SOCIO-ECONOMIC EFFECTS OF RURAL ELECTRIFICATION ON THE HOUSEHOLD WELL-BEING OF PROPRIETORS OF MICRO AND SMALL ENTERPRISES IN KENYA

BONFACE IMBALI MUDI

DOCTOR OF PHILOSOPHY

(Development Studies)

JOMO KENYATTA UNIVERSITY OF

AGRICULTURE AND TECHNOLOGY

2020

Socio-Economic Effects of Rural Electrification on the Household Well-Being of Proprietors of Micro and Small Enterprises in Kenya

Bonface Imbali Mudi

A Thesis Submitted in Partial Fulfilment for the Degree of Doctor of Philosophy in Development Studies in the Jomo Kenyatta University of Agriculture and Technology

2020

DECLARATION

This thesis is my original work and has not been presented for a degree in any other University

Signature: …….. Date: ……

Bonface Imbali Mudi

This thesis has been submitted for examination with our approval as the University Supervisors.

Signature: …….. Date: ……

Prof. Maurice M. Sakwa, Ph.D.

JKUAT, Kenya.

Signature: …….. Date: ……

Prof. Elegwa Mukulu, Ph.D.

JKUAT, Kenya.

DEDICATION

I dedicate this research on household well-being to my mother Dymphina Busolo who sacrificed and selflessly supported me throughout my education, my wife Juliane Waswa, my children Dalton, Denver, Derryl, Derric and Diana, and my late brother Remmy Mudi, who relentlessly encouraged me to pursue my education to the highest echelon – may his soul rest in eternal peace.

ACKNOWLEDGEMENTS

I wish to express my sincere gratitude to the Almighty God and everyone who has supported me throughout this thesis. In particular, I am extremely thankful to my supervisors Prof. Maurice M. Sakwa and Prof. Elegwa Mukulu for their incredible support and guidance. Very special thanks go to my wonderful family for their unwavering support and endless encouragement during this journey. I am greatly indebted to the 2015 Ph.D. class for the team spirit that energized me to this end. I cannot mention all those who have played one role or another on this research but, through this sentence, I wish to appreciate their support and dedication to the study.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABBREVIATIONS AND ACRONYMS

ADF	Augmented Dickey-Fuller
AfDB	African Development Bank
AICD	Africa Infrastructure Country Diagnostic
ANOVA	Analysis of Variance
ESMAP	Energy Sector Management Assistance Program
GDP	Gross Domestic Product
GEA	Global Energy Assessment
GNP	Gross National Product
GoK	Government of Kenya
GSOEP	German Socio Economic Panel
HDI	Human Development Index
ICT	Information Communication Technology
IEA	International Energy Agency
IFAD	International Fund for Agricultural Development
IMF	International Monetary Fund
KPLC	Kenya Power and Lighting Company
K-S	Kolmogorov-Smirnov

KWH	Kilowatt hour
LS	Livelihood Strategies
MSEs	Micro and Small Enterprises
MTP	Medium Term Plan
MW	Mega Watt
NR	Natural Resources
OECD	Organization for Economic Cooperation and Development
PP	Phillips-Perron
RBI	Resource Based Industrialization
REA	Rural Electrification Authority
SDGs	Sustainable Development Goals
SEU	Social Exclusion Unit
SLA	Sustainable Livelihoods Approach
SSA	Sub-Saharan Africa
S-W	Shapiro-Wilk
UN	United Nations
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Program

USA	United States of America
WB	World Bank

OPERATIONAL DEFINITION OF TERMS

Access to Healthcare: Provision of preventive, diagnostic, treatment and rehabilitative health services conveniently delivered and properly coordinated for households to remain healthy (Barron & Torero, 2016).

Electricity Supply: The degree to which electricity being delivered to customers is within accepted standards and in the amount desired (Neelsen & Peters, 2013).

Employment Status: Level of labor demand and supply as a result of enhanced productivity through improved technology, non-farm activities, business diversification and self-employment (Van de Walle, Ravallion, Mendiratta, & Koolwal, 2013).

Household Well-being: A state of satisfaction of basic human needs and privileges as being a critical pre-requisite before people can flourish and live happily, healthy and comfortably (Tinkler & Hicks, 2013).

Income Level: Includes wages, salaries, profits, interest payments, rents, and other forms of earnings received in a given period of time (Grogan & Sadanand, 2013).

Micro Enterprises: Farm and non-farm enterprises, formal or informal, with less than ten employees, including sole proprietorships, part-time businesses, and home-based businesses (Buschfeld, Bernadette, Luisa, Kurt, Eckhard &, Wilke, 2011).

Small Enterprises: Business enterprises with between 10 to 49 employees, with sales turnover not exceeding Ksh. 500 Million annually (Muller, Shaan, Jenna, Dimitri & Chiara, 2016).

Skills and Knowledge Application: Use of expertise and comprehension achieved by proprietors to perceive and seize business opportunities to improve performance (Ucbasaran, Westhead & Wright, 2008).

ABSTRACT

Kenya's poverty rates remain relatively higher implying low levels of household well-being compared to other lower middle income countries. A developing country like Kenya requires electricity for startup of farm and nonfarm micro and small enterprises to enhance well-being of a majority of the rural inhabitants. It is in this regard that an explanation is required studying socio-economic effect of rural electrification on the household well-being of proprietors of micro and small enterprises in Kenya. The specific objectives of the study were to investigate the effect of; skills and knowledge application, access to healthcare, income level and employment status due to rural electrification on household well-being among proprietors of micro and small enterprises in Kenya. The study also sought to determine the moderating effect of electricity supply on the relationship between socio-economic effect of rural electrification and household well-being of proprietors of micro and small enterprises in Kenya. The study adopted a cross-sectional descriptive survey design. The target population for this study comprised 172,554 proprietors of micro and small enterprises registered in Kenya by 2015. The study adopted multistage sampling involving systematic and simple random sampling procedures due to the large target population involved. Primary data from proprietors of rural micro and small enterprises in eight counties namely; Kakamega, Bungoma, Nakuru, Busia, Bomet, Siaya, Kericho and Kirinyaga forming a sample size of 418 was used. The data collection instrument was pilot tested on 5% of the sample size. Pearson correlation analysis showed that there was a general moderate positive relationship between socio-economic effects of rural electrification and household well-being among proprietors of micro and small enterprises. Combined multiple regression analysis revealed that there was a significant positive relationship between socio-economic effects of rural electrification (access to healthcare, income level and employment status) and household well-being among proprietors of micro and small enterprises. The study findings also revealed a significant direct moderating effect of electricity supply on the relationship between socio-economic effects of rural electrification and household well-being among proprietors of micro and small enterprises. It was concluded that socio-economic effects of rural electrification have an influence on household well-being among proprietors of micro and small enterprises in Kenya. It is recommended that the Kenyan government should come up with clear policies and review legislations to ensure Rural Electrification Authority is given a clear mandate, authority and resources to fulfil their mandate, and ensure accountability. Future research is recommended on the effect of skills and knowledge application due to rural electrification on the household well-being in a different social setting to establish whether similar results would be obtained.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

This chapter introduces the study by describing socio-economic effects of rural electrification, household well-being and rural electrification in Kenya. It also presents statement of the problem, objectives of the study, the hypotheses that were formulated and tested, justification of the study, significance of the study and scope of the study.

1.1.1 Well-being

Well-being is a state of satisfaction of basic human needs and rights and a crucial pre-requisite before people can flourish and live well (Tinkler & Hicks, 2013). People from diverse cultures appear to emphasize different elements of happiness and have distinct beliefs about well-being. Americans, for example, may associate happiness with excitement while, in contrast, Japanese people are more likely to associate happiness with peace and calm (Oishi, 2018). The data of World Happiness Report 2016-2018 supports the argument that developed nations are happier than poor nations. According to this report, the top 10 countries are from the developed world whereas the 10 countries with the lowest average happiness are poor nations (Helliwell, Layard & Sachs, 2016). Surprisingly, according to the Gallup Healthways Well-Being Index, the global well-being map is dynamic and changing in favor of growing economies. For the Gallup Healthways Well-Being Index the highest 10 well-being countries include developing and Latin America economies while the lowest 10 well-being countries are largely poor nations (Gallup-Healthways, 2015).

Countries with the highest levels of poverty and lower levels of household well-being tend to have lower access to modern energy services - a problem that is most pronounced in sub-Saharan Africa and South Asia (IEA, 2017). Improvement with rural electrification is manifest, with the global rural electrification proportion increasing from

63 percent in 2000 to 73 percent in 2014 (World Bank, 2017). In 2014, 1.06 billion people still lived without access to electricity - approximately 15 percent of the global population and almost 3.04 billion people still relied on traditional biomass and kerosene for cooking and heating which is an indication of low level of well-being (IEA, 2017). Well-being has become a policy concern in a range of nations, including the United Kingdom, Bhutan, the United Arab Emirates, and France, as well as at international organizations such as the United Nations and the OECD (Sachs, 2018; Tay, Chan & Diener, 2014).

Countries that enjoy the highest levels of well-being are those that are closest to reaching the 17 SDGs – those that have the highest social capital, the most inclusive and equitable economies, and policies that effectively protect and promote the natural environment (Global Council for Happiness and Wellbeing, 2019). The global financial crisis of 2008 - 2009, and the deep recession it triggered in Western economies, illustrated that focusing on ever increasing Gross Domestic Product, (GDP), was not resulting in increased wellbeing for the vast majority of people (Gray, Lobao & Martin, 2012). Consequently, in response to the financial crisis, the Stiglitz, Sen and Fitoussi report (2009) specifically recommended that measures of wellbeing were incorporated into national surveys.

1.1.2 Socio-economic Effects of Rural Electrification and Well-being

Socioeconomic status encompasses income, educational attainment, financial security, and subjective perceptions of social status and social class. Socioeconomic status can encompass quality of life attributes as well as the opportunities and privileges afforded to people within society (Phelan, Link & Tehranifar, 2010). Further, socioeconomic status is a consistent and reliable predictor of a vast array of outcomes across the life span, including physical and psychological health (Kabudula, Houle, Collinson, Kahn, Tollman & Clark, 2017). This study uses; skills and knowledge application (Kulkarni & Barnes, 2017), access to healthcare (Barron & Torero, 2016), income level (Grogan & Sadanand, 2013) and employment status (Chakravorty, Pelli & Marchand, 2014) as

socio-economic effects of rural electrification which are considered to have a significant effect on household well-being of proprietors of micro and small enterprises.

The skills and knowledge of MSE proprietors mainly achieved through use of electricity can impact the path to business success, and aid the process of building absorptive capacity of enterprise owners such as confidence, psychology, knowledge and skills. Educated people are creative and innovative and they are always looking for something unique to fulfil a need or want (Chowdhury, Alam & Arif, 2013). It is widely recognized that necessary skills and knowledge positively influences managerial decisions that enhances business development opportunities. This shows that additional business owners and employees using internet and watching relevant television programs have the essential skills, discipline, inspiration, information and self-assurance to attain greater growth rates in their place of work; hence more likely to perceive and seize business opportunities to improve performance (Ucbasaran, Westhead & Wright, 2008). The above listed benefits coupled with a state of health and happiness may lead to a state of well-being.

Maheran and Khairu (2009) asserted that highly-skilled and competent persons are required to enable the supply of high value-added goods and services as well as the capabilities to build consumers' confidence and trust. Chang, Gong and Shum (2011) avers that both hiring and training multi-skilled core customer-contact employees have significant and positive effects on incremental and radical innovation among hotel and restaurant businesses. Rural electrification may herald purchase of technology equipment such as computers, television, mobile phones among others that enhance people's skills and knowledge which may contribute to enhanced household well-being. Education is essential to reducing poverty and enhancing household well-being, and a lack of electricity access can create considerable obstacles towards escaping poverty and correlates with many factors that contribute directly towards it (UNDESA, 2014).

Electricity access seems to have a notable impact on some key health service indicators, such as reducing indoor pollution, prolonging night-time service provision, attracting

and retaining skilled health workers, and providing faster emergency response, including for childbirth deliveries (Sustainable Energy for All, 2013). Healthcare facilities must be strategically located, offer uniquely affordable services, universally acceptable, adequately available and evenly distributed in order to enhance access to healthcare services and increase the level of household well-being. Rural electrification makes healthcare facilities to be strategically available reducing the distance travelled to seek medical services (Noor, Amin, Gething, Atkinson, Hay & Snow, 2006). Healthcare expansion to the community level as a result of electrification enhances access to healthcare (WHO, 2015) which may enhance household well-being.

Besides improving the direct functionality of health facilities, access to electricity is equally instrumental in attracting and retaining skilled health workers, especially in rural areas (World Health Organization, 2015). Recorded cases show that health workers choose to even quit employment when they are assigned to work in remote rural areas where energy is a problem (IEA, 2014). Poor energy infrastructure can affect the quality of service: for example, reduced operating hours resulting in an un-served population, reduced capacity for lab tests, night-time safety concerns and decline in staff morale (USAID, 2012).

Income opportunities following electrification process comprises openings for households to earn wages, salaries, profits, interest payments, rents, and other forms of earnings received in a given period of time (Grogan & Sadanand, 2013). Ahmed and Fausat (2012) indicated that following electrification, most households were involved in income diversification activities such as petty trading, mat making and tailoring. They suggest that to enhance income diversification it is important to improve rural infrastructure in terms of the provision of electricity and improving access to markets. Income diversification through off-farm activities offer an important route out of poverty, provide higher income earning, increase food consumption, generate employment and reduce income inequality all geared towards enhancing household well-being (Adugna, 2006). Non-farm income provide self-insurance against likely shocks, overcome farm credit constraints and enhance farm investment, absorb labor

surplus, and ultimately improve the financial well-being of households through increased total income (Hoang, Pham & Ulubasoglu, 2014).

Prasad and Dieden (2007) assert that micro and small enterprises uptake is higher among households with electricity connections, while Dinkelman (2008) reiterate that women in middle income quartiles are better able to take advantage of electrification for income generation. According to Kirubi, Jacobson, Kammen and Mills (2009) access to electricity extends operating hours of businesses and longer hours for households to produce hand-made goods that translates to increased income and household well-being. Furthermore, access to electricity enables the use of electric equipment and tools by small and micro-enterprises thereby improving their productivity (by 100-200 percent depending on the task at hand) and the revenue of the enterprises (by 20-70 percent, depending on the product made) that culminates to enhanced household well-being.

Rural electrification may affect employment status through three potential channels: first, household electrification frees up women's time spent in collecting and preparing fuel, and increases the productivity of household tasks through improved technology. It therefore increases labor supply and results in more engagement in market based work (Grogan & Sadanand, 2013). Second, having access to electricity creates opportunities to generate income within the home and allows for new types of jobs outside the home, thus potentially increasing self-employment and labor demand (Van de Walle *et al*., 2013). Third, a change from agricultural to non-agricultural undertakings associated with increase in productivity and thus, increases in employment level (Torero, 2015).

