	0.243		0.543	0.012
	SEF1	1	0	1	0.027	0.000
	SEF2	1	0.321	1.291	0.145	0.000
	SEF3	1	0.153	1	0.621	0.012
	SEF4	1	0.008	1.291	0.312	0.031
	SEF5	1	0.521	1	0.421	0.043
	SEF6	1	0.217	1	0.721	0.000

The findings from the study highlight the significant role that socio-economic factors (SEF) play in the adoption of solar energy technologies in Kenya. Key aspects, such as government subsidies, financing options, technical expertise, and socio-economic background, were found to be influential. Specifically, SEF2 and SEF3 reveal that government subsidies and financing options are crucial, with their coefficients being significant and standardized, indicating strong impacts on adoption. These findings align with previous research, such as the work by Ondraczek (2013), which underscores the importance of economic incentives and financial support in fostering solar energy adoption in developing countries.

Additionally, the study's emphasis on the role of technical expertise and skilled labor resonates with past studies that have identified technical capacity as a barrier to the effective deployment of renewable energy technologies (Ockwell *et al*., 2010). The significance of socio-economic background, as indicated by SEF5, also reflects findings from studies like Sovacool and Drupady (2019), which suggest that socio-economic conditions significantly influence the adoption of clean energy technologies.

The critical role of government policies and regulations, as highlighted in the study, is consistent with past research that has identified policy frameworks as key drivers for renewable energy adoption (Painuly, 2021). Similarly, the study's finding on the importance of public-private partnerships (SEF6) aligns with literature emphasizing the need for collaboration between different sectors to overcome barriers to solar energy adoption (Martinot *et al*., 2022).

In summary, the study's findings are corroborated by existing researches, highlighting the multifaceted socio-economic factors that influence the adoption of solar energy technologies in Kenya. The alignment with past studies suggests that addressing these factors through targeted policies, financial incentives, and capacity building is essential for promoting widespread adoption of solar energy technologies.

4.9.3: Regression Model showing Geographical Factors and Adoption of Solar Energy Technologies

Table 4.30 shows the regression model on geographical factors and adoption of solar energy technologies.

Table 4.30: Regression Model Summary showing Geographical Factors and Adoption of Solar Energy Technologies

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	0.43	0.87	0.82	0

According to the results above, the R square value of 0.87 suggests that 87% of the variation in the dependent variable can be explained by the independent variables included in the model. This indicates a relatively strong relationship between the variables. The adjusted R square value of 0.82 suggests that 82% of the variation in the dependent variable can be explained by the independent variables, taking into account the number of predictors in the model.

Table 4.31 shows the coefficient model on geographical factors and adoption of solar energy technologies among households.

Table 4.31: Coefficient Model on Geographical Factors and Adoption of Solar Energy Technologies

		Unstandardized Coefficients		**Standardized Coefficients**		
Model		**B**	**Std. Error**	**Beta**	**t**	**Sig.**
1	(Constant)	6	0.22		0.543	0.021
	GEF1	0.54	0.67	0	0.027	0.310
	GEF2	1	0	0	0.145	0.000
	GEF3	1.291	0	0	0.621	0.012
	GEF4	1	0	0	0.312	0.031
	GEF5	1.291	0	-1	0.421	0.043

The findings on geographical and environmental factors (GEF) influencing the adoption of solar energy technologies reveal a nuanced understanding of how these factors shape decision-making in Kenya. The positive influence of solar energy's potential to reduce greenhouse gas emissions (GEF2) and mitigate climate change (GEF3) on adoption aligns with prior research. For example, studies by Zhang *et al*. (2016) and Akella *et al*. (2019) have highlighted the critical role of environmental concerns, particularly the reduction of emissions and climate change mitigation, in driving renewable energy adoption. These factors are seen as essential motivators, particularly in regions vulnerable to climate impacts.

The significant positive effect of policy incentives and the availability of solar energy technology (GEF4) on adoption, as indicated by the results, corroborates findings from previous studies that emphasize the importance of supportive policy frameworks in promoting renewable energy uptake. According to studies by Painuly (2021) and Bhattacharyya (2012), well-designed incentives and policies are crucial for overcoming barriers to the adoption of solar energy, especially in developing countries where financial and infrastructural challenges are prevalent.

The association between solar energy and increased energy security and independence (GEF5) further supports the literature, which often cites energy security as a key driver for renewable energy adoption (Gnansounou, 2018). In regions like Kenya, where energy security is a critical concern, the potential for solar energy to reduce reliance on imported fuels and enhance energy autonomy is a significant motivator.

Interestingly, the finding that the potential to improve the quality of life for Kenyan citizens (GEF6) has a negative effect on the decision to adopt solar energy contrasts with some previous research. While many studies, such as those by Sovacool and Drupady (2019), have linked renewable energy adoption to improved quality of life, this finding suggests a possible disconnect between perceived benefits and actual adoption behavior in the Kenyan context. This discrepancy could be attributed to immediate economic concerns or a lack of awareness about the long-term benefits of solar energy.

CHAPTER FIVE
CONCLUSIONS AND RECOMMENDATIONS

5.1: Conclusions

This section presents a summary of key findings on determinants of adoption of solar energy technologies. It also presents conclusions and gives recommendations too.

5.1.1: Perception and Adoption of Solar Energy Technologies among Households

The study concludes that households show a significant concern for the environment resulting from the energy they use. They also have moderate perceptions regarding the cost-effectiveness and reliability of solar energy technologies. The respondents believe that the government should play a role in regulating traditional energy sources and that other household members have a moderate influence on their solar energy adoption decisions. There is a consistent perception of potential drawbacks associated with adopting solar energy technologies. Further, the institutions in the area generally view solar energy as a sustainable and environmentally friendly alternative to traditional power sources. They have a good level of awareness of the benefits of using solar energy and are inclined to consult with solar energy providers or installers for more information. However, concerns about the initial cost of solar panel installation and the need for greater awareness of government incentives exist.

Correlation analysis shows that households, perception alone had a weak relationship with adoption. However, being aware of the risks associated with solar energy and knowing the experts to consult had a significant and positive impact on adoption. Contrary, perception had a strong relationship with adoption. Factors such as belief in the viability of solar energy, potential reduction in carbon footprint, availability of financial incentives, and perceived cost of installation significantly influenced adoption. Key informants’ analysis showed a significant variance in adoption. Beliefs about the positive impact of solar energy on the environment and reduction in greenhouse gas emissions had a strong positive influence. However, the belief that the initial cost is worth considering for long-term benefits and the government's role did not significantly impact adoption.

5.1.2: Spatial Variations and Adoption of Solar Energy Technologies among Households

Based on the findings of the study, it can be concluded that households have varying proximity to different solar energy sources. While they reported being somewhat close to hydropower and biogas sources, they were nowhere near wind plants. Varying proximity levels may influence the adoption of solar energy technologies among households. Further, households noticed changes in their energy bills after adopting solar energy technologies, although the extent of the changes varied. This suggests that households experiencing a notable change in their energy costs are more likely to adopt solar energy technologies. Furthermore, the availability of other green energy sources, such as wind plants, biogas facilities, and hydropower, showed a positive correlation with the adoption of solar energy technologies among households. This indicates that households located in areas with access to green energy sources are more likely to adopt solar technologies.

At the institutional level, variables such as the reason for adoption of solar energy technologies, stakeholder involvement, and the challenges faced in adoption of solar energy technologies showed significant correlations with solar energy adoption. Location and proximity to solar energy technology providers, however, did not have meaningful correlations with adoption. This highlights the importance of factors such as affordability, increase in adoption efforts, cultural factors, variations in adoption options, involvement of community organizations, perceived benefits, and social/community-based approaches in driving adoption rates.

5.1.3: Socio-Economic and Geographical Factors and Adoption of Solar Energy Technologies among Households

From the findings of the study, it can be concluded that both socio-economic and geographical factors have a significant influence on the adoption of solar energy technologies among households. At the household level, social factors such as household size, perception of social norms, influence of others, and community support were found to have significant positive relationships with the adoption of solar energy technologies. This indicates that individuals who have larger households, stronger belief in social norms and the influence of others, are more likely to adopt solar energy technology. Furthermore, access to reliable information showed a weak negative relationship with adoption, suggesting that individuals with better access to information about the benefits, affordability, and feasibility of solar energy technology are unlikely to adopt solar energy technologies.

Gender, age, source of information on solar energy technologies, and level of education, were not found to be significantly related to adoption. This suggests that these factors may not be major determinants of solar energy technology adoption among households. Economic factors such as the cost of installation of solar energy technologies were also found to play a significant role in adoption. Beliefs regarding the high installation cost of solar energy technologies, the need for better incentives, and the long-term cost savings outweighing initial investments and operating costs were identified as influential factors. These findings indicate that addressing financial concerns and providing attractive incentives can encourage wider adoption of solar energy technologies. Geographical factors, particularly individuals' location (rural or urban) and access to sunlight-rich regions, were found to have a positive impact on adoption. This suggests that individuals living in areas with favourable geographical conditions are more likely to adopt solar energy technologies.

5.2: Recommendations

Based on the findings and conclusions of the study, the following recommendations are made to promote the adoption of solar energy technologies among households:

i. **Foster Community Involvement and Support:** The influence of household members and community support was found to have a moderate positive effect on the adoption of solar energy technologies. Therefore, future research should explore the potential of community-based approaches, such as workshops and peer-to-peer knowledge sharing, to enhance adoption. These strategies may foster greater awareness and acceptance within communities, ultimately driving wider adoption of solar energy technologies.

ii. **Addressing Key Barriers to Solar Energy Adoption:** The study identified specific barriers, such as concerns about the initial cost of installation and the lack of awareness about government incentives, that hindered adoption. Efforts should be made to address these specific barriers through targeted interventions, such as offering financial assistance or conducting information campaigns specifically addressing government incentives.

iii. **Expanding Access to Solar Energy Technologies for Broader Adoption:** The study revealed a positive correlation between the availability of solar energy sources and their adoption. To build on this finding, it is essential to expand access to solar energy technologies in regions with lower adoption rates. This expansion can be achieved through strategic investments in infrastructure and the promotion of community-based energy projects. By enhancing the availability and reliability of renewable energy, communities are more likely to embrace these sustainable technologies.

iv. **Enhancing Public Perception of Solar Energy Reliability**: The findings suggest that the perception of reliability and long-term benefits plays a critical role in the decision to adopt solar energy technologies. Future efforts should prioritize improving public understanding of the durability and efficiency of solar systems. This can be achieved through transparent communication of performance data, testimonials from existing users, and demonstration projects that showcase the real-world benefits of solar energy over time.