Electricity supply allows households to reallocate labor away from household tasks and towards formal wage labor (Van de Walle *et al*., 2013). Chakravorty, Pelli and Marchand (2014) infers that access to electricity causes expansion of micro-enterprises that create new employment, income opportunities and consequently improves household well-being for the rural population. Electricity may directly create jobs within households by enabling the production of new goods and services for the market. In this

way, household electrification could unleash previously unrealized demand for labor and an increase in market work (Dinkelman, 2011).

The framework developed by the Sustainable Energy for All initiative to define and measure access to energy considers 30 kWh a month to be the subsistence level for grid electricity. The framework considers electricity affordable if a household does not have to spend any more than 5 percent of its total monthly income to purchase it (World Bank, 2015). When a government policy seeks to promote access to renewable energy sources, it needs to influence factors such as: affordability, disposable income, availability and high quality of modern sources (Barnes, Krutilla and Hyde, 2005). In the case of rural areas, affordability is particularly considered to be one of the main obstacles to adoption of modern energy. World Bank (2017) reports that in Africa connection costs often exceed a country's monthly income per person, and households have to pay this plus fees for inspection and application, security deposits, internal wiring, and equipment costs. These fees are usually charged upfront making it difficult for low income households to afford the service.

Interruptions to power supplies potentially affect MSEs' costs of production through the expense of repairing or replacing damaged equipment, the cost of spoiled goods and the additional cost of alternative sources of energy, such as generators (Cissokho & Seck, 2013). The effect of these costs on the competitiveness of MSEs depends in part on their impact on total costs. Eifert, Gelb and Ramachandran (2008), for instance, demonstrate that firm performance is sensitive to the cost of indirect inputs and that these costs, in which energy has the largest share, are a major factor in explaining the low productivity of enterprises in Africa.

1.1.3 Rural Electrification in Kenya

There have been various policy programs set up by the government and other relevant institutions, such as the Kenya Power and Lighting Company (KPLC), to increase rural electrification. The Rural Electrification Program (REP) funds are obtained from a 5%

levy, namely the Rural Electrification Program Levy Fund (REPLF), which is charged to all electricity users nationwide. The REPLF is one of seven decentralized operational funds in Kenya aimed at alleviating socio-economic disparities at the local level. Since 2003, the government of Kenya embarked on a vigorous rural electrification that was aimed at supplying power to rural areas. The rural electrification program in Kenya was enhanced through the formation of Rural Electrification Authority (REA) in the year 2006 that formulated a number of strategies involving the use of grid and off-grid supply systems through diesel stations, wind, solar, biogas and other renewable energy sources (Rural Electrification Authority, 2013).

The potential to generate 7,000 MW of geothermal electric power exists in Kenya (Hope, 2010). However, by the year 2011, only 130 MW had been exploited in Kenya (United Nations Human Settlements Program, 2011). In 2012, 18 percent of the population had access to electricity in Kenya, compared to 14.8 percent in Tanzania and 23 percent in Ethiopia (African Development Bank, 2014). In 2014, electricity produced from Kenya's natural endowments accounted for 56 percent of its capacity, with a large share coming from geothermal origins (19.1%), which continued to grow in 2015 (26.6%). Notably, Kenya owns the largest single geothermal plant in the world in Olkaria IV (140 MW) which produces the cheapest electricity in the country (Millien, 2017).

Building new capacity and extending new transmission and distribution lines are considered Kenya's two main priorities. Consequently, two strategic projects: a quantified roadmap for building new capacity for which KPLC is responsible, and the Last Mile Connectivity project, which was launched by the REA in 2015 have been initiated (Millien, 2017). The Last Mile Connectivity project, aimed at connecting 70% of households by 2017 by extending the grid distribution lines and increasing the number of transformers, targeting 314,000 households within 600 meters of 5,320 selected substations (Lee, Brewer, Christiano, Meyo, Miguel, Podolsky, Rosa & Wolfram, 2014).

According to International Energy Agency (2013), 33.6 million people (80 per cent of a population of 42 million) in Kenya lacked access to electricity in 2011. This means that Kenya had the seventh highest deficit in access to electricity in the world. Electricity consumption per capita was 155kWh per year in 2011, as compared to an average 219kWh in all low income countries, 535kWh in sub-Saharan Africa and a world average of 3,045kWh. Generation capacity as of March 2014 was 1,810MW (Republic of Kenya, 2014).

In Kenya, electrification gap is larger in rural areas, where only seven per cent of the population has access compared to an urban electrification rate of 58 per cent (International Energy Agency, 2013). There are also significant differences across counties and constituencies. Electricity demand is expected to be 14 times higher in 2031 than in 2010, which will put the Kenyan system under high strain, according to the official Kenyan demand forecast presented in the Least Cost Power Development Plan (Republic of Kenya, 2011). Most rural areas within the regions where the national grid operates still don't have a supply point due to the limitations of the distribution network. Rural communities with a connection to the grid suffer frequent and prolonged outages and poor voltage levels. The dire condition of the distribution network in rural areas with long and undersized feeders, also causes high loses and long response times (Pueyo, 2015).

According to Lee, Miguel and Wolfam (2016), electrification rates remained very low, including for relatively well-off households, averaging 5.5 and 22.3 percent for households and businesses, respectively. However, according to World Bank (2017), Kenya is leading the way in the East African region on how to balance a rapidly growing electrification program with consumer affordability in a financially sustainable manner. There is a substantial decrease in the connection fee charged to household customers - from KES 35,000 ($343) to KES 15,000 ($147) to be paid in instalments (World Bank, 2017). However, it has been estimated that the burden of power outages on the economy is as high as two percent of GDP and that the country needs a further 1,000 megawatts of generating capacity between 2010 and 2020 (AICD, 2010).

1.2 Statement of the Problem

According to World Bank (2017), use of electricity and equipment in developing countries improved the productivity and incomes of local small and micro-enterprises and supported improved village infrastructure such as schools, healthcare facilities and markets. Khandker, Hussain, Rubaba and Douglas (2012) agree that the role and intent of electrification programs is not only to provide access to electricity but also to improve the overall well-being of people. According to World Happiness and Well-being Report 2019, Kenya was ranked position 121 globally with a relatively dismal performance index of 4.509 on a scale of 1-10 (Helliwell, Layard & Sachs, 2019). Similarly, poverty rates in Kenya remain relatively high compared to other lower middle income countries indicating that household well-being has equally remained low (World Bank, 2018).

Tegene, Berhe and Teklemariam (2015) found a positive and significant relationship between rural electrification and poverty reduction especially through enhanced access to healthcare, education and on the development of both on-farm and off-farm commercial activities in Ethiopia. In a related study, Osanyinlusi, Awotide, Awoyemi, Ogunniyi, Adeyemi and Ogundipe (2017) established that rural electrification reduced poverty and improved standard of living in Nigeria. Correspondingly, a study by Bezerra, Callegari, Ribas, Lucena, Portugal-Perreira, Koberle, Sziko and Schaeffer (2017) revealed that rural electrification had a positive influence on all dimensions of Human Development Index (HDI) in Brazil. Jimenez (2017) also found that rural electrification leads to increases in school enrollment, employment, and incomes in Latin America. Kenya's electricity sector currently experiences the challenge of inability to meet electricity demand (Mutua, Ngui, Osiolo, Aligula & Gachanja, 2012). Conversely, households in Kenya are willing and able to pay, on average, about Ksh. 37 per kWh (US$0.35 per kWh) for improved energy services based on renewable energy resources (Kirubi *et al.*, 2009). In view of the foregoing, it is acknowledged that rural electrification improves well-being of the rural poor. This study therefore sought to establish whether the same trends are also realizable in Kenya.

1.3 Objectives of the Study

1.3.1 General Objective

The general objective of this study was to investigate the socio-economic effects of rural electrification on the household well-being among proprietors of micro and small enterprises in Kenya.

1.3.2 Specific Objectives

The specific objectives of this study were;

i) To determine the effect of access to healthcare due to rural electrification on household well-being among proprietors of micro and small enterprises in Kenya.
ii) To evaluate the effect of employment status owing to rural electrification on household well-being among proprietors of micro and small enterprises in Kenya.
iii) To examine the effect of income level due to rural electrification on household well-being among proprietors of micro and small enterprises in Kenya.
iv) To investigate the effect of skills and knowledge application owing to rural electrification on household well-being among proprietors of micro and small enterprises in Kenya.
v) To assess the moderating effect of electricity supply on the relationship between socio-economic effects and household well-being among proprietors of micro and small enterprises in Kenya.

1.4 Research Hypotheses

This study was guided by the following hypotheses;

H_o1: Access to healthcare due to rural electrification has no effect on the household well-being among proprietors of micro and small enterprises in Kenya.

H_o2: Employment status owing to rural electrification has no effect on the household well-being among proprietors of micro and small enterprises in Kenya.

H_o3: Income level due to rural electrification has no effect on the household well-being among proprietors of micro and small enterprises in Kenya.

H_o4: Skills and knowledge application owing to rural electrification has no effect on the household well-being among proprietors of micro and small enterprises in Kenya.

H_o5: Electricity supply has no moderating effect on the relationship between socio-economic effect of rural electrification and household well-being among proprietors of micro and small enterprises in Kenya.

1.5 Justification of the Study

This study was partly motivated by the fact that very little has been researched and written about socio-economic effects of rural electrification on household well-being among proprietors of micro and small enterprises in Kenya. The study could therefore bring new insights and understanding regarding the country's disappointing performance in terms of poverty reduction and household well-being. The results of this study will add to the limited empirical literature available in Kenya and the findings are useful to researchers and scholars and members of the public interested in the area of study or its implications.

Through a critical examination of socio-economic effects of rural electrification on household well-being, the study sought to investigate how rural electrification may enhance household well-being in Kenya. The findings of this study therefore forms a basis upon which prevailing efforts at promotion of participatory development strategies in Kenya may be evaluated and refocused. Recommendations drawn from the findings may aid planners and other stakeholders in Kenya to formulate more effective household well-being interventions.

Poverty reduction and household well-being efforts at global level require a thorough understanding of the critical factors that either foster or undermine the war against improved household well-being and how these factors present themselves in specific locations. The study will communicate directly to Sustainable Development Goals (one, two, three and seven) on ending poverty in all its forms everywhere, ending hunger, achieving food security and improved nutrition and promoting sustainable agriculture, ensuring healthy lives and promoting well-being for all at all ages and ensuring clean and affordable energy by 2030 respectively. Investors in the areas of poverty reduction and energy will find this study useful in preparing their proposals and justification for their business plans. This study will also make a scholarly contribution towards the understanding by providing insights based on empirical evidence from areas affected by poor household well-being. These insights could inform Kenya and other low and medium income countries pursuing improved household well-being goals and, in particular, planning anti-poverty programs targeting the poor.

1.6 Significance of the Study

This research provides information that improves knowledge on the relationship between rural electrification and well-being and promotes micro and small enterprises to address poverty among rural households in Kenya. It provides recommendations on how to improve household well-being for rural households and reduce poverty in Kenya. The research output is useful to the government agencies at national and county government

levels, non-governmental organizations and development partners who are involved in poverty reduction and improvement of well-being.

1.7 Scope of the Study

The study targeted proprietors of micro and small enterprises connected to the national electricity grid in rural Kenya. This study was limited to the effect of: skills and knowledge application; access to healthcare; income level; employment status and electricity supply. Kenya is divided into 47 Counties that are further subdivided into 290 Sub-counties. The study used primary data that was collected from a sample of eight counties namely; Kakamega, Bungoma, Nakuru, Busia, Bomet, Siaya, Kericho and Kirinyaga. The eight counties were systematically sampled from the list of county poverty headcount ratio, contribution to national poverty and county ranking (Republic of Kenya, 2014).

1.8 Limitations of the Study

Proprietors of micro and small enterprises in this study dreaded to fill some parts of the questionnaires due to fear of exposing their financial status. To mitigate against this, the researcher guaranteed the respondents that the information gathering would only be used for academic purposes only. Furthermore, a few proprietors of micro and small enterprise were not readily available in their business enterprises because they had engaged employees to run their businesses and spent most of their time in other economic activities. This was addressed by booking appointments for meetings over the weekend in order to administer questionnaires.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature on relevant theories, discusses conceptual framework, examines empirical literature on rural electrification, household well-being and the interaction between variables. Critique of existing literature relevant to the study and research gaps are also addressed at the end.

2.2 Theoretical Literature Review

The theoretical anchoring for this study is the Rural Livelihoods Approach. The choice of Rural Livelihoods Approach as the anchor theory for this study was informed by theoretical arguments that proprietors of micro and small enterprises may experience improved livelihoods through enhanced income and employment levels (Chambers & Conway, 1992). Other well-being theories supporting this study include social exclusion theory, capability theory and resource-based industrialization development theory. These theories effectively highlights an important correlation between socio-economic effects of rural electrification and household well-being. Based on these theories, rural electrification is assumed to exert positive impact on household well-being.

2.2.1 Rural Livelihood Approach

Rural Livelihood Approach encompasses the process by which households construct an increasingly diverse portfolio of activities, social support capabilities, and assets for survival or in order to improve their standard of living (Ellis, 1998). Off-farm income generating options include rural non-agricultural activities such as micro and small enterprises (OECD, 2007). Households typically diversify their livelihood activities by

engaging in more than one income-generating activity at the same time, by shifting between different activities over time, or by engaging in livelihood activities in different locations (Goulden *et al.,* 2013). In poor rural households, sometimes engaging in micro and small enterprises is primarily a means of survival, a way to temporarily deal with risk or to cope with the immediate effects of shocks and stresses (Assan, 2014).

Urbanization in sub-Saharan Africa is taking place without industrialization (Djurfeldt, 2015). In the absence of manufacturing industries and high-return service sectors to provide skilled nonfarm opportunities, prospects for increased employment and rising incomes in urban areas of SSA remain limited. Micro and small enterprise generating activities provide an important source of primary employment in the rural areas of most developing countries, and it is assumed that as farm size due to population pressure becomes smaller, the percentage of non-farm income becomes larger (Hilson, 2016). Micro and small enterprise activities have the potential to play a crucial role in reducing vulnerability to poverty by providing households with a form of insurance against the risks of farming and reducing reliance on natural resources (Simtowe *et al.,* 2016).

The rural livelihoods approach is essentially a micro policy analysis framework in which the assets are the devices in processes/activities that improve livelihoods. The framework comprises four blocks; the asset (resources) block, the livelihood mediating processes block or the conditioning factors block, the livelihood strategies and activities block, and the outcomes/effects block (Ellis, 2000) as illustrated in Figure 2.1.