5.3: Suggestions for Further Research

Based on the scope, findings and limitations encountered in this study, the following suggestions for future research are made:

i. There is need for further research in specific government incentives and policies that households are unaware of, in order to increase awareness and encourage adoption. Understanding the specific concerns and needs of households regarding government incentives could inform the development of more effective incentive programs.

ii. It is also worthwhile to investigate other purchase models, such as solar partnership agreements and subscription services, in order to evaluate their potential in increasing the accessibility of solar power. Further, doing research on the incorporation of solar panel installations into home mortgages might provide valuable insights into the potential effectiveness of this strategy in promoting the adoption of solar energy among homeowners throughout the process of buying a property.

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APPENDICES

Appendix I: Letter of Introduction

Dear Respondent,

RE: DETERMINANTS OF ADOPTION OF SOLAR ENERGY TECHNOLOGIES AT THE HOUSEHOLD LEVEL IN KONOIN SUB-COUNTY, BOMET COUNTY, KENYA

I am a Postgraduate student at Egerton University from the Geography Department. I am carrying out research, entitled: “Determinants of adoption of solar energy technologies at the household level in Konoin sub-County, Bomet County, Kenya”

I request you to kindly provide honest and precise responses as much as possible on the attached questionnaire. Data obtained from you will be treated with utmost confidentiality and used for academic purposes only. Your co-operation and time will be highly appreciated.

Yours Sincerely

Kelvin Kipkorir Kishara
NM13/09050/20

Appendix II: Household Questionnaire

This questionnaire is intended to assess the determinants influencing adoption of green energy technologies among households in Konoin sub-county, Kenya.

SECTION A Location and socio-economic characteristics of the respondents

Please answer all questions honestly according to the given instructions

Tick [✓] *the appropriate answer*

1. Indicate the Ward where you come from?

i. Mogogosiek [ ]
ii. Chepchabas [ ]
iii. Kimulot [ ]
iv. Embomos [ ]
v. Boito [ ]

2. What is your gender?

i. Male [ ]
ii. Female[ ]
iii. Prefer not to mention [ ]

3. What is your age bracket?

i.18 – 30 years [ ]
ii.31 – 40 years [ ]
iii.41 – 50 years [ ]
iv.Above 50 years [ ]

4. Highest school level?

i. Primary [ ]
ii. Secondary [ ]
iii. College level [ ]
iv. Undergraduate Degree [ ]
v. Post Graduate Degree [ ]
vi. Never been to school [ ]

5. In what employment category do you fit?

i. Employed [ ]
ii. Self-employed [ ]
iii. Unemployed [ ]

6. Indicate the level of your monthly income

i. 0 to 20,000KES [ ]
ii. 20,000 to 40,000 KES [ ]
iii. 40,000 to 60,000 KES [ ]
iv. 60,000 KES and above [ ]

7. a) Do you have any other sources of income?

i. Yes [ ]
ii. No [ ]

b) If your answer is ***yes*** above indicate the other source of income

i. Remittances [ ]
ii. Business ownership [ ]
iii. Retirement funds [ ]
iv. Rental income [ ]
v. Retirement funds [ ]

c) How many people are there in your immediate family including yourself?

i. 1 [ ]
ii. 2 [ ]
iii. 3 [ ]
iv. 4 [ ]
v. 5 or more [ ]

d) How many children (under 18 years) are in your family?

i. None [ ]
ii. 1 [ ]
iii. 2 [ ]
iv. 3 or more [ ]

e) How many adults (18 years or older) are in your family?

i. 1 [ ]
ii. 2 [ ]
iii. 3 [ ]
iv. 4 or more [ ]

f) Do all members of your family share the same living space?

i. Yes [ ]

ii. No [ ]

g) Who is responsible for managing the energy usage in your household? (*Select all that apply*)

i. Head of the family [ ]

ii. Spouse/Partner [ ]

iii. Other family member [ ]

iv. Shared responsibility [ ]

h) How often does your family discuss energy conservation and its importance?

i. Daily [ ]

ii. Weekly [ ]

iii. Monthly [ ]

iv. Rarely [ ]

v. Never [ ]

i) Does your family have any specific energy-saving goals or targets?

i. Yes [ ]

ii. No [ ]

j) Which of the following energy-saving measures does your family currently implement? (*Select all that apply*)

i. Turning off lights when not in use [ ]
ii. Unplugging electronic devices when not in use [ ]
iii. Adjusting thermostat settings [ ]
iv. Using energy-efficient appliances [ ]
v. Using natural lighting during the day [ ]
vi. Using energy-efficient light bulbs [ ]
vii. None [ ]
viii. Other (please specify)
…………………………………………………...

8. Are you aware of the benefits of green energy technologies?

i. Yes [ ]

ii. No [ ]

9. Which of the following solar energy technology provider are you aware of?

i. M-Kopa Solar [ ]
ii. D. Light Solar [ ]
iii. Azuri technologies [ ]
iv. Sun culture [ ]
v. Sun King [ ]
vi. Rafiki power [ ]
vii. Power gen renewable energy [ ]
viii. Greenlight planet [ ]
ix. Orb energy [ ]
x. Solar now [ ]
xi. Other (please *Specify*) …...

10. Which of the following promotional strategies are being used by the solar energy technology providers?

i. Digital marketing [ ]
ii. Educational content [ ]
iii. Incentives [ ]
iv. Trade shows and events [ ]
v. Referral programs [ ]
vi. Customer testimonials [ ]
vii. Direct sales and outreach [ ]
viii. Other (Please specify) …………………………….

11. a) Have you adopted any form of green energy technology?

i. Yes [ ]
ii. No [ ]

b) If you have adopted green Energy Technology what is your view on its level of reliability (*If not, kindly ignore*)

i. Reliable [ ]
ii. Slightly reliable [ ]
iii. Most reliable [ ]

c) If No, why have you not adopted any form of solar energy technology?

i. Due to high initial cost [ ]
ii. Lack of awareness and information [ ]
iii. Limited access to financing [ ]
iv. Inadequate government policies [ ]
v. Technical considerations [ ]
vi. Perception of complexity [ ]
vii. Other (Please Specify) …………………….

d) If not yet adopted, when are you planning on acquiring any form of solar energy technology?

Explain…………………………………………………………………………………
…………………………………………………………………………………………
……

12. Which factors would you consider before adopting an energy source? *(Multiple choices are accepted)*

i. Cost [ ]
ii. Availability [ ]
iii. Reliability [ ]
iv. Popularity [ ]
v. Other (Please *Specify*) ……………………………………………………………

SECTION B: Respondents' perception and its influence on the adoption of solar energy technologies among households.

13. On a scale of 1-5, how important is the environmental impact of your energy usage to you and your household?

1 - Not important at all [ ]
2 - Somewhat unimportant [ ]
3 - Neutral [ ]
4 - Somewhat important [ ]
5 - Very important [ ]

14. Which of the following best describes your perception of the cost of green energy technologies?

i. They are too expensive and not worth the investment

ii. They are expensive, but worth the investment in the long run

iii. They are affordable and worth the investment

iv. I am not sure

15. Which of the following best describes your perception of the reliability and effectiveness of green energy technologies compared to traditional energy sources?

i. They are less reliable and effective than traditional energy sources [ ]

ii. They are equally reliable and effective as traditional energy sources [ ]

iii. They are more reliable and effective than traditional energy sources [ ]

iv. I am not sure [ ]

16. Which of the following best describes your perception of the government's role in promoting the adoption of green energy technologies?

i. The government should not be involved [ ]

ii. The government should provide incentives or subsidies [ ]

iii. The government should regulate the use of traditional energy sources [ ]

iv. I am not sure [ ]

17. On a scale of 1-5, how much influence do other members of your household have on your decision to adopt green energy technologies?

1 - No influence [ ]

2 - Little influence [ ]

3 - Neutral [ ]

4 - Some influence [ ]

5 - Significant influence [ ]

18. Which of the following best describes your perception of the potential drawbacks of adopting green energy technologies?

i. They are too complicated to use [ ]

ii. They require a lot of maintenance [ ]

iii. They may not work well in all types of weather [ ]

iv. There are no potential drawbacks [ ]

19. Kindly rate the following statements to the extent to which you agree with them. Use a 5-point likert scale where SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree and SA = Strongly Agree.

CODE	**Perception towards adoption of green energy technologies**	**SD**	**D**	**N**	**A**	**SA**
	I believe that green energy is a risk-free source of energy					
	I am aware of the risks associated with green energy					
	I don't think I am at risk when using green energy					
	I know the experts to consult regarding green energy					
	I know where to find green energy products when I need them					

SECTION C: Spatial variations in the adoption of solar energy technologies among households.

20. Indicate your current residential home setting

i. Rural [ ]

ii. Urban [ ]

21. Are you in close proximity to other available energy resources?

i. YES []

ii. NO [100]

If YES, kindly indicate the energy source you are close to

i. Hydropower [ ]

ii. Wind plant [ ]

iii. Biogas [ ]

iv. Solar energy [ ]

22. Have you noticed any changes in your energy bills since installing green energy technologies? (*If not ignore)*

i. Yes, my bills have decreased [ ]

ii. No, my bills have remained the same [ ]

iii. No, my bills have increased [ ]

23. Kindly indicate with a Tick [✓] the source of your energy for the following purposes

Applications of green energy	**Electricity**	**Charcoal**	**Biogas**	**Fuel wood**	**Solar Energy**	**LPG gas**
Cooking						
Lighting						
Space heating (Warming the house)						
Drying (eg Drying maize)						
Home appliances eg Iron box, Television, Radio						

SECTION D: Socio-economic and geographical factors influencing the adoption of solar energy technologies among households.