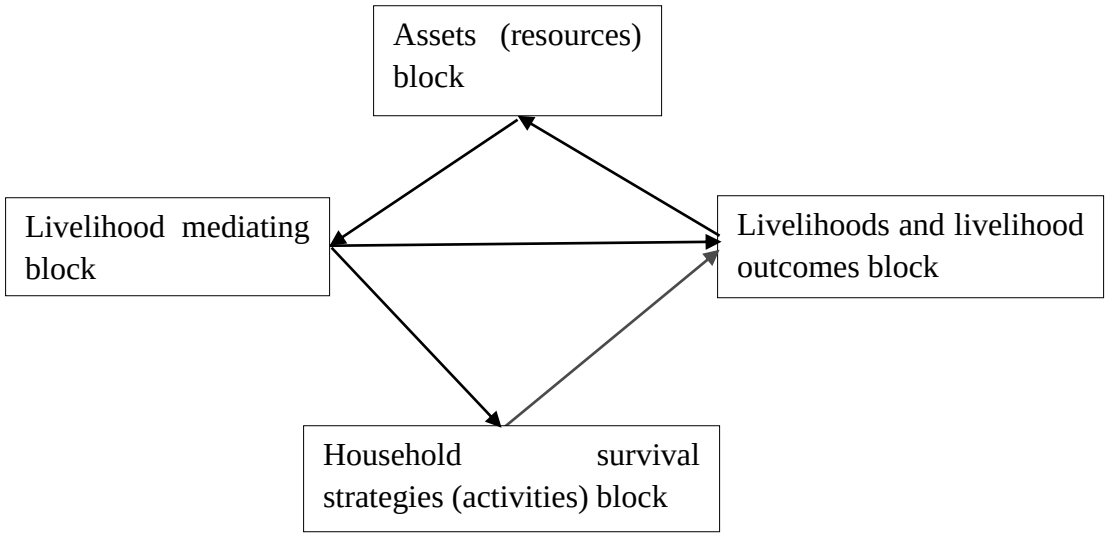

Figure 2.1: A Framework of Rural Livelihoods

Source: Author's formulation based on Ellis (2000)

The resources block comprises resources accessed in some way by the household. The term resources refer to stocks of capital that can be utilized directly or indirectly to generate livelihood of the household or to sustain its well-being at different levels above survival. Different types of resources are categorized and distinguished between five capital types as natural capital, physical capital, human capital, financial capital and social capital (Ellis, 2000). The resources block is the basic building block upon which households are able to undertake production, engage in labor markets, and participate in exchange with other households (Scoones, 2009). Financial capital is the financial resources that people can use to achieve the livelihoods that they are striving for while human capital refers to the skills, knowledge, ability to labor and good health that enable people to achieve their desired livelihoods (Flora & Flora, 2013).

The livelihood mediating processes block is characterized by factors that influence households' access to resources and pursuit of viable livelihoods. The mediating processes for livelihoods encompass the agencies that inhibit or facilitate the exercise of capabilities and choices by individuals and households (Ellis, 2000). For example, the cost of electricity installation and monthly bills at a particular moment in time comprise good determinants of access to affordable energy. The majority of rural households are disadvantaged in terms of ownership and control over livelihood resources, information and technology necessary for attainment of well-being (Godfray, Beddington, Crute, Haddad, Lawrence, Muir, Pretty, Robinson, Thomas & Toulmin, 2010).

Household survival strategies are the way that people act in order to achieve their desired livelihood for instance start-up of micro and small enterprises due to rural electrification (Ellis & Freeman, 2004). The identification of livelihood strategy groups are most commonly based on the share of income generated from different remunerative activities (Zenteno *et al*., 2013). Different Livelihood Strategies (LS) have different asset requirements but the general principal is that those sufficiently endowed with assets are more likely to be able to make positive livelihood choices (Carney, 1998). This implies that they can choose from a range of options in order to maximize their achievement of well-being rather than being forced into any given strategy as the only option (IFAD, 2012). Further to the above, through owning and using modern electrical equipment, business performance improves, a household's social status is dignified and well-being improved (Worku & Mekonnen, 2012).

The livelihood outcomes block is characterized by some combination of attributes related to the level and stability of rural household income as well as access of the household to social services and basic needs including education, health, water, shelter, and so on. This study assumes that rural electrification has a significant influence on rural household's ability to pursue meaningful livelihood strategies, to access other assets and consequently to attain well-being (Lee *et al.,* 2014). Socio-economic effects of rural electrification may produce welfare-enhancing livelihood outcomes and benefits for individuals, households, and the economy such as lower crime rates, improved

health, improved educational attainment, increased household income, improved economic performance and improved government efficiency. Moreover, the ability of a household to pursue a meaningful diversity of livelihood strategies depends on its asset endowment and its ability (in terms of socio-demographic characteristics) to combine them (Borras, Hall, Scoones, White & Wolford, 2011).

2.2.2 Capability Approach

Sen (1985) defines capabilities as what people are able to do or able to be - the opportunity they have to achieve various lifestyles and as a result, the ability to live a good life. Central to the capability approach is the concept of 'functionings'. This encompasses various states of human beings and activities that a person can undertake (Sen, 1979). Examples are; being well nourished, being housed in a particular kind of house, having obtained a specific education, being literate, consuming a specific amount of goods, choosing particular leisure activities, consumption of energy for heating, and participating in the labor market. Robeyns (2005) defines capability as a broad normative framework for the evaluation and assessment of individual well-being and social arrangements, the design of policies, and proposals about social change in society. Rural electrification is considered an integral part of the above listed 'functionings'. People have varying needs and will thus require different levels of resources in order to achieve the same standard of living. For example, additional costs associated with disability might mean that a disabled person requires a greater amount of resources to achieve the same standard of living as an able-bodied person (Sen, 2009).

Anand and Sen (1997) argues that economic inequality is not necessarily similar to income inequality. The reason for this is that knowledge about people's income in itself does not tell us about other things that matter for their well-being. People may be restricted in their choices as a result of discrimination, customs, moral codes, political regime, climate, infrastructure, transport, organization of health care, etc. This study focusses on rural areas that seem discriminated against in terms of electrification compared to urban areas. Sugden (1993) asserts that although Sen is not entirely clear in

some of his writings, a reasonable interpretation might be that a normative evaluation of well-being should depend upon both the individual's achieved "functionings' and his or her 'capability sets', where the 'capability set' represents the extent of freedom, whereas the achieved 'functionings' measure aspects of welfare other than freedom. The concept of freedom emphasizes the importance of empowering people to help themselves, and of focusing on individuals as the actors of their own development (Stiglitz, Sen & Fitoussi, 2009). This study focuses among others on how rural electrification enhances startup of new micro and small enterprises that leads to creation of more employment levels.

'Capability' refers to the real opportunity that we have to accomplish what we value. Capability is, thus, a set of vectors of 'functionings', reflecting the person's freedom to lead one type of life or another (Sen, 1992). Sen's capability approach is widely regarded to be at once novel and of substantive importance for the conceptualization of multidimensional poverty and well-being (Anand & Sen, 2008). The capability approach appreciates all changes in a person's quality of life: from knowledge to relationships to employment opportunities and inner peace, to self-confidence and the various valued activities. Rural electrification may bring about some of the above mentioned changes that are paramount to an improved household well-being. Sen has been clear that well-being influences the selection of relevant capabilities (Sen, 1984). The capabilities approach is an exceptional philosophy in that it has been operationalized to engage abstract concepts of human well-being and development with the values and experiences of the poor (Clark, 2005). To understand the concept of well-being, one needs to address 'functionings', that is, what MSE proprietors do with electricity supplied in order to enhance their household well-being (Todaro & Smith, 2010).

Additional principles or procedural considerations such as equity, efficiency, stability across time, sustainability, voice and participation, as well as additional information, for example pertaining to human rights and responsibility, might also be considered in an evaluation that fully reflects the capability approach (Sen, 2000). Sen argues that, in analyzing well-being, we should shift our focus from 'the means of living', such as income, to the 'actual opportunities a person has', namely their 'functionings' and

'capabilities' (Sen, 2009). Well-being is best understood in terms of capabilities; that is, a person's ability to do and to be the things he/she has reasons to value (Sen, 2000). Therefore, the higher the level of a person's capabilities, the higher is the level of his/her well-being. The capabilities approach can be used to evaluate several aspects of people's well-being, such as inequality, poverty, the well-being of an individual or the average well-being of members of a group.

From a capability perspective, poverty that has an influence on well-being is viewed as the deprivation of certain basic capabilities, and these can vary from such elementary physical ones as being well nourished, being adequately clothed and sheltered, avoiding preventable morbidity, and so forth, to more complex social achievements such as taking part in the life of the community, being able to appear in public without shame, and so on (Sen, 1995). Nussbaum *et al*. (2012) argues that the central capabilities are the ones that a minimally just society will endeavor to nurture and support. They are not instrumental but have a value in and of themselves and are part of a well lived life and without them we cannot properly flourish. The capabilities approach is, then, an explicitly normative philosophy, aiming to increase social justice for oppressed groups (Sen, 2009; Nussbaum *et al*., 2012). By evaluating how people are actually able to live, what they can actually do and be, and capabilities develops an objectivist account (Sayer, 2011).

Amartya Sen championed the idea that the goal of development should be an expansion of freedoms: having the capability to access health and welfare services, having political, civil, and economic rights, having the ability to feed oneself, and having the opportunity to pursue education (Haslam *et al.*, 2012). This theory helped the researcher in understanding the critical role of capabilities under which household well-being fall. This is the ability of members of households being well nourished, being housed in a particular kind of house, having obtained a specific education, being literate, choosing particular leisure activities, consumption of energy for heating, and participating in the labor market. In addition the theory was useful to the researcher in appreciating that rural electrification enable proprietors of MSEs to acquire skills from participation in

business activities and group trainings that are fundamental to addressing well-being issues.

2.2.3 Social Exclusion Theory

The idea of social exclusion focuses attention on the processes (Room, 1995) by which poverty or disadvantage occurs. Increasing attention has been paid to the possible relevance of the concept to social policy analysis in developing countries, and it is widely adopted by development agencies and in development studies as another way of understanding and reducing poverty and enhancing well-being. Sen (2000) argues that the idea of social exclusion needs to be examined in relation to its utility in providing new insights in understanding the nature of poverty and well-being, identifying causes of poverty, contribution to thinking on policy and social action in alleviating poverty. Social exclusion is a broader concept than poverty, encompassing not only low material means but the inability to participate effectively in economic activities like micro and small enterprises, social, political and cultural life and in some characterizations alienation and distance from mainstream society (Duffy, 1995).

Todman (2004) explains that social exclusion is a consequence of the discriminatory decisions and actions undertaken by a society's political and economic elite who, by acting in their own self-interest exclude the other members of society, for instance, inadequate access to affordable energy in rural areas. Such powerful class and status groups, which have distinct social and cultural identities as well as institutions, use social closure to restrict the access of outsiders to valued resources such as employment, income, education, electricity, healthcare, good nutrition among others. The excluded proprietors of micro enterprises are unable to remedy their disadvantage because they are unable to enforce political, economic, social, and other rights that undergird inclusion.

Social inclusion on the other hand has been defined as a process in which those at risk of poverty and social exclusion gain the opportunities and resources that are needed to fully

participate in societal activities (Frazer & Marlier, 2013). In this study, adequate income, employment healthcare and skills and knowledge gained after electrification, have been treated as key means to tackle social exclusion, poverty and inequality that may finally enhance well-being of proprietors of MSEs. Social inclusion has also been seen as a foundation for shared prosperity that characterizes the process of improving abilities, opportunities and dignity of the poor through access to markets and services (World Bank, 2013). Spatial inclusion has been defined as a goal of connecting people to assets and goods regardless of their location for instance rural areas and is argued to be critical for poverty eradication, inclusive growth and improved household well-being (AfDB *et al*., 2014). Social inclusion has also been referred to as the endpoint of overcoming social exclusion, where social exclusion is characterized by the involuntary exclusion of individuals and groups from society's political, economic and societal processes, which prevents their full participation in the society in which they live (UNDESA, 2010).

Social exclusion is a short-hand term for what can happen when people or areas face a combination of linked problems, such as lack of electricity, poor healthcare, unemployment, discrimination, poor skills, low incomes, poor housing, high crime and family breakdown (Social Exclusion Unit, 2004). The extent of social exclusion calls on the responsibility of society and or government to ensure equal opportunities for all. This includes equal access to cheap energy, to the labor market, to education, to healthcare, to the judicial system, to rights and to decision-making and participation (Saraceno, 2002). Risk factors assumed to be associated with social exclusion are low income, unskilled labor, poor health, immigration, low education level, school dropout, gender inequality, discrimination, old age, divorce, drug abuse and alcoholism (European Commission, 2002). Low income and lack of labor participation are generally seen as the main risk factors for social exclusion (Saraceno, 2002). This study sought to address skills and knowledge application, access to healthcare, employment status and income level that are among the risks of social exclusion.

Hulme and Shepard (2003) note that those who are poor for at least five years or more are very unlikely to escape social exclusion. Exclusion dynamics are not as precise as

this, but numerous studies of people who are unemployed for a year or more document the increasing difficulty they experience in ever finding a job again. Both chronic poverty and social exclusion approaches are context-dependent and take institutional and cultural variation into account. According to Green and Hulme (2005), what constitutes ‘poverty,’ is neither obvious nor universal. Poverty is a consequence of lacking a social or institutional safety net during adverse events or periods of increasing needs over the life course.

Silver (1995) defines three paradigms of social exclusion: the 'solidarity' paradigm, which is concerned with the failure of a society fully to incorporate all its members as social participants; the 'specialization' paradigm, which is concerned with the difficulties an industrialized society can have integrating some of its members into its complex division of labor; and the 'monopoly' paradigm, which is concerned with the way dominant classes in society mobilize so as effectively to exclude subordinate classes. Jordan (1996) extrapolates from a version of economic club theory to argue that - from the level of the global clubs established by rich nations (such as the G7 or the European Union) down to the level of local amateur sports and social clubs - the world is divided into competing and mutually exclusive communities or clubs: clubs, which by regulating competition among their own members can mobilize more effective competition against rival clubs. Social exclusion theory was used by the researcher to explain how lack of electricity excludes proprietors in rural areas from using this vital resource in enhancing income, employment, healthcare, knowledge and skills. This theory however, helped to appreciate that rural electrification is treated as a key means to tackle social exclusion, poverty and inequality that may finally enhance well-being of proprietors of MSEs.

2.2.4 Resource-Based Industrialization Development Theory

Lewis (1938), writing on the birth of the workers' movement in the Caribbean, advocated the need for industrial development based on the utilization of local raw materials. In the mid-1990s, Sachs and Warner conceptualized this perspective into what is known as the ‘resource curse’ hypothesis. This concept has been supported by data

analysis across a large sample of countries which shows, in many cases, negative correlations between resource intensity and indicators of economic performance such as rates of growth, investment, and human capital (Van Der Ploeg, 2011). Fagerberg, Mowery and Verspagen (2009) argue that successful long-term economic growth of developing countries may be closely linked to dynamics within resource-based sectors of the economy.

Rather than looking at natural resources' abundance as an obstacle (e.g. the resource curse literature), resource-based industrialization (RBI), through technological change, can be seen as a window of opportunities for generating employment, creating wealth and ensuring well-being for resource-dependent countries (Perez, 2015). RBI can work both as a path to economic growth and development (Perez, 2016) and as a way to escape the resource curse (Joya, 2014). Perez *et al*. (2014) argued that natural resource industries experienced a transformation process that shed light on sectors that are now considered a pool of opportunities in terms of technology and innovation. The Information and Communication Technology (ICT) revolution has provided new potential for NR to support innovation and learning both upstream and downstream (Perez, 2010). Moreover, the fragmentation of production changed local interactions' dynamics and challenged traditional trends: for example, the tradition to process NR close to the users (advanced economies) could change in favor of a proximity to the source if and when the countries at the source have the ability to process in a competitive and innovative way (Perez, 2016).