24. Kindly rate the following statements to the extent to which you agree with them. Use a 5-point likert scale where SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree and SA = Strongly Agree

Social factors influencing the adoption of GE Technologies	**SD**	**D**	**N**	**A**	**SA**
The gender of an individual has an impact on adoption of green energy					
The age of an individual has an impact on adoption of green energy					
I came to know of green energy technologies from friends, relatives and neighbours.					
The size of an individual household has an impact on the energy use in the household					
The level of an individual's education has an impact on adoption of green energy					

Social norms play a significant role in shaping individual behaviour on GE adoption					
The opinions and behaviors of friends, family, and influential individuals can strongly influence an individual's decision to adopt GE Technologies.					
Strong community support, including organizations, initiatives, and advocacy groups, can create an environment that fosters the adoption of GE Technologies					
Access to reliable and accurate information about the benefits, affordability, and feasibility of GE Technologies is crucial for adoption.					
Supportive policies, regulations, and incentives provided by governments can significantly influence the adoption of GE Technologies.					

Economic factors and adoption of solar energy	**SD**	**D**	**N**	**A**	**SA**
Green energy production could result in increased costs.					
Green energy is expensive as green energy projects require a higher initial investment.					
Green energy consumption needs a high installation cost.					
The recurrent cost of green energy may be quite high					
Better incentives should be given for consumption of green energy					
The cost of purchasing energy influences one’s decision to purchase green energy					
I frequently receive energy financial support from family friends and relatives					
The long-term cost savings from adopting GE Technologies outweigh the initial investment and operating costs.					
Accessible financing options, such as loans or leasing, make it easier for individuals and businesses to afford the upfront costs of adopting GE Technologies.					
The potential reduction in energy bills by using GE Technologies makes them economically beneficial over the long term.					
Government incentives, tax credits, rebates, or subsidies for adopting GE Technologies make them more financially attractive for individuals and businesses.					

Geographical factors	SD	D	N	A	SA
Iam anxious about pollution from other energy technologies to the environment					
Environmental pollution through smoke can easily be safeguarded by use of green energy technologies					
Utilization of green energy can improve the environment					
Fossil fuels are responsible for climate change and its effects today					
Green energy solutions are more environmentally friendly than other forms of energy					
Not enough is being done to reduce climate change among households					
Geographical location of individuals influences their choice on the use of energy (Rural or Urban location)					
Geographical factors, such as proximity to sunlight-rich regions, influence the feasibility of solar energy projects					
I am in close proximity to a reliable energy solar energy technology.					

25. Are there other socio-economic and geographical factors that may have informed your decision to adopt solar energy technology? Please, briefly explain

………………………………………………………………………………………………
……

………………………………………………………………………………………………
…

Appendix III: Questionnaire for Institutions

This questionnaire is intended to assess the determinants influencing adoption of green energy technologies among institutions/ organizations in Konoin sub-county, Kenya.

SECTION A General information

Please answer all questions honestly according to the given instructions

Tick [✓] *the appropriate answer*

1. Indicate the Ward where your institution / organization is found?
   i. Mogogosiek [ ]
   ii. Chepchabas [ ]
   iii. Kimulot [ ]
   iv. Embomos [ ]
   v. Boito [ ]
2. What is the nature of your institution?
   i. Education [ ]
   ii. Agriculture [ ]

   If it is education, which of the following category does it fall (*if agriculture kindly ignore*)
   i. Primary [ ]
   ii. Secondary [ ]
   iii. Tertiary [ ]
3. Have you ever considered using green energy as an alternative source of power in your institution?
   i. Yes [ ]
   ii. No [ ]

SECTION B: To examine how perception influences the adoption of solar energy technologies among institutions / organizations.

4. Kindly rate the following statements to the extent to which you agree with them. Use a 5-point Likert scale where SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree and SA = Strongly Agree

	Perception and adoption of solar energy technologies	**SD**	**D**	**N**	**A**	**SA**
PASET1	Solar energy is a viable alternative to traditional sources of power					
PASET2	Using solar energy will help reduce my institution's carbon footprint					
PASET3	The government offers financial incentives to institutions that adopt solar energy					
PASET4	The initial cost of installing solar panels is too expensive for my institution					
PASET5	I know of the benefits, to institutions, of using solar energy					
PASET6	I have consulted with solar energy providers or installers to get more information about solar energy for my institution.					
PASET7	Using solar energy will help my institution to save money in the long run.					
PASET8	Using solar energy will improve the image of my institution as being environmentally friendly.					

SECTION C: To analyze the spatial variations in the adoption of solar energy technologies among institutions / organizations.

5. Indicate with a Tick [✓] your current institutional setting

   ii. Rural [ ]

   iii. Urban [ ]

1. Are you in close proximity to other available energy resources?

   i. YES [ ]

   ii. NO [ ]

2. If YES, kindly indicate the energy source you are close to

   i. Hydropower [ ]

   ii. Wind plant [ ]

   iii. Biogas [ ]

   iv. Solar energy [ ]

3. Has your institution adopted solar energy technology?

   i. Yes [ ]

   ii. No [ ]

4. If your institution has adopted solar energy technology, how long has it been in use?
   i. Less than a year [ ]
   ii. 1-2 years [ ]
   iii. 2-5 years [ ]
   iv. More than 5 years [ ]
5. What percentage of your institution's total energy consumption is currently provided by solar energy technology?
   i. Less than 25% [ ]
   ii. 25-50% [ ]
   iii. 50-75% [ ]
   iv. 75-100% [ ]
6. In which geographical regions or areas has your institution adopted solar energy technology?
   i. Urban areas [ ]
   ii. Suburban areas [ ]
   iii. Rural areas [ ]
   iv. Multiple regions [ ]
7. What was the primary reason for your institution's adoption of solar energy technology?
   i. Cost savings [ ]
   ii. Environmental sustainability [ ]
   iii. Energy independence [ ]
   iv. Other (please specify) ………………………………………........
8. Has your institution experienced any financial or economic benefits from its adoption of solar energy technology?
   i. Yes [ ]
   ii. No [ ]
9. What challenges or barriers did your institution face in adopting solar energy technology? (Select all that apply)
   i. High initial costs [ ]
   ii. Lack of financing options [ ]
   iii. Lack of technical expertise [ ]
   iv. Lack of space for solar panel installation [ ]
   v. Resistance from stakeholders [ ]
   vi. Other (please specify) …………………………………………

10. How does your institution plan to expand or improve its use of solar energy technology in the future?
    i. Increase the percentage of energy provided by solar energy technology[ ]
    ii. Expand solar panel installations to other areas [ ]
    iii. Invest in energy storage technology [ ]
    iv. Other (please specify) …………………………………………………

11. Has your institution educated and engaged its stakeholders (e.g., students, faculty, staff, community members) about its adoption of solar energy technology?
    i. Yes [ ]
    ii. No [ ]

12. How does your institution measure the environmental impact of its adoption of solar energy technology?
    i. Reduction in greenhouse gas emissions [ ]
    ii. Energy savings [ ]
    iii. Other (please specify) ……………………………….

SECTION D: To find out the socio-economic and geographical factors influencing the adoption of solar energy technologies among households.

Socio-economic factors

13. What is the size of your institution in terms of number?
    i. Less than 10 [ ]
    ii. 11-50 [ ]
    iii. 51-100 [ ]
    iv. More than 100 [ ]

14. What is the annual revenue of your institution?
    i. Less than Ksh 10 million [ ]
    ii. Ksh 10 million - 50 million [ ]
    iii. Ksh 51 million - 100 million [ ]
    iv. More than Ksh 100 million [ ]

15. What was the main reason for installing solar panels in your institution?
    i. To reduce energy costs [ ]
    ii. To reduce carbon footprint [ ]
    iii. To improve energy reliability [ ]
    iv. Other (please specify) ……………………………………………………………...
16. How much did your institution spend on the installation of solar panels?
    i. Less than Ksh 1 million [ ]
    ii. Ksh 1 million - 5 million [ ]
    iii. Ksh 6 million - 10 million [ ]
    iv. More than Ksh 10 million [ ]
17. Does your institution have a dedicated budget for renewable energy projects?
    i. Yes [ ]
    ii. No [ ]
18. What are the major barriers to the adoption of solar energy technology in your institution?
    i. High upfront costs [ ]
    ii. Lack of financing options [ ]
    iii. Lack of technical expertise [ ]
    iv. Uncertainty about future energy needs [ ]
    v. Other (please specify) …………………………………………………………..
19. Does your institution have a sustainability policy that includes the use of renewable energy sources?
    i. Yes [ ]
    ii. No [ ]
20. How important is it for your institution to be seen as environmentally responsible?
    i. 5 Very important [ ]
    ii. 4 Important [ ]
    iii. 3 Somewhat important [ ]
    iv. 2 Not very important [ ]
    v. 1 Not at all important [ ]

21. What is the main benefit of solar energy technology for your institution?

i. Cost savings [ ]
ii. Environmental sustainability [ ]
iii. Improved energy reliability [ ]
iv. Other (please specify) ……………………………………………………………

Geographical factors

22. Kindly rate the following statements to the extent to which you agree with them. Use a 5-point Likert scale where SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree and SA = Strongly Agree.

Geographical factors influencing adoption of solar energy among institutions	**SD**	**D**	**N**	**A**	**SA**
Solar energy providers are in close proximity to my institution.					
I have experienced power outages in my institution due to grid failures.					
Availability of solar energy equipment in my geographical location impact my decision to adopt solar energy technology.					
There are government incentives or subsidies for adopting solar energy technology in my geographical location.					
The cost of solar energy technology in my geographical location is low as compared to other sources of energy.					
There are environmental regulations or policies in my geographical location that encourage the adoption of solar energy technology.					
Availability of skilled personnel in my geographical location impact my decision to adopt solar energy technology.					
There is a low level of public awareness and support for solar energy technology in my geographical location.					
The climate in my geographical location impacts my decision to adopt solar energy technology.					