RBI considers diversification as a path dependence process with several constraints imposed by past technological achievements (Andersen *et al*., 2015). There is consistent evidence of 'synergetic links' between NR and the manufacturing sectors who's restructuring at a global level reinforced the scope for linkages' development (Morris *et al.,* 2012). Stemming from the global value chain analysis, Kaplinsky (2011) shed light on the fact that global linkages (Gereffi *et al*., 2005) have to be combined with local linkages' activation in order to have both qualitative and quantitative development.

2.3 Conceptual Framework

A conceptual framework is a thinking schema through which different aspects of research project are organized and their presumed relationships are constructed with the aim of guiding a researcher throughout the process and position him in relationship to the research in terms of theoretical and ideological inclination (Holliday, 2007). A conceptual framework lays out the key factors, constructs, or variables, and presumes relationships among them (Miles & Huberman, 1994). A conceptual framework is structured from a set of wide-ranging ideas and theories that help a researcher to properly identify the problem they are looking at, frame their questions and find suitable literature (Smith, 2004).

This study was guided by four independent variables and one moderating variable representing rural electrification that influence household well-being among proprietors of micro and small enterprises in rural Kenya. For this study, effect of rural electrification is confined to skills and knowledge application (Kulkarni & Barnes, 2017), access to healthcare (World Health Organization, 2014), income level (Grogan & Sadanand, 2013) and employment status (Lipscomb, Mobarak & Barham, 2013). Electricity supply (Millien, 2017) was used as a moderating variable. The conceptual framework for this study is shown in Figure 2.2.

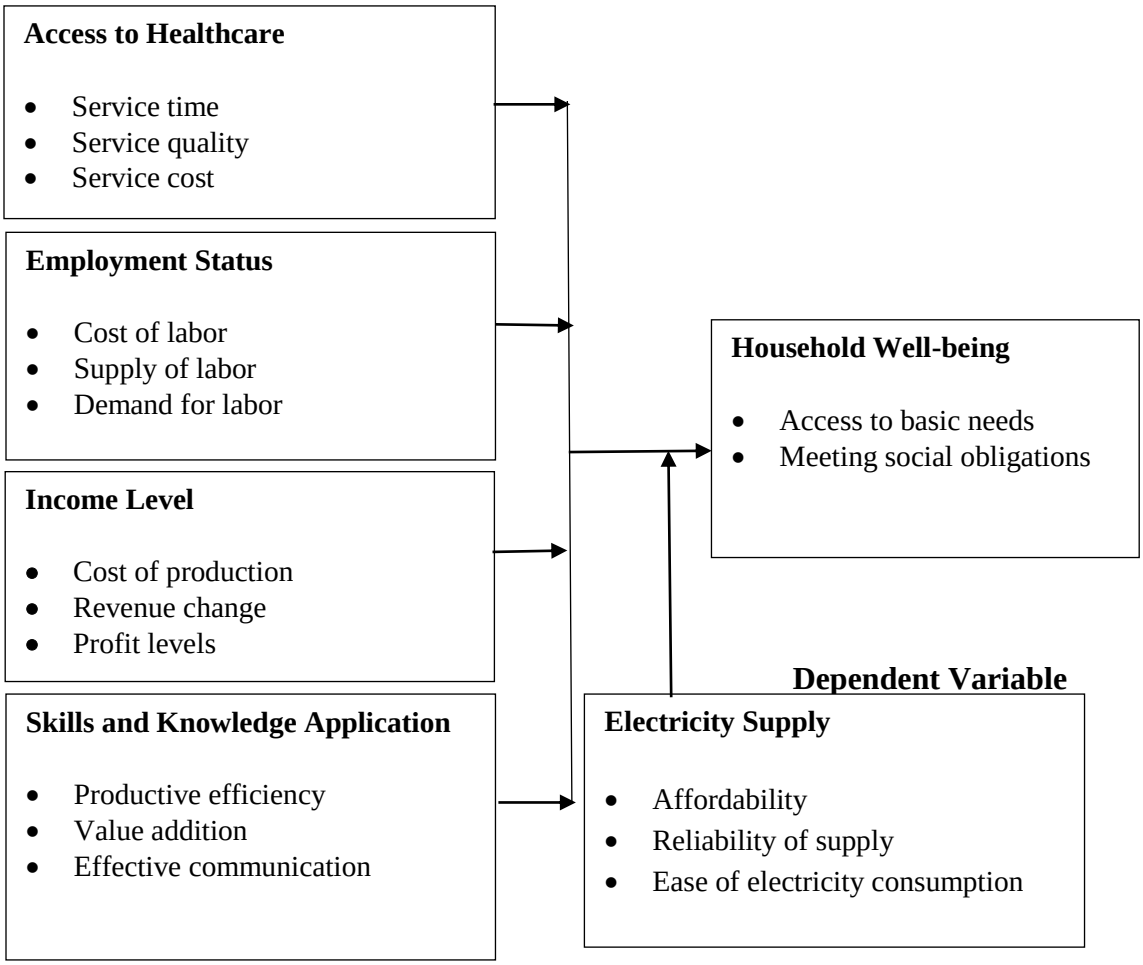

Figure 2.2: Conceptual Framework

2.4 Review of Variables

2.4.1 Access to Healthcare and Well-being

According to World Health Organization, access to healthcare is the degree to which healthcare services are available to as many people as possible. Health facility expansion

to the community level as a result of electrification enhances access to healthcare (WHO, 2015). Rural electrification makes health facilities to be strategically available reducing the distance travelled to seek medical services. These facilities must be strategically located, offer uniquely affordable services, universally acceptable, adequately available and evenly distributed to easily access healthcare services (Noor *et al*., 2006). Availability of utility services such as electricity and water is imperative for the functioning of a health facility, and is an important determinant of effective delivery of essential health services (WHO, 2015). According to Energypedia (2014), if the cold chain is inoperable when supplies arrive, vaccines, blood, and other medicines may go to waste. If a clinic is without lights, patients arriving at night may be forced to wait until morning to receive healthcare.

Electricity access in healthcare facilities increased by 1.5% annually in Kenya between 2004 and 2010, and by 4% annually in Rwanda between 2001 and 2007 (Adair-Rohani, Zukor, Bonjour, Wilburn, Kuesel, Hebert, & Fletchera, 2013). In Cuba, 170 rural clinics provided with electricity saw improvements in both quality of life and infant mortality (GVEP, 2013). The systems provided included lights, a vaccine refrigerator, and other key pieces of equipment including electrocardiographs and x-ray machines. The use of radiant warmers for newborn care, cold chain storage for vaccines, and nighttime deliveries are all dependent on the availability of reliable power. World Health Organization and the World Bank maintains that besides improving the direct functionality of health facilities, access to electricity is equally instrumental in attracting and retaining skilled health workers, especially in rural areas (WHO, 2015).

Health facilities with electricity may be better positioned to attract and retain skilled health workers, especially in rural areas (WHO, 2015). In Tanzania there are health facilities with no single health worker and one of the contributing factors is the unavailability of energy. Recorded cases show that health workers choose to even quit employment when they are assigned to work in remote rural areas where energy is a problem (IEA, 2014). A study of South African doctors listed better accommodation as

one of the three most important factors that would influence them to remain in a rural area (WHO, 2010).

From the few studies that have been carried out, it can be seen that electricity may have a significant impact on some key health service indicators such as: prolonging night-time service provision; attracting and retaining skilled health workers to a facility; and providing faster emergency response, including for childbirth emergencies (WHO, 2015). Poor energy infrastructure can affect the quality of service: for example, reduced operating hours resulting in an un-served population, reduced capacity for lab tests, night-time safety concerns and decline in staff morale (USAID, 2012). A project in Columbia provided electricity for four rural communities to provide health care services by powering vaccine refrigeration, lighting, communications, and medical appliances. Services were noted to have improved with increased vaccine coverage, more rapid malaria diagnosis and improved lighting for night visits. Opening hours were increased in Bangladeshi and Kenyan clinics with electricity. In the case of Bangladesh this was 7.1 hours with electricity and 6.1 without, and in Kenya, 15.1 hours with electricity and 11.0 without (GVEP, 2013). Impact assessment for rural health facilities electrification for Uganda, found that the use of electricity at health clinics enhances the delivery of medical services through the provision of quality light for use during treatment of night time emergencies, emergency deliveries and for security purposes (Energypedia, 2014).

The powering of emergency medical equipment, storage of blood and vaccines, and performing of basic health procedures, especially after dark, are all contingent on reliable electricity supplies (Van Leeuwen, 2014). The provisions of reliable, secure and affordable energy services are central to addressing many of today‘s global development challenges including poverty, inequality, climate change, food security, health and education as well as wealth creation and economic development (Bazilian, Nussbaumer, Rogner, Brew-Hammond, Foster, Pachauri & Williams, 2011). Furthermore, electricity can improve food quality and nutrition through cooking and refrigeration (World Bank, 2015).

Suhlrie, Bartram, Burns, Joca, Tomaro and Rehfuess (2018) carried out a data assessment on the role of energy among health facilities in Malawi. Based on extensive literature searches and iterative discussions within the research team, they developed a conceptual framework that was used to explore how characteristics of electricity supply affect distinct energy uses in health facilities (e.g. lighting), and how functional or non-functional lighting affects the provision of night-time care services in Malawi. The study applied descriptive statistics and conducted logistic and multinomial regressions using data from the Service Provision Assessment (SPA) of the Demographic and Health Surveys (DHS) for all health facilities in Malawi in 2013/2014. The conceptual framework depicted the pathways from different energy types and their characteristics, through to distinct energy uses in health facilities (e.g. medical devices) and health-relevant service outputs (e.g. safe medical equipment). The study revealed that the outputs can improve outcomes for patients (e.g. infection control), facilities (e.g. efficiency) and staff (e.g. working conditions) at facilities level and, ultimately, contribute to better population health outcomes.

Chen, Chindarkar and Xiao (2019) examine the effect of Jyotigram Yojana (JGY), a rural electrification program providing 24-h electricity to rural non-agricultural users in Gujarat, India, on core components of health systems including health facilities, health information, and health services utilization. The study matched data from the District Level Household and Facility Survey (DLHS-II and DLHS-III) and administrative data from electricity distribution companies on JGY implementation. They then apply a difference-in-differences framework to address potential bias in JGY implementation by comparing the sample from Gujarat (treatment group) with that from Maharashtra (control group). The study found that JGY implementation significantly improved the operational capacity of health facilities, in particular primary health centers (PHCs), by increasing the availability and functionality of a wide range of essential devices and equipment. JGY also significantly increased access to health information through television. Further, JGY increased utilization of health services; in particular, it increased the probability of children receiving critical vaccinations and pregnant women

receiving antenatal care. The study concluded that reliable electricity can be an effective tool in improving core components of health systems.

Adair-Rohani, Zukor,Bonjour,Wilburn, Kuesel, Hebert and Fletchera (2013) conducted a systematic review of available national data on electricity access in health care facilities in sub-Saharan Africa. They identified publicly-available data from nationally representative facility surveys through a systematic review of articles in PubMed, as well as through websites of development agencies, ministries of health, and national statistics bureaus. They identified 13 health facility surveys from 11 sub-Saharan African countries. On average, 26% of health facilities in the surveyed countries reported no access to electricity. Only 28% of health care facilities, on average, had reliable electricity among the 8 countries reporting data. Among 9 countries, an average of 7% of facilities relied solely on a generator. Electricity access in healthcare facilities increased by 1.5% annually in Kenya between 2004 and 2010, and by 4% annually in Rwanda between 2001 and 2007.

2.4.2 Employment Status and Well-being

The labor market participation outcomes that researchers have focused on are employment, hours worked, and wages (Lipscomb *et al*., 2013; Dinkelman, 2011; Khandker *et al*., 2012; Grogan & Sadanand, 2013; Khandker *et al*., 2013). Rural electrification is expected to affect labor market participation through three potential channels: first, household electrification frees up women's time spent in collecting and preparing fuel, and increases the productivity of household tasks through improved technology. It therefore increases labor supply and results in more engagement in market based work (Dinkelman, 2011; Grogan & Sadanand, 2013). Second, having access to electricity creates opportunities to generate income within the home and allows for new types of jobs outside the home, thus potentially increasing self-employment and labor demand (Van de Walle *et al*., 2013). Third, a shift from agriculture-based to non-agriculture-based activities that are associated with growth in productivity and thus,

increases in income (Torero, 2015). This is specifically relevant to rural Kenya, which is a predominantly an agricultural economy.

The arrival of electricity allows the household to reallocate labor away from household tasks and towards formal wage labor (Dinkelman, 2011; Van de Walle *et al*., 2013). The provision of rural infrastructure, including water, electricity, roads, health care and other social services, to reduce women's unpaid care and household work, are a precondition for women's business creation and labor market participation (UN Women, 2015). In lower-income countries, inadequate access to water supply, sanitation, electricity, roads, safe transportation, health care and other social care services is a key factor in explaining the amount of time spent by women on unpaid work (ADB, 2013). Dinkelman (2011) finds a positive impact of electrification on women's employment in South Africa. Fedderke and Bogetic (2006) asserts that electricity access is positively related to labor productivity and total factor productivity growth and household well-being in South Africa. Access to electricity not only releases people from hard work, but also increases productive working hours and provides opportunities for self-employment, in particular for women in rural areas (Dinkelman, 2011).

According to Jimenez (2017), access to electricity leads to a 25% increase in labor market participation on average, with a median of 20%. He also suggests systematic differences by gender, with women tending to benefit more in terms of labor market participation. The growing informal economy is manifested in increase in household business of which female business comprise a big part. This has led to increase in the labor force participation of females as self-employed business owners (Coad & Tamvada, 2012). Using household data from Nicaragua, Grogan and Sadanand (2013) investigated rural electrification's effect on labor market participation. They found that agricultural activities decline significantly, while non-farm salary work increases. In particular, women in rural areas have a high probability of taking up work outside their homes. Electricity may change work opportunities in rural areas, by stimulating the growth of new firms that create jobs outside the home. Quite apart from this, electricity may directly create jobs within households by enabling the production of new goods and

services for the market. In this way, household electrification could unleash previously unrealized demand for labor and an increase in market work (Dinkelman, 2011).

It is worth noting that electrification could work against education by working in favor of productive enterprise and employment. A study by Squires (2015) in Honduras found that electrification reduces educational attainment. The reduction was accompanied by an increase in childhood employment, suggesting that improved labor market opportunities, due to electricity access, led to increased dropout rates. Shah and Steinberg (2013) present evidence that increases in labor market opportunities reduce childhood educational attainment in a wide variety of settings. Increased adult employment drives children to stay at home to compensate for parents going off to work (Squires, 2015). While it may be desirable for adult household members to work more to earn money, it is less desirable for adolescents to use their time in this way, especially if labor market participation crowds out school attendance and enrolment (Aevarsdottir, Barton, & Bold, 2016).