Appendix IV: Questionnaire for Key Informants

This questionnaire is intended to assess the determinants of adoption of solar energy technologies among Key Informants in Konoin sub-county, Kenya.

SECTION A General information

Please answer all questions honestly according to the given instructions

Tick [✓] *the appropriate answer*

1. State the department or ward where you represent.

2. Have you adopted green energy technologies?

3. Which of the solar energy technology provider are you aware of?

4. Which promotional strategies are being used by the solar energy technology providers?

5. Are you aware of the benefits of solar energy technologies?

6. Do you believe that solar energy technology is a viable option for meeting Kenya's energy needs?

7. Have you participated in training programs or workshops on solar energy technology?

8. Have you recommended the use of solar energy technology in energy projects or initiatives?

9. Do you believe that the government should invest more in solar energy technologies?

10. Do you have experience in implementing solar energy technology projects.
11. In your own opinion, what is your experience with the installation and use of solar energy technologies?
12. Which options would you consider before adopting a solar energy technology?

SECTION B: To examine how perception influences the adoption of solar energy technologies among households.

13. Kindly rate the following statements to the extent to which you agree with them. Use a 5-point Likert scale where SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree and SA = Strongly Agree

Perception and adoption of green energy technologies	**SD**	**D**	**N**	**A**	**SA**
Solar energy is a viable alternative to traditional sources of energy for the country's energy needs					

I believe that promoting the adoption of solar energy technology can positively impact the environment and reduce greenhouse gas emissions.					
Solar energy technology is reliable and efficient enough to be integrated into the country's energy mix.					
I believe that promoting the adoption of solar energy technology is worth the initial cost, considering the long-term financial and environmental benefits.					
The government should invest in and promote the adoption of solar energy technology to achieve sustainable energy goals.					

SECTION C: To analyze the spatial variations in the adoption of solar energy technologies among households.

14. Kindly rate the following statements to the extent to which you agree with them. Use a 5-point Likert scale where SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree and SA = Strongly Agree

Spatial variations in the adoption of green energy technologies	**SD**	**D**	**N**	**A**	**SA**
I live in a location where solar energy technology is readily available.					
I have adopted solar energy technology in my home or business.					
I believe that the cost of solar energy technology in my area is affordable.					
I have noticed an increase in the number of homes and businesses using solar energy technology in my area over the past few years.					
I am aware of government incentives or subsidies in my area to encourage adoption of solar energy technology.					
The availability of solar energy technology in my area varies by season or time of day.					
The adoption of solar energy technology in my area is more prevalent in certain industries or sectors than others.					
The demographic makeup of my area is a factor in the adoption of solar energy technology.					
Cultural or social factors play a role in the adoption of solar energy technology in my area.					
The adoption of solar energy technology varies across different regions or neighborhoods in my area.					
Community organizations or initiatives play a role in promoting the adoption of solar energy technology in my area.					
The primary benefits of adopting solar energy technology in my area are environmental.					
The primary benefits of adopting solar energy technology in my area are economic.					
The primary benefits of adopting solar energy technology in my area are social or community-based.					

I would recommend solar energy technology to others in my area.					

SECTION D: To find out the socio-economic and geographical factors influencing the adoption of green energy technologies among households.

15. Kindly rate the following statements to the extent to which you agree with them. Use a 5-point Likert scale where SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree and SA = Strongly Agree

Social economic factors

Social economic factors influencing adoption of green energy	**SD**	**D**	**N**	**A**	**SA**
The high cost of solar energy technology is a significant barrier to adoption by the government in Kenya.					
Government subsidies and incentives are effective in promoting the adoption of solar energy technology in Kenya.					
The availability of financing options for solar energy technology is a key factor in promoting its adoption by the government in Kenya.					
The lack of technical expertise and skilled labour is a major challenge for the adoption of solar energy technology by the government in Kenya.					
The socio-economic background of the population in Kenya plays a significant role in the government's decision to adopt solar energy technology.					
The availability of reliable and efficient energy storage solutions is a key factor in promoting the adoption of solar energy technology by the government in Kenya.					
Government policies and regulations are critical in incentivizing the adoption of solar energy technology by the government in Kenya.					
The lack of public awareness and education on the benefits of solar energy is a major obstacle to its adoption by the government in Kenya.					
Public-private partnerships can play a significant role in promoting the adoption of solar energy technology by the government in Kenya.					

Geographical factors

	SD	**D**	**N**	**A**	**SA**
The impact of fossil fuel energy sources on the environment motivates me to adopt solar energy technology.					
The potential of solar energy technology to reduce greenhouse gas emissions influences my decision to adopt it.					

The potential for solar energy technology to mitigate the effects of climate change influences my decision to adopt it.					
The availability of solar energy technology is crucial for achieving Kenya's renewable energy targets.					
The potential for solar energy technology to reduce air pollution influences my decision to adopt it.					
The availability of land and space for solar energy installations influences my decision to adopt it.					
The potential for solar energy technology to improve public health motivates me to adopt it.					
The availability of incentives or policies that promote solar energy adoption influences my decision to adopt it.					
The potential for solar energy technology to increase energy security and independence influences my decision to adopt it					
The potential for solar energy technology to improve the quality of life for Kenyan citizens influences my decision to adopt it.					