Government of Kenya (2004) confers that micro and small enterprises (MSEs) sector accounted for 30% of the GDP and for over 90% (about 500,000) of new jobs created outside agriculture in 2003. In view of this, start-up and growth of MSEs for employment creation and enhanced household well-being is a key and explicit assumption of virtually every rural electrification program on the continent. Rural areas remain to be the home to the bulk of Kenya's population and similarly the hub of micro and small enterprises. To seize this opportunity, Kenya has developed a national policy aimed at building the capacities of micro and small enterprises through the rural electrification projects (Abdullah & Markandyab, 2012). According to Khandker, Hussain, Rubaba and Douglas (2012), the role and intent of electrification programs is not only to provide access to electricity but also to improve the overall well-being of people.

Chaieb and Ahmed (2011) conducted a study seeking to identify whether community perceptions affects rural electrification in parts of Tunisia. The study was conducted

using participatory rural appraisals (community interviews and investigations) to discover the perceived benefits of introduced access to electricity in Tunisian communities. Linkages were discovered between rural electrification and the areas of education, basic health, family planning, and women's reproductive health. Many families had purchased (and now consistently watch) televisions, which prompted intellectual expansion, expose women to political happenings, and introduce families to messages concerning personal hygiene and health. Findings revealed that communities' perception increased economic opportunities for women, who were choosing to sew or open hair-salons at home rather than travel to cities in search of employment.

Lipscomb *et al*. (2013) investigated the long-run effects of the expansion of electricity network in Brazil on economic development at the County level during 1960 – 2000 period. Similar to Dinkelman (2011), they both use an exogenous program placement instrument to identify the impacts. The studies found significant effects on the Counties' Human Development Index and average housing value as a proxy for enhancements in living and working conditions. They identified positive effects of electricity access on employment and income as well as literacy and school enrolment.

Amoah and Amoah (2018) carried out a study to investigate the role of micro small and medium enterprises (MSMEs) to employment in Ghana. The study adopted the methodology employed by Ghana Statistical Service (GSS) to undertake a nationwide survey on the Integrated Business Establishment Survey II (2016). It was revealed from the study that the MSMEs in Ghana offered employment of about 82 percent to the working population in the country with marked differences in the regions. Out of the employment offered by MSMEs in Ghana, about 81 percent was for permanent whilst 86 percent was for temporary employment. The study also revealed that the micro enterprises employed larger percentage of the working population than the small and medium enterprises.

Dinkelman (2011) estimates the impact of electricity provision in rural areas of South Africa during 1990-2007. She takes advantage of the roll-out of an electrification

program done by ESKOM, the electricity utility. Between 1993 and 2003, about 470,000 households were electrified. Program placement was not random so the author uses community level data and relies on instrumental variables and fixed-effects strategies to uncover their parameters of interest. In particular, she uses land gradient as an instrument for program placement and then adopts a fixed-effects estimator to remove time-invariant unobservable that may jointly affect program placement and employment. Her results indicate that electrification leads to an increase in female employment in both the extensive and intensive margin and that women's wages fall while male earnings go up.

Libscomb et al. (2013) analyze the effects of electrification on the Human Development Index (HDI) using county-level data from Brazil. The authors also rely on geographic characteristics to adopt an IV approach. More specifically, they simulate how the electricity grid would have evolved if its expansion had only taken into account geographic cost considerations (water flow and river gradient), ignoring demand-side considerations. Then, they use this forecast as an instrument for actual program placement. Their results indicate that electricity provision is associated with higher levels of HDI. Moreover, their analysis suggests that migration is unlikely to account for the large magnitude of development gains observed. They also estimate large, positive effects of electrification on employment, salaries, and investments in education, but not health.

Dasso and Fernandez (2015) study the effects of a rural electrification program on employment in Peru. Taking advantage of the program's roll-out across districts over time. They adopt differences-in-differences and fixed-effects strategies to estimate the impact of electrification on labor market outcomes. The results reveal that, among males, the program increases hours of work and diminishes the likelihood of having a second occupation. Among females, the treatment raises employment and earnings and increases the probability of working outside the agricultural sector.

2.4.3 Income Level and Well-being

There are numerous ways in which rural electrification might affect income of newly connected households spanning from direct effects through home business activities to better job prospects in newly connected enterprises in the locality (Torero, 2015). A considerable number of research suggests that household access to electrification enhances household well-being through providing income generation opportunities, alleviating poverty, improving children's health, reducing instances of child labor, and improving status of women and girls (Grogan & Sadanand, 2013). Although a causal relationship between the electrification process and income cannot be inferred, a correlation between them can be noticed (IPEA, 2013).

Reliance on generators for electricity during outages can be expected to increase the cost of electricity, and the effect on cost-competitiveness is related to the proportion of total costs accounted for by electricity leading to reduced firm income (Scott, Darko, Lemma & Rud, 2014). Firms created after electrification, amongst them some highly dependent on electricity for their operations, exhibited profits that are considerably higher than non-connected firms (Peters, Vance, & Harsdorff, 2011). Indirect benefits ensuing the well-documented encouraging association between income and education (Khandker *et al*., 2012) implies better levels of household income leading to greater enrollment rates and better outcomes.

Some empirical studies (Khandker *et al*. 2012; Khandker *et al.* 2013) show that electricity access boosted household employment, or income, or both, but they do not identify the actual productive activities that generated these results. In the Philippines, a study in four provinces found 25% of households in the electrified areas are running a home business (mainly small retail shops) compared to 15% in non-electrified areas (ESMAP, 2002). Electricity and its reliability are amongst several considerations when MSEs make investment decisions to enhance productivity (Scott, Darko, Lemma & Rud, 2014).

An evaluation of Word Bank-assisted rural electrification projects in Asia indicates that rural electrification in Bangladesh and India enhances non-farm income, thereby significantly enhancing household well-being (Songco, 2002). A study conducted in Bhutan by the Asian Development Bank (2010) also found positive effects of electrification on non-farm income but not on farm income. Non-farm incomes of electrified households were found to be 50-72 % higher than those of non-electrified households, but these accounted for only 21-29 % of household income. On average, incomes for home businesses using electricity are higher than those who do not use electricity (Energy Sector Management Assistance Program, 2002).

A study of the impact of rural electrification on household income in India by Chakravorty, Pelli and Marchand (2012) found that the reliability of electricity supply is more important than being connected to the grid. In Nigeria where 40% of electricity consumed is produced through own-generation, firms spend up to 20-30% of initial investment on measures to enhance the reliability of electricity supply (Alby, Dethier, & Straub, 2011). Grimm, Lange and Lay, (2011) found that tailors in Burkina Faso with access to electricity have revenues 51% higher with an improved household well-being than tailors without electricity, and attribute this to the use of electric sewing machines and longer working hours.

Chakravorty, Emerick, and Ravago (2016), find that the arrival of electricity in the last ten percent of non-electrified villages in the Philippines increased household income and expenditures by 42 and 38 percent, respectively. But not all studies reach this conclusion. In rural Kenya, Lee, Miguel, and Wolfram (2016) estimate experimental demand and cost curves suggesting that rural electrification reduces welfare. Similarly, Burlig and Preonas (2016) estimate the effects of India's national electrification program, which increased access to electricity in 400,000 villages, and find close to no effects on labor markets, asset ownership, housing characteristics, and village-wide outcomes.

Using Chinese data from 1970-97, Fan, Zhang and Zhang (2002), show that, for every 10,000 Yuan spent on electricity development, 2.3 persons are brought out of poverty hence improved household well-being. Balisacan, Pernia and Asra (2002) did a similar analysis for Indonesia in 1990 and concluded that a 10 percent improvement in access to a composite technology measure (including electricity in a village) raised the income of the poor by roughly two percent. Escobal and Torero (2005) also conducted similar assessments for Guatemala and Peru and drew very similar positive conclusions on the gains from electrification. One exception to these findings is a study by Fan, Jitsuchon and Methakunnavut (2004) in Thailand. Their results show that out of different types of public investments (irrigation, rural education, road infrastructure and electricity infrastructure), investments in rural electrification has the largest poverty reduction impacts.

Based on data from the World Bank second and third Rural Electrification Projects in Bangladesh and the Bangladesh Rural Electrification and Renewable Energy Development Projects, Songco (2002) asserted that areas which were targeted under a rural electrification project had incomes 50% higher than in control areas, 22% of which has been attributed to electrification. Firms established after electrification may be new types of business, offering goods and services that were previously imported from elsewhere or simply been unavailable (Mayer-Tasch, Mukherjee & Reiche, 2013). Diversification to nonfarm livelihood strategies rather than relying only on subsistence farming enables rural households to have better incomes, enhance food security, increase agricultural production by smoothing capital constraints and also to better cope with environmental stresses (Hoang *et al*., 2014). The creation of new, often informal, home-based businesses induced by access to electricity has been analyzed in a number of countries using data from household surveys. Some of these studies find positive correlations between electrification and numbers of MSEs (Attigah & Mayer-Tasch, 2013).

Using household data from Nicaragua, Grogan and Sadanand (2013) explored rural electrification's effect on labor market participation. They discovered that agricultural

activities decrease considerably, whereas non-farm salary work rises. Specifically, women are more likely to take up work outside their homes in rural areas. Khandker *et al*. (2013) study a World Bank rural electrification program in Vietnam implemented during 2000 to 2005 period. Using a two-period household panel data with an electrification intervention that affected some of the sample in between the two surveys, they investigated income-related and educational outcomes with a fixed effects model. They found out that various income measures were positively affected: agricultural and non-agricultural income, salaries, and expenditures. For both boys and girls, school enrolment and total years of schooling improved.

A study of rural electrification in Southern Uganda by Neelsen and Peters (2013), explored its impact on fishing communities near Lake Victoria and did not find any significant difference between communities with or without access to electricity. No evidence was found for an expansionary effect of electrification on either firm profits or worker remuneration. The average monthly expenditure on energy in the non-access areas was 38% higher than in the access areas. Access to the grid also led to a shift in the composition of the capital stock towards more electricity using machinery and equipment. However, the availability of electrical equipment did not trigger an expansion in manufacturing activities.

Bose, Uddin and Mondal (2013) conducted a study targeting at evaluating the impact of electricity availability on the operation and productivity of MSEs in the rural areas of Bangladesh. The results were based on a study from a survey carried out in two electrified villages in Paikgacha, Khulna. The study identified favorable changes on the production costs, profit margin, development and modernization of business, women empowerment, quality of life, and human development due to the electrification.

Peters, Vance and Harsdorff (2013) investigated the impact of electricity on the productivity of micro-enterprises by comparing the performance of firms in grid-covered and non-covered villages in Northern Benin. The study used firm-level data while the empirical analysis employed Propensity Score Matching techniques. Findings revealed

that beneficial impacts are found from firm creation after electrification, firms that existed before showed an inferior performance compared to their matched counterparts from a non-electrified region. However, the performance gap was insignificant.

Khandker *et al*. (2012) used a large cross-sectional household survey in Bangladesh to study effects of electricity access on income, expenditures and investments into education. They observed quite a substantial increase in income and expenditures as well as completed schooling years for both girls and boys. Another pointer they examined is the study time of school children at home, which is often mentioned as an early sign for investments into education caused by electrification. The transmission channel is the facilitation of reading at night through quality lighting. In fact, they find that school boys study around 22 minutes more and girls around 12 minutes more per day as a result of electrification.

Sultana, Hossain and Islam (2015) carried out a study to investigate the state of income diversification and its impact on households' wellbeing in the rural areas of Bangladesh. A multi-stage random sampling technique was used to select 138 households from the study area. Simpson Index of Diversity (SID) was calculated to measure the level of income diversification while household consumption expenditure was used for measuring the level of well-being. A multiple regression model was employed to determine the factors affecting households' wellbeing. The findings of the study indicate that the extent of income diversification was very low in the study area and it had positive and significant effect on households' wellbeing. The study suggested development of rural infrastructure and improving information facilities in rural areas to enhance income diversification.

2.4.4 Skills and Knowledge Application and Well-being

The skills and knowledge of business proprietors mainly achieved through interaction with electronic equipment due to electrification can impact the path to business success, it aids the process of building absorptive capacity of enterprise owners such as

confidence, psychology, knowledge and skills. Educated people are creative and innovative and they are always looking for something unique to fulfil a need or want (Chowdhury *et al*., 2013). It is widely recognized that necessary skills and knowledge (which may be achieved through use of computers and machines) positively influences managerial decisions that enhances business development opportunities. This implies that additional business owners and employees using internet and computers have the prerequisite skills, self-restraint, enthusiasm, information and confidence to attain optimum growth rates in their businesses; and are more likely to perceive and seize business opportunities to enhance performance (Ucbasaran *et al*., 2008).

According to Maheran and Khairu (2009) successful businesses seem to be those that persistently put prominence on skills and knowledge of employees, instead of assets, such as machinery. They further asserted that highly-experienced and skilled individuals are required to expedite delivery of high value-added goods and services together with the competences to build consumers' trust and confidence. Chang, Gong and Shum (2011) avers that both hiring and training multi-skilled core customer-contact employees have significant and positive effects on incremental and radical innovation among hotel and restaurant businesses. Rural electrification may herald purchase of learning aids such as computers, television, mobile phones among others that enhance people's skills and knowledge.

One of the success factors in small business is the knowledge level of the owner, which can assist the business to survive and manage a complex environment and maintain the profitability of the business (Radipere & Dhliwayo, 2014). The World Bank distinguishes three channels through which electrification may affect education: time allocation at home, with increased study time; by improving the quality of schools, either through the provision of electricity-dependent equipment, or increasing teacher quantity and quality; and through the availability of television which may have educational and informative benefits (IEG, 2008). Human capital obtained based on knowledge and skills has been shown to be one of the strongest drivers of business performance (Unger, Rauch, Frese & Rosenbusch, 2011). A more highly educated

working population increases the supply of human capital that is associated with more productivity and innovation (Gennaioli, La Porta, Lopez-de-Silanes & Shleifer, 2013). Firms that are young or even new and using electricity dependent appliances (Van Praag & Versloot, 2008), benefit from the presence of an educated workforce and/or educated consumers.

Acquired knowledge and skills has been put forth, besides consumer wealth as an important factor affecting preferences for variety and innovative products and services (Witt, 2001). Preferences for variety or differentiation have a positive effect on business opportunities through the demanded development of new and alternative products and services in new markets (Wennekers, Van Stel, Carree & Thurik, 2010). This may imply that a population with a higher level of education attracted in rural areas as a result of rural electrification leads to more differentiated consumer demand and to a higher level of demand for new and innovative products and services. Both consumer wants and consumption knowledge become more detailed and induce specialization in consumption (Witt, 2001) and may thereby shape the demand for innovation.

Mulugeta, Fisseha and Mengesha (2016) analyzed the perception and competency among MSEs of the Dire Dawa Administration, Ethiopia, towards business, technical, entrepreneurial and interpersonal skills. Descriptive statistics was used to determine the perception and competency among MSE's of the Dire Dawa administration towards set of skill required for success. T-test was also applied to measure whether there was a significant difference between the mean scores of the two samples. The finding of descriptive statistics indicates that among the different set of skills, technical skills were perceived as more important for MSE's success followed by interpersonal skills, entrepreneurial and business skills. The finding of T-test reveals that there was a significant skill difference between successful and unsuccessful enterprises MSE's in DDA.

Fatoki (2014) investigated the level of financial literacy of the owners of new micro-enterprises in South Africa. The study used financial planning, analysis and control,

book-keeping, understanding of funding sources, business terminology, finance and information skills, use of technology and risk-management to measure the financial literacy of entrepreneurs. The results suggested a low level of financial literacy by the owners of new microenterprises. Recommendations to improve financial literacy are suggested.

Ochieng and Nyangosi (2017) sought to find out the effect of knowledge management practices on organizational performance with particular reference to MSMEs. Data was analyzed using both descriptive as well as inferential statistics. The study found that knowledge sharing had a significantly positive effect on MSMEs performance, whereas organizational learning and knowledge acquisition had positive but insignificant effects on MSMEs performance in Migori County, Kenya. The study recommended that MSMEs be encouraged to facilitate implementation of knowledge sharing so as to realize significant improvements in their performance.

Mwithiga, Kagwiria, and Shano (2017) carried out a study aimed at establishing the influence of entrepreneurial skills on the growth of women owned micro and small enterprises in Meru town. Data analysis was done using descriptive and inferential statictics. The study found that entrepreneurial skills such as marketing skills, financial management skills, human management skills, organizing skills among others had very strong influence on the growth of MSEs owned by women. The multiple regression analysis showed that entrepreneurial skills had a strength of 0.829 and a correlation of 0.696.The study recommended policy measures to ensure women entrepreneurs have the necessary enterprise running skills.

2.6.5 Electricity Supply and Well-being

The framework developed by the Sustainable Energy for All initiative to define and measure access to energy considers 30 kWh a month to be the subsistence level for grid electricity. The framework considers electricity affordable if a household does not have to spend any more than 5 percent of its total monthly income to purchase it (IEA, 2015).

When a government policy seeks to promote access to renewable energy sources, it needs to influence factors such as: affordability, disposable income, availability and high quality of modern sources (Barnes *et al*., 2005).

Electricity and its reliability are amongst several considerations when MSEs make investment decisions (Scott, Darko, Lemma & Rud, 2014). Firms demonstrate high willingness to pay for reliable power through their investments in self-generation, which Steinbuks and Foster (2010) suggest is an opportunity for government and the private sector to charge higher prices for electricity in order to fund investments that will make power supply more reliable. The provisions of reliable, secure and affordable energy services are central to addressing many of today‘s global development challenges including poverty, inequality, climate change, food security, health and education as well as wealth creation and economic development (Bazilian *et al*., 2011). In a study of the impact of rural electrification on household income in India, Chakravorty *et al*. (2012) found that the reliability of electricity supply is more important than being connected to the grid.

In countries where electricity reliability is very low, electricity-reliant businesses have to invest in diesel generators if they want to sustain regular business operations (Attigah & Mayer-Tasch, 2013). Adoption of generators by firms to cope with unreliable electricity can induce a reallocation of sales and profits towards more productive firms (Rud, 2012). Reliance on generators for electricity during outages can be expected to increase the cost of electricity, and the effect on cost-competitiveness is related to the proportion of total costs accounted for by electricity (Scott, Darko, Lemma & Rud, 2014). Unreliable electricity supply has a significant negative impact on a firm’s total factor productivity (Attigah & Mayer-Tasch, 2013). In Nigeria where 40% of electricity consumed is produced through own-generation, firms spend up to 20-30% of initial investment on measures to enhance the reliability of electricity supply (Alby *et al*., 2011).

In a study on household energy use in Uganda, Drazu, Olweny and Kazoora (2015) assert that use of charcoal as the predominant fuel for cooking was a significant revelation in households connected to mains electricity. This could be linked to two key factors: first, a perception that electricity tariffs are high (relative to income); second, the unreliable electricity supply compelling households to seek out alternatives in order to maintain regular meal times. Frequent outages in Kenya may be the reason for reluctance among households to subscribe, because they may consider the cost of service too high given its erratic availability, regardless of their specific budget constraints (Millien, 2017).

Interruptions to power supplies potentially affect MSEs' costs of production through the expense of repairing or replacing damaged equipment, the cost of spoiled goods and the additional cost of alternative sources of energy, such as generators (Cissokho & Seck, 2013). The effect of these costs on the competitiveness of MSEs depends in part on their impact on total costs. Eifert *et al*. (2008), for example, demonstrate that firm performance is sensitive to the cost of indirect inputs and that these costs, in which energy has the largest share, are a major factor in explaining the low productivity of enterprises in Africa.

Individual decision to connect to grid electricity is linked to the cost of the connection, which may be prohibitive to the rural poor households. Lee *et al.* (2016) reiterate that in Kenya moving away from full subsidization of connection costs leads to lower take-up rates than expected. By randomly allocating 10 and 20 per cent discount vouchers for connection fees to rural Ethiopian households, Bernard and Torero (2015) find that connections increase, on average, by 18 per cent, indicating that connection fees represent a significant barrier to the adoption of electricity. Similarly, Hanna and Oliva (2015) find that an asset transfer program in India led to a significant increase in the use of electricity as the main source of light echoing the presence of economic barriers to connection and electricity.

According to Neelsen and Peters (2013), decisions by MSEs to connect to an electricity supply when it becomes available and their consumption of electricity are influenced by the costs involved. They use the example of a carpenter in Uganda to show that the marginal returns to connection are often deemed to be off-set by the high cost of connecting, which are out of proportion to the perceived short and medium terms benefits. Abeberese (2012) uses data on Indian manufacturing firms to show that in response to an exogenous increase in electricity price, firms reduce their electricity consumption and switch to industries with less electricity-intensive production processes, meaning that electricity constraints may lead firms to operate in industries with fewer productivity-enhancing opportunities.

In Uganda, Neelsen and Peters (2013) found that manufacturing firms were less inclined to connect to the grid or use decentralized electricity than service firms, because of the high investment costs of electric machinery coupled with sharp competition in the market for manufactured goods. Abeberese (2012) suggests that, in countries with high levels of electricity insecurity, firms may not be attracted to move to productivity-enhancing industries and grow larger since doing so comes with the cost of having to rely on electricity.

A study by Scott, Darko, Lemma and Rud (2014) used data from the Enterprise Surveys for six selected countries (Bangladesh, Nepal, Nigeria, Pakistan, Tanzania and Uganda) to assess the effect of electricity insecurity on the productivity of manufacturing MSEs and followed the approach taken in other studies using a production function and OLS regression analysis to determine the effects of electricity insecurity on firms' total factor productivity, cost-competitiveness, and investment. The analysis revealed that many firms which experience outages have lower productivity than firms which do not. This is shown when productivity is measured in terms of total factor productivity and output per worker, and when the measure of electricity insecurity is binary (outages/no outages).

A study examining the impact of power disruptions on firm productivity in the manufacturing sector in Nigeria shows that power outage variables (measured using

hours per day without power and percentage of output lost due to power disruptions) have a negative and significant effect on productivity (Moyo, 2012). Cissokho and Seck (2013) obtained quite different findings in Senegal. Here, outages were found to have a positive and significant effect on the productivity of firms, and MSEs performed better than large-scale firms. The suggested explanation for this contradictory finding is that outages stimulated better management practices, which mitigated the negative effects of power supply interruptions, and that firms that were more inefficient and with lower productivity had gone out of business in the face of electricity insecurity (Cissokho & Seck, 2013).

In a study by Scott *et al*. (2014), data analysis in regard to costs focused on the effects of electricity insecurity on unit costs of production, as an indicator of competitiveness and firm income. World Bank Enterprise Survey datasets, which included data on total sales and costs, were analyzed to determine whether firms with different characteristics had higher unit costs when exposed to outages. The country enterprise surveys included in this analysis were for Bangladesh, Nepal, Nigeria, Pakistan, Tanzania and Uganda. The statistical analyses found that MSEs experiencing outages do not necessarily have higher unit costs of production. This finding holds for the duration as well as the number of outages, it holds when using the log of total costs, and it holds when using the ratio of total costs to (fixed) capital as the indicator of competitiveness and firm income.

Barfour (2013) conducted a study seeking to establish the barriers to rural electrification in Ghana. The results showed that there existed various challenges which include: economic level of the rural people; high cost of grid extension to thinly populated and remote areas; lackluster acceptability of off-grid systems; ownership, management and operations of renewable systems especially mini grid; inadequate funding from government budget; low level of electrification levy and lack of private capital.

2.4.6 Rural Electrification and Well-being

The importance and the role played by electricity in households' productivity, economic survival and development have been well documented in the literature (IEA, 2012). Household well-being has three basic and interacting dimensions; a material dimension, a relational dimension and a subjective dimension (McGregor & Sumner, 2010). In basic terms we can think of a household's well-being as arising from a combination of what they have (material), how they are able to use what they have (relational) and the level of satisfaction or subjective quality of life that they derive from what they have and can do (McGregor, 2007). Household well-being is seen as an outcome that is continuously generated through conscious and subconscious participation in social, economic, political and cultural processes (Coulthard, Johnson & McGregor, 2011).

There are many examples from a wide ranging literature that explain situations in the real world where people may be doing well in terms of the material well-being, but nevertheless are dissatisfied in their own judgments of their quality of life (Graham, 2010). Households living on very limited incomes face difficulties relating to food, energy, and housing security (March, Ettinger, Cook, Bailey, Becker, Meyers & Frank, 2011). Children in these households are at risk of under-nutrition, developmental delay, physical ill health, and poorer emotional, cognitive and behavioral outcomes (March *et al*., 2011). Living with the threat of poverty or deprivation also correlates strongly with negative physical and mental health for parents, particularly for single mothers (March *et al*., 2011).

There has been much economic growth around the globe, but it has been criticized for not being sufficiently 'inclusive' (Gupta, Pouw & Ros-Tonen, 2015) and it has not resulted in a markedly more equitable distribution of household well-being on a global scale (Bourguignon, 2015). The connection between energy and household well-being is established by the fact that the poor in developing countries constitute the bulk of the estimated 2.7 billion people relying on traditional biomass (wood, coal, charcoal, or animal waste) and kerosene for meeting their basic energy needs and the vast majority of

the 1.4 billion without access to grid electricity (IEA, 2011; GEA, 2012). The relationship reveals a vicious cycle in which people who lack access to cleaner and affordable energy are often trapped in a re-enforcing cycle of deprivation, lower incomes and the means to improve their living conditions (GEA, 2012).

Adoption of labor saving household technologies (e.g. electric cookers, electric lights, propane gas) leads to significant reduction of time spent on household activities and to a significant level, increase of time spent on economic activities (Grogan & Sadanand, 2013). In Bangladesh, incomes of households in electrified areas are 12.2% higher than those of comparable households in non-electrified areas, positive effect on both farm and non-farm incomes (Khandker, 2009). Ahmed, Buckley and Mabe (2012) showed that most households connected to electricity were involved in income diversification activities such as petty trading, mat making and tailoring. Material disadvantage, such as poor housing quality, and difficulty in making ends meet, is strongly associated with low household well-being (Watson, Pichler & Wallace, 2010).

Being employed is related to subjective well-being, and unemployment is strongly negatively related to various measures of household well-being (Blanchflower & Oswald, 2011). Household income is positively related to life satisfaction and household well-being within and between countries and at any point in time (Kahneman & Deaton, 2010). There is a relationship between low household well-being and poor self-reported health, even after controlling for the reverse impact that well-being has on health (Dolan, Peasgood & White, 2008). Quality of education is important in making learning enjoyable, fostering personal development, and promoting social well-being, all of which are associated with household well-being (Statham & Chase, 2010).

A review of the Mpeketoni Electricity Project, a community-based diesel-powered micro-grid in rural Kenya, found that the use of electricity and equipment improved the productivity and incomes of local small and micro-enterprises, contributed to the mechanization of agriculture, and supported improved village infrastructure such as schools, markets and water pumps (World Bank, 2017). Interruptions to power supplies

potentially affect MSEs' costs of production through the expense of repairing or replacing damaged equipment, the cost of spoiled goods and the additional cost of alternative sources of energy, such as generators hence reducing their productivity and lowering household well-being among the owners (Cissokho & Seck, 2013). A study examining the impact of power disruptions on firm productivity in the manufacturing sector in Nigeria shows that power outage variables (measured using hours per day without power and percentage of output lost due to power disruptions) have a negative and significant effect on productivity and by extension household well-being (Moyo, 2012). Khandker *et al*. (2012) conclude that the role and intent of electrification programs is not only to provide access to electricity but also to improve the overall well-being of people.

2.5 Critique of Existing Literature

Most studies points to the importance of micro enterprises in job creation (Chakravorty, Pelli, & Marchand, 2014; Khandker *et al.* 2013; World Bank, 2017). However, at the same time, micro enterprises are criticized for being not very innovative and productive. Indeed, most studies on MSEs are not able to capture the survival rates of MSEs and, when they do, job creation rates do not seem to differ from those of larger enterprises (Page & Soderbom, 2012).

A number of studies show a strong correlation between energy consumption and employment - notably through higher household employment following electrification (Khandker *et al.* 2013; World Bank, 2017). Other studies show that household employment increases only for women. In Nicaragua, women are 23 percent more likely to work while there is no change for men (Grogan & Sadanad 2013). Similar results are reported in rural Kwazulu-Natal in South Africa (Dinkelman, 2011) and India (Khandker *et al*., 2012).

Using Chinese data from 1970-1997, Fan, Zhang and Zhang (2002), show that, for every 10,000 Yuan spent on electricity development, 2.3 persons are brought out of poverty

and their household well-being enhanced. Balisacan *et al*. (2002) did a similar analysis for Indonesia in 1990 and concluded that a 10 percent improvement in access to a composite technology measure (including electricity in a village) raised the income of the poor by roughly 2 percent. Taylor (2005) also conducted similar assessments for Guatemala and Peru and drew very similar positive conclusions on the gains from electrification. However, the above studies do not account for the fact that electricity is often installed first in areas with the greatest potential for economic growth (Estache & Wodon, 2010).

Using a randomized field experiment in India, Aklin, Patrick, Harish and Johannes (2017) find no evidence for changes in spending, business creation, and time spent working or studying and other indicators of socioeconomic development within a year of electrification. Also using an experimental approach, Lee, Miguel and Wolfram (2016) suggest that rural electrification in Kenya may reduce social welfare as the costs of grid expansion significantly outweigh its benefits. Bensch, Kluve, and Peters (2011) find no effect of rural electrification on income and children's home study using data from Rwanda.