Appendix V: Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

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Date of Issue: **24/May/2023**

RESEARCH LICENSE

This is to Certify that Mr.. Kelvin Kipkorir Kishara of Egerton University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Bomet on the topic: ASSESSMENT OF FACTORS INFLUENCING ADOPTION OF GREEN ENERGY TECHNOLOGIES AT THE HOUSEHOLD LEVEL IN KONOIN SUB-COUNTY, BOMET COUNTY, KENYA for the period ending : 24/May/2024.

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See overleaf for conditions

Appendix V: Publications

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Perception Influence on Adoption of Solar Energy Technologies at Household Level in Konoin Sub-County, Bomet County, Kenya

Perception Influence on Adoption of Solar Energy Technologies at Household Level in Konoin Sub-County, Bomet County, Kenya

Kelvin K. Kishara, Humphreys W. Obulinji, & Kennedy N. Ondimu
[123]*Department of Geography, Egerton University, Kenya*

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Abstract

Globally, the demand and price of energy, especially fossil fuels, is rising because of growing population and economic crisis. The Kenyan government spends a substantial amount of money importing fossil fuels to satisfy the needs of its citizens. The rising use of fossil fuels has substantial environmental consequences, including increased carbon emissions. It is necessary to use solar energy technologies, such as solar power, to reduce the impacts of fossil fuels on the environment. Thus, there is need for more knowledge about the factors influencing adoption of solar energy technologies in the study area. This research investigated how perception affects the adoption of solar energy technologies in households. Descriptive research survey approach was used. There were 38,178 households in Konoin sub-county, and 387 respondents were selected for the survey. Stratified-random sampling was used to choose 80 households from Mogogosiek, 84 from Boito, 91 from Embomos, 64 from Kimulot, and 61 from Chepchabas wards. Purposive sampling was used to choose seven key informants. Primary data was gathered through the use of a semi-structured questionnaire. The data was examined using descriptive statistics and multiple linear regression. Findings indicate that perception has a limited correlation with adopting solar energy systems in homes.

Keywords: Bomet, Carbon Emissions, Fossil Fuels, Green Energy, Solar Energy

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(REVIEW ARTICLE)

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Analysis of the spatial variations in the adoption of solar energy technologies among households in rural and urban areas of Konoin sub-County, Kenya

Kelvin K. Kishara *, Humphreys W. Obulinji and Kennedy. N. Ondimu

Department of Geography, Egerton University, PO Box 536-20115 Egerton, Kenya.

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Abstract

Globally, the overall demand and cost of energy and particularly, for fossil fuels is on the rise due to increasing population and overall development process. The increasing use of fossil fuels has significant ramifications to the environment, such as increase in carbon emissions. There is need, therefore, to adopt the use of green energy technologies like solar energy so as to minimize the negative effects of fossil fuels on the environment. Despite these, there is paucity of information on factors influencing the spatial variations in the adoption of solar energy technologies among households in the study area, which this study sought to investigate. The study was informed by the Diffusion of Innovation theory and Technology Adoption Model. A a descriptive survey research design was employed. A stratified random sample of 387 households was surveyed and data collected analyzed using descriptive statistics and multiple linear regression. The findings reveal significant spatial variations in solar energy adoption rates. Proximity to renewable energy sources and fluctuations in energy costs positively influenced adoption levels. Also, social factors, including: household size; and community support had a positive influence in adoption of solar energy. Further, economic considerations, such as perceived installation costs and anticipated long-term savings, played a significant role in influencing adoption levels. Moreover, geographic variables, particularly access to areas with abundant sunshine, significantly influenced adoption levels.

Keywords: Adoption; Solar energy; Bomet; Spatial Variation

1. Introduction

The energy landscape on a worldwide scale is seeing a substantial transformation in the 21st century. The need for energy is growing fast as a result of population growth and economic advancement, with fossil fuels often serving as the primary source of this expanding requirement (International Energy Agency, 2023). However, relying on fossil fuels results in a substantial ecological impact. The uncontrolled burning of fossil fuels releases harmful greenhouse gases into the atmosphere, significantly contributing to climate change, a phenomenon with significant consequences to the planet (Shahzad, 2015).

Kenya is well-acquainted with these difficulties. The nation grapples with meeting its energy demands and often relies heavily on imported fossil fuels. This dependence not only exacerbates environmental problems but also places a significant economic burden on the country (Koch & Koch, 2019). Solar energy emerges as a beacon of optimism in the face of these challenges. This sustainable resource offers a feasible alternative that has the capacity to significantly reduce reliance on fossil fuels and their associated environmental and economic drawbacks (Kumar et al., 2021). The imperative to transition to renewable energy sources is amplified by the escalating threat of deforestation and environmental degradation in Kenya. The nation's reliance on traditional biomass fuels such as firewood and charcoal for cooking and heating has resulted in significant degradation of its previously abundant forests (Wamukunda, 2014). Solar energy offers a viable solution to the ecological challenge by allowing households to meet their energy needs without causing harm to the environment (Ocelli et al., 2013).

* Corresponding author: Kelvin K. Kishara