Several studies show a positive effect of use of skills and knowledge on well-being of proprietors of micro and small enterprises (Radipere & Dhliwayo, 2014; Unger, Rauch, Frese & Rosenbusch, 2011; Mulugeta, Fisseha & Mengesha, 2016; Fatoki, 2014; Ochieng & Nyangosi, 2017). However, Mulugeta, Fisseha and Mengesha (2016) argue that MSEs produce largely for the low income group and employ lower levels of techniques. Furthermore, many microenterprises are the self-employed type with a low graduation rate into higher size categories and their innovative activities are limited.

Microenterprises remains influential ventures to 'graduate' people out of poverty; however, critics question their ability to deliver prosperity, pointing to indebtedness, erosion of social capital and exacerbation of economic vulnerabilities as its major problems, especially in poor, traditional contexts such as rural Kenya (Banerjee & Jackson, 2017; Kent & Dacin, 2013; Roodman & Morduch, 2014). Recent evidence

suggests that the beneficial effects of micro-entrepreneurship on downstream outcomes such as income, consumption, child schooling and female empowerment are very uncertain (Banerjee et al., 2015). To date, little remains known about well-being effects of micro entrepreneurship (Becchetti & Conzo, 2013; Chindarkar, 2012).

Chakravorty, Emerick, and Ravago (2016) carried out a study on the benefits and costs of extending electricity to the rural poor in the Philippines. They use data on costs of electrifying individual villages to show that in a majority of cases, the physical cost of expanding electricity infrastructure is recovered after only a single year of realized expenditure gains. The finding of the study reveal that electricity does not increase employment, suggesting that increased labor force participation is not the relevant mechanism. Rather, increases in agricultural income appear to account for a meaningful share of the income gains from electrification.

A study conducted by Khandker *et al.* (2009) in Bangladesh, based on cross-sectional household survey data from 2005, found that the incomes of households in electrified areas are 12.2% higher than those of comparable households in non-electrified areas. The authors found positive effects on both farm and non-farm incomes, but do not explore the actual causes of these effects. A study on the impact of electrification in Ethiopia by Bernard and Torero (2009) took differences in household expenditure as a proxy for poverty levels and found no significant positive effect.

2.6 Research Gaps

Malunda (2011) suggests future research on issues of vulnerability i.e. the probability of falling into poverty for non-poor households and also proposes studies to be carried out using qualitative data on household well-being which would be combined with survey panel data. This study addresses this by using qualitative data in order to study the broader dimensions of household well-being. Studies conducted in Kenya on household well-being have used the 1994 household survey (Mwabu, Alemayehu, Nick & Mwangi, 2001). These studies focused either on the national, district or household level analysis.

This study used primary data to investigate the effect of rural electrification on household well-being among proprietors of MSEs in Kenya.

As Gertler, Lee, and Mobarak (2016) summarize, outages are caused by supply side factors, such as insufficient generating capacity; demand side factors, such as local capacity overloads; and political economy factors, such as the infrastructure quality and subsidy trap. Most of the existing evidence on electricity supply focuses on firm-level impacts for example, by investing in back-up generators (Steinbuks & Foster, 2010); by switching to more electricity efficient technologies (Alam, 2014); or by substituting intermediate inputs to production (Fisher-Vanden, Mansur, & Wang, 2015). In some studies, the negative impacts of electricity supply on productivity are quite limited (Allcott, Collard-Wexler, & O'Connell, 2016). This study sought to fill this knowledge gap by addressing the moderating effect of electricity supply at household level.

A review of literature indicates that several conceptual and contextual research gaps exists. For instance (Nanka, 2010; Hisaya & Yuko, 2011) have a contextual gap since they did not cover specifically the determinants of electrification of micro enterprises in rural areas. Other studies, for instance (Bose *et al*., 2013; Peters *et al*., 2013) have significant research gaps in terms of concepts as they addressed the impact of rural electrification on the performance of MSEs but failed to address the effects of rural electrification on well-being. This study sought to fill this gap by addressing socio-economic effect of rural electrification on household well-being among proprietors of micro and small enterprises in Kenya.

Bonan, Pareglio and Tavoni (2017) suggest a gap in literature regarding the role of barriers and drivers to the connection to the grid. The individual decision to connect seems to be linked to the price of the connection. Despite subsidization, such fees may be prohibitive for most poor households. This study sought to fill this gap by addressing the moderating effect of electricity supply on the relationship between socio-economic effect of rural electrification and household well-being among proprietors of micro and small enterprises in Kenya.

According to Van de Walle *et al.* (2015), electrification can result in symmetric spillovers (e.g., changes in labor markets and income due to the electrification of local businesses), asymmetric spillovers (e.g., shared power connections), and social interaction effects. Lee, Miguel and Wolfram (2017) assert that few studies rigorously identify or estimate the effects of these various spillovers. They suggest future work shedding light on the most relevant spillovers from electrification, as well as the policies that increase the likelihood of realizing these spillovers. This study addresses this by specifically investigating the effect of symmetric spillovers (employment status and income level) due to rural electrification on well-being. The study also sheds light on policies that can enhance realization of the above mentioned spillovers.

2.7 Summary

The chapter reviewed the theoretical literature, the empirical literature and the conceptual framework relevant to this study. Theories of well-being; rural livelihoods approach, capability theory, social exclusion theory and resource-based industrialization development theory have been used to explain the effect of rural electrification on household well-being. The theories effectively highlights an important correlation between rural electrification and household well-being. A discussion regarding the relationship between four independent variables (skills and knowledge application, access to healthcare, income level and employment status) and a moderating variable (electricity supply) with household well-being has been addressed. From the empirical literature, it is clear that rural electrification plays a leading role in enhancing well-being of the rural poor by enhancing access to healthcare, employment status, income level and skills and knowledge application. Lastly, by interlinking the theoretical and empirical literature, the variables that form the conceptual framework have been extrapolated. The conceptual model shows the linkage for testing the causation between skills and knowledge application, access to healthcare, income level and employment status (independent variables), electricity supply (moderating variable) and household well-being as a dependent variable.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research methodology that was used in conducting the research. This section describes the general design and execution of the study and rationalizes choices for particular methods and procedures in data collection and analysis. The layout of this chapter consists of the research design, population, sampling frame, sampling technique, instruments, data collection procedures and finally data analysis.

3.2 Research Design

Kothari and Garg (2014) defines research design as the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure. The design which gives the smallest experimental error is considered the best design in many investigations (Kothari & Garg, 2014). A survey is an attempt to collect data from members of a population in order to determine the current status of that population with respect to one or more variables. Survey research is therefore a self-report study which requires the collection of quantifiable information from a sample (Mugenda & Mugenda, 2003).

This study was conducted using a cross sectional survey research design. The cross sectional survey design involves making observations of a population or sample of the study at one point in time (Babbie, 2010). Houser (2011) reiterates that a cross-sectional survey design provides in-depth information about the characteristics of subjects within a particular field of study. The design is useful in identifying characteristics of an observed phenomenon or exploring possible correlations among two or more phenomenon (Leedy, 2001). This design is appropriate for this study since Zikmund (2003) note that cross sectional survey research is intended to produce statistical

information about the aspects of the research issue that may interest policy makers and MSE entrepreneurs.

The study is anchored on a critical realist approach philosophy. Critical realism focuses on a complex view of ontology which investigates the properties that societies and people possess that might make them possible objects of knowledge (Bhaskah, 1979). It argues that research should be able to make generalized claims but that the subjectivities of individuals and the meanings instilled within action are central to understanding the external world (Prowse, 2010). It therefore provides a solid epistemological basis for a reflexive well-being research of this type. Critical realist thinking also postulates that the world is structured, differentiated, stratified and changing (Danermark, Ekstrom, Jakobsen, & Karlsson, 2002) which corresponds well with the dimensions undertaken in understanding the effect of rural electrification on household well-being in this work.

3.3 Target Population

Population refers to all the items under consideration in any field of inquiry (Kothari & Garg, 2014). A study population is a group of individuals taken from the general population who share a common characteristic (Sekaran & Bougie, 2011). Target population includes all the members real or hypothetical set of people, events or objects to which researchers wish to generalize the results of their research (Singleton & Strait, 2010). The target population for this study was 172,554 rural registered micro and small enterprises in Kakamega, Bungoma, Nakuru, Busia, Bomet, Siaya, Kericho and Kirinyaga Counties (Republic of Kenya, 2016). The decision to use the above named counties for this study was based on their contribution to national poverty as shown in Table 3.1.

Table 3.1: Contribution to National Poverty by County

County	Total Population	Contribution (%)	Rank (Highest to lowest)
Kakamega	1,644,328	4.77	1
Bungoma	1,359,983	3.79	5
Nakuru	1,562,625	3.08	10
Busia	735,294	2.61	15
Bomet	721,873	2.18	20
Siaya	833,230	1.87	25
Kericho	737,942	1.71	30
Kirinyaga	520,585	0.79	45

Source: Republic of Kenya (2014).

3.4 Sampling Frame

A sampling frame consists of a list of items from which the sample is to be drawn (Kothari & Garg, 2014). Sekaran and Bougie (2011) defines sampling frame as a physical representation of all the elements in the universe/population from which the sample is drawn. Creswell (2003) defines sample frame as the list of accessible population of people, events or documents that could be included in a survey and from which the researcher will pick a sample to collect data. The sampling frame for this study consisted of 172,554 micro and small enterprises registered in Kakamega, Bungoma, Nakuru, Busia, Bomet, Siaya, Kericho and Kirinyaga Counties by 2015 (Republic of Kenya, 2016) making a total of 172,554 in number as shown in Table 3.2.

Table 3.2: Population Sampling Frame

County	Total Registered MSEs.	Total Registered Rural MSEs.
Kakamega	52,470	30,957
Bungoma	17,149	10,118
Nakuru	117,254	69,180
Busia	27,748	16,371
Bomet	14,000	8,260
Siaya	14,114	8,327
Kericho	19,522	11,518
Kirinyaga	30,209	17,823
Total	**292,466**	**172,554**

Source: Republic of Kenya (2016)

3.5 Sample and Sampling Technique

A sample is a subset of a population (Hyndman, 2008) while sampling technique is the process of selecting respondents that constitute a sample (Kothari & Garg, 2014). The study adopted multistage sampling technique to select the sample size. Multistage sampling involves dividing the population into groups or clusters. This type of sampling is suitable for this study due to the large target population involved (Nafiu, 2012). In the first stage, systematic sampling was used to arrive at the choice of the eight counties based on their contribution to national poverty and county ranking as shown in Table 3.3.1. Systematic sampling is useful when a sampling frame is available in the form of a list. In such a design, the selection process starts by picking some random point in the list and then every n^{th} element is selected until the desired number is secured (Kothari & Garg, 2014). In the second stage, simple random sampling technique using random numbers (Cooper & Emory, 2000) was used to select the individual proprietors of MSEs from each of the counties involved in the study. This fulfilled the requirements of

efficiency, representativeness, reliability and flexibility taking care of systematic bias that may result from non-respondents (Kothari, 2012).

Since the target population (172,554) is more than 10,000, Mason, Lind and Marchal (1999) explains that the sample size may be computed by the following formula;

$$n = \frac{z^2pq}{d^2} \quad \text{..... Equation 1}$$

Where;

n is the desired sample size when population is greater than 10,000.

z is the standard normal deviate at 95% confidence level (z = 1.96).

p is the proportion in target population estimated to have characteristic being measured (p = 0.5).

d is the level of statistical significance set (d = 0.05).

Substituting the values into equation 1, the estimated sample size for infinite population was obtained as follows:

$$n = (1.96)^2 (0.5)^2 \div (0.05)^2$$

$$= 3.8416 \times 0.25 \div 0.0025$$

$$= 384.16$$

Correcting for finite population, the following formula was used (Naing, *et.al.* 2006)

$$n^1 = n/ (1+n/N) \quad \text{..... Equation 2}$$

Where:

n^1 = sample size for finite population

N = the target population = 172,554

n = calculated sample size from infinite population = 384.16

Substituting these values into equation 2:

n^1 = 384.16/ (1+384.16/172,554)

= 384.16/1.00223

= 383.3

The calculated sample size was therefore 384.

The proportionate sample sizes for each stratum are computed on the basis of the size of the stratum and the target population. In view of the above explanation concerning the sample size, it is ensured that the sample size for each stratum (for our case each county) is the larger value as proportionately computed from the formula above or 30, being the minimum sample size as per the central limit theorem or the total of the particular stratum for a population size below 30. The sample for each county is then divided by the number of rural wards in the county.

This study therefore used a sample population of 418 respondents for data collection. This sample is most likely to be well informed about socio-economic effects of rural electrification on the household well-being among proprietors of micro and small enterprises in Kenya. Questionnaires were administered in various counties based on the proportionate number of registered rural micro and small enterprises as shown in Table 3.3.

Table 3.3: Sample Population per County

County	Total Reg. Rural MSEs	Proportionality	Sample
Kakamega	30,957	17.94	69
Bungoma	10,118	5.86	30
Nakuru	69,180	40.09	153
Busia	16,371	9.49	37
Bomet	8,260	4.79	30
Siaya	8,327	4.83	30
Kericho	11,518	6.68	30
Kirinyaga	17,823	10.32	39
Total	**172,554**	**100**	**418**

3.6 Data Collection Instruments

Data collection instrument refers to the device used to collect data such as a paper questionnaire or computer assisted interviewing system (Sekara & Bougie, 2010). According to Denzin and Lincoln (2000), a data collection instrument is a document containing questions presented in a systematic, highly precise fashion. The data collection instrument enables the evaluator to obtain uniform data that can be compared, summed and subjected to additional statistical analysis. The main instrument for data collection was a structured questionnaire with a fixed set of choices designed with alternative answers expressed on a Likert scale (Cooper & Schindler, 2006). Likert type scales utilizes the item analysis approach where a particular item is evaluated between responses whose total score is high and those whose score is low.

3.7 Data Collection Procedure

Data collection is the process of gathering and measuring information on targeted variables in an established systematic fashion that enables one to answer relevant

questions, test hypotheses, and evaluate outcomes (Sekara & Bougie, 2010). Data collection was through a structured questionnaire. The choice to use questionnaires was informed by the fact that they can be send to a large number of people and thus save the researcher time and money. According to Leedy and Ormrod (2010) people are also more truthful while responding to the questionnaires due to the fact that their responses are anonymous.

Research assistants in each of the eight counties were contacted by the researcher and introduced to the questionnaire. A period of four weeks was given for the research assistants to allow respondents to answer the questions. Post-paid envelops with the researcher's postal address were left so that once the questionnaires were filled they could be posted. Contact mobile number and email address of the researcher was given to the respondents for any clarification. Follow up telephone calls were made after two weeks and at the end of the four weeks to find out if the questionnaires had been posted and to thank them for participating in the research.

3.8 Pilot Testing

According to Hulley (2007) a pilot study is a small scale preliminary study conducted in order to evaluate feasibility, time, cost, adverse events, and effect size (statistical variability) in an attempt to predict an appropriate sample size and improve upon the study design prior to performance of a full-scale research project. Pilot study was carried out to evaluate the suitability of the questionnaires. Sample for the pilot study was obtained from proprietors of micro and small enterprises within Kakamega County, who did not make part of the sample population. Questionnaires were administered to 30 respondents during the pilot study. Creswell (2003) states that the size of a sample to be used for pilot testing varies depending on the time, cost and practicability, but would tend to be between 5-10 percent of that of the main survey. The pilot study helped to detect flaws in the administration of the questionnaires and therefore helped ensure reliability and validity of the questionnaires.

3.8.1 Test of Validity

Validity refers to the extent to which a test measures what we actually wish to measure (Kothari & Garg, 2014). Before the questionnaire was used to collect data, three experts evaluated it in terms of the percentage of questions that they considered relevant and the average score from the three experts was calculated. The first expert gave it 98%, the second expert gave 94% and the third expert gave 92%. This yielded an average congruency percentage of 94.7% which is greater than the lower limit of 90% hence the content validity of the questionnaire's was confirmed. Data from the pilot test and the actual survey were further subjected to Kaiser-Meyer-Oklin Measure of Sampling Adequacy and the Bartlett's Test of Sphericity before factor analysis was performed.

3.8.2 Test of Reliability

Reliability refers to the accuracy and precision of a measurement procedure (Kothari & Garg, 2014). Sekaran (2003) observes that reliability is established by testing for both consistency and stability. To test the reliability of the instruments, a test-retest method was used. Test-retest estimates of reliability are obtained by correlating data collected with those from the same questionnaire collected under as near equivalent conditions as possible (Saunders, Lewis, & Thornhill, 2007). The results obtained, were coded and entered into a computer program (Statistical Package for Social Sciences - version 22) after which a reliability index was calculated using the Cronchbach's alpha.

$$KR_{20} = \frac{(K)\,(S^2-\Sigma S^2)}{(S^2)\,(K-1)}$$

Where;

$\boldsymbol{KR_{20}}$ is reliability coefficient of internal consistency

$\boldsymbol{K}$ is the number of items used to measure the concept

$\boldsymbol{S^2}$ is the variance of all scores

The computed Cronbach's Alpha for the entire data set was 0.852. A Cronchbach's alpha coefficient of 0.7 and above is considered high enough to judge the instrument as reliable. A high Cronchbach's alpha coefficient implies that the items correlate highly among themselves that is there is consistency among the items in measuring the concept of interest (Pallant, 2007).

3.9 Data Processing and Analysis

Data processing included coding and classification of the collected data, cleaning the raw data and organizing data according to emerging themes. Coding was carried out before data was entered into Statistical Package for Social Scientists (SPSS) version 22.0 for analysis. Information on what each code means was listed in a codebook that accompanied the dataset. Following Ijaiya *et al.* (2009), descriptive statistics was used to describe the socio-demographic characteristics of the respondents. Descriptive statistics particularly mean and standard deviation were computed. An exploratory factor analysis was performed to identify patterns in data, reduce the data table and number of items to a few interpretable linear combinations of the data, avoid multicollinearity and check the integrity of the key variables.

The necessary tests which involved checking the correlation matrix for evidence of correlation coefficients, computing Kaiser-Meyer-Olkin Measure of Sampling Adequacy, and the Bartlett's Test of Sphericity, were carried out to confirm the suitability of the dataset for factor analysis. The three requirements were met hence supporting the need for factor analysis to be performed. After conducting the necessary tests, the principal factor analysis was conducted using principal components as the main factor extraction technique. The analysis of principal component involved using the Kaiser's criterion and scree plot to determine the number of components to retain. The component correlation matrices were generated alongside oblique rotations to estimate the correlation coefficient (r).

Pearson's correlation analysis was carried out to determine the nature and strength of the relationships between independent variables and the dependent variable. Multiple regression analysis was carried out as elaborated by Tabachnick and Fidell (2007) to estimate the effects of independent variables on the dependent variable and test the hypotheses of the study. The coefficient of determination (R^2) was used to establish the combined effect (percentage of the variation explained by all the independent variables in the multiple regression equation) of the independent variables on the dependent variable. The null hypotheses were tested using multiple regression analysis. The multiple regression coefficient measures the amount of change in the dependent variable associated with one unit change in the independent variable while controlling for all other variables in the equation (Nachmias & Nachmias, 2004). The following regression equation was used:

$$Y = \beta 0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

Where:

Y	= Household Well-being
β_0	= Constant Term
β_1, β_2, β_3 and β_4,	= Beta Coefficients
X_1	= Skills and Knowledge Application
X_2	= Access to Healthcare
X_3	= Income Level
X_4	= Employment Status
X_5	= Electricity Supply
ε	= Stochastic Disturbance Error Term.

3.9.1 Normality Test

The study sought to determine normality of the data for the study. Normality is used to describe a symmetrical, bell-shaped curve, which has the greatest frequency of scores around in the middle combined with smaller frequencies towards the extremes (Pallant, 2005). This can be done using the Kolmogorov-Smirnov test and Shapiro-Wilk tests. These tests compare the variable to a normally distributed set of scores with the same mean and standard deviation. If these tests are non-significant ($p > .05$), it tells that the distribution in the sample is not significantly different from a normal distribution (Garson, 2012). The Kolmogorov-Smirnov test was used for this research. Data is considered good and decent in research if it is normally distributed.

3.9.2 Test of Assumptions of Multi-collinearity

Leech, Barrett and Morgan (2005) assert that multi-collinearity is excessively high level of inter-correlation among the independent variables, such that the effects of the independent variables on the dependent variable cannot be easily detached from each other. The study used correlation matrix to investigate the pattern of inter-correlation among all the variables. Huck (2010) recommends that inter-correlation among the independent variable beyond .08 is a sign of multi-collinearity and should be put to further scrutiny. However, Leech, Barrett and Morgan (2005) observed that use of correlation matrix to indicate signs of lack of multi-collinearity among the variables is not adequate. Hence, this study further assessed the multi-collinearity issues by examining tolerance and the Variance Inflation Factor (VIF) which are some two collinearity diagnostic factors.

3.9.3 Test for Independence of Observations

When an important independent variable is omitted from a model, its effect on the dependent variable becomes part of the error term. Hence, if the omitted variable has a positive or negative correlation with the dependent variable, it is likely to cause error

terms that are positively or negatively correlated (Marquardt, 2012). One of the assumptions of regression is that the observations are independent. If observations are made over time, it is likely that successive observations are related. If there is no autocorrelation (where subsequent observations are related), the Durbin-Watson statistic should be between 1.5 and 2.5.

3.9.4 Heteroscedasticity

Homoscedasticity describes a situation in which the error term is the same across all values of the independent variables. Kennedy (2010) points out that if a model is well-fitted, there should be no pattern to the residuals plotted against the fitted values. If the variance of the residuals is non-constant then the residual variance is said to be heteroscedastic. This study used graphical method to show this by fitting residuals versus fitted (predicted) values.

3.9.6 Operationalization of Variables

Operationalization is the process of strictly defining variables into measurable factors (Shuttleworth, 2008). Measurements from different sources were employed in the study. The development of the variables and measurements was supported in empirical studies reviewed in the literature. The dependent variable (household well-being) measurement was a seven-day amount of consumption expenditure per adult equivalent (OECD, 2013). Service time (hours) and service cost (percentage of monthly income) was used to measure access to healthcare. Employment status was measured using cost of labor (percentage of monthly income). The cost of energy (percentage of monthly income) was used to measure income level. Skills and knowledge application was measured using production efficiency (ratio of total output to total input). The description of hypothesized variables is summarized in Table 3.4.

Table 3.4: Operationalization of Variables

Concept	Description	Measurement
Access to Healthcare		
Service time	Time of health service provision in hours per day	Number of respondents who receive healthcare at night Average opening hours
Service quality	The degree to which healthcare services increase the likelihood of desired health outcomes	Ratio of trained personnel to patients Patient waiting time Use of electric laboratory equipment
Service cost	Amount paid to healthcare providers for services rendered	Cost of treatment Cost of referrals
Employment Status		
Cost of labor	The sum of all wages paid to employees, as well as the cost of employee benefits and payroll taxes paid by an employer	Wages Employee benefits and taxes
Supply of labor	Total hours that workers are willing to work at a given real wage rate	Working hours per day Number of employees in non-farm employment
Demand for labor	The number of labor-hours an employer is willing to hire based on wage rate, unit cost of capital, output price etc.	Labor hours per week Wage per week Number of established businesses after electrification
Income Level		
Cost of production	All the payments necessary to obtain the factors of production	Wages Rent Interest rate
Revenue change	An increase of a business' sales when compared to previous year's revenue performance.	Sales volume Annual change in revenue
Profit levels	The ratio of profits earned to total costs over some defined period.	After tax profit rate Unit cost Level of value addition
Skills and Knowledge Application		
Productive efficiency	Production of goods and services with the optimal combination of inputs to produce maximum output for a minimum cost.	Level of input Level of output Cost of production
Value addition	A change in the physical state of a product aimed at enhancing its value	Number of innovative products Number of micro-processing firms
Effective communication	Information sharing between people within and outside an organization that is performed for the commercial benefit of the organization	Use of emails Use of e-business Use of mobile-communication
Electricity Supply		
Affordability	State of being cheap enough for people to be able to buy	Number of customers connected Monthly consumption
Reliability of supply	The degree to which electricity being delivered to customers is within accepted standards and in the amount desired.	Quality of supply in voltages Number of appliances affected per year Outage duration in hours per week.
Ease of electricity consumption	Ability to use electric appliances and pay for electricity bills comfortably	Percentage of power bills in relation to monthly income Number of electric appliances used
Household Well-being		
Access to basic needs	Access to clean water, nutrition, healthcare, education, clothing and shelter	Quality of nutrition Housing condition Quality of education Quality of healthcare
Meeting social obligations	A condition where people have an opportunity to participate in social development.	Membership to social groups Asset ownership Participation in community decision making

3.10 Ethical Considerations

The study considered ethical issues in order to avoid the loss of integrity in the study. All ideas used from other scholars were acknowledged in order to avoid plagiarism. Only the respondents who indicated readiness to participate in the study were given questionnaires to fill. Those who were not keen to take part in the study were not coerced to participate. The research also followed strict confidentiality and no information was given to any unauthorized person. To enhance the anonymity of the respondents, assurance was given to the respondents on the integrity of their confidentiality and the respondents were not required to give their names or sign the questionnaire.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSIONS

4.1 Introduction

In this chapter, the results obtained from the study are discussed. The chapter begins with description of data collected, factor analysis, correlation analysis and regression analysis for each variable. This chapter also presents the overall regression analysis results, test of hypotheses results and ends with discussion of key research findings for each specific objective as stated in each section.

4.2 Questionnaire Response Rate

Table 4.1, which shows the summary of return rate of questionnaires from the respondents, reveals that the questionnaires were quite adequate for the study.

Table 4.1: Questionnaire Return Rate by Gender

Respondents	Administered	Returned	Return Rate (%)
Male	231	175	75.75
Female	187	132	70.59
Total	**418**	**307**	**73.44**

Table 4.1 shows that from a total of 231 and 187 questionnaires administered to male and female respondents respectively, 175 and 132 were returned in the same order. A total of 307 questionnaires were returned for data analysis, which is equivalent to 73.44% response rate. Zikmund, Babin, Carr and Griffin (2010) suggests that a 50% return rate is adequate, 60% is good enough while the return rate of above 70% is very good. Grounded on this assertion, the current study's questionnaire return rate of 73.4% is therefore considered as very good. The noted high response rate was attributed to the fact that the researcher was a Sub-county Administrator and he used his network to

engage county administrators in the sampled counties to help him administer the questionnaires. The researcher also pre-notified the study participants of the intention of the study, communicated aggressively to track responses and sent reminders to stimulate participation. Telephone call follow ups were made to respondents who were left with questionnaires to help make clarifications on areas that may not have been clear.

4.3 Respondents' Demographic Information

4.3.1 Age, Level of Education and Marital Status

Information on age, level of education and marital status of the respondents in the survey is tabulated in Table 4.2.

Table 4.2: Personal Bio-Data of the Respondents

Bio-data	Count	Percentage	Cumulative percentage
Age (Years)			
< 25	38	12.4	12.4
25-34	110	35.8	48.2
35-44	75	24.4	72.6
45-54	60	19.5	92.2
≥ 55	24	7.8	100.0
Total	**307**	**100.0**	
Level of Education			
Certificate	119	38.8	38.8
Diploma	81	26.4	65.2
Bachelor's Degree	72	23.5	88.7
Master's Degree	28	9.1	97.8
PhD	7	2.2	100.0
Total	**307**	**100.0**	
Marital Status			
Single	80	26.1	26.1
Married	195	63.5	89.6
Divorced	20	6.5	96.1
Separated	4	1.3	97.4
Widowed	8	2.6	100.0
Total	**307**	**100.0**	

From the results of the survey, it was established that almost half of the respondents were youths aged below 35 years. This could be attributed to the fact that a majority of persons unemployed in Kenya are the youths. Those who were aged 55 years and above only made less than a tenth of the proprietors of micro and small enterprises in the counties where the survey was conducted. Nonetheless, other ages were equally represented in the study; with those aged between 35-54 years forming about two fifths of those who took part in the survey. Similarly, on marital status, the findings of the study show that whereas three fifths of the proprietors were married, about three tenths of them were single. Given that the study had established that majority of the respondents were youths, this finding concurs with the generally held opinion that most young people today are not keen to marry, they prefer to stay single possibly for fear of the responsibilities that come with marriage. This fact could also be attributed to the general declining marriage prevalence in the world being replaced by high rates of non-marital cohabitation, either replacing marriage or as part of a pattern of delayed marriage.

4.1.1 4.3.2 Household Size and Type, Type of House and Ownership Status

From the analysis of the responses, it was established that most of the households had between one to four members in the family. This may be attributed to the fact that a majority of the respondents were still in the youthful ages. Almost a third of them had 5 to 7 members in the family and less than a tenths of them had above 10 members in the family as shown in Table 4.3. The high number of household members is characteristic to developing countries like Kenya. Household sizes also provide evidence of high dependency ratio in developing countries including Kenya.

Table 4.3: Household Characteristics

Bio-data	Count	Percentage	Cumulative percentage
Household Size			
1-4	140	45.6	45.6
5-7	113	36.8	82.4
8-10	34	11.1	93.5
Above 10	20	6.5	100.0
Total	**307**	**100.0**	
Type of Household			
Nuclear	161	52.4	52.4
Extended	93	30.3	82.7
Single	40	13.0	95.8
Shared	13	4.2	100.0
Total	**307**	**100.0**	
Type of House			
Communal	126	41.0	41.0
Bungalow	81	26.4	67.4
Flat	72	23.5	90.9
Duplex	28	9.1	100.0
Total	**307**	**2.2**	
House Ownership			
Owner	80	26.1	26.1
Tenant	227	73.9	89.6
Total	**307**	**100.0**	

It also emerged from the results of the survey that more than half of the families were nuclear in nature possibly due to the fact that a majority of the respondents were youths. However, other types of families such as extended, single and shared were also

represented in the survey. The type of house that was most prevalent among the sampled owners of the enterprises was communal, where more than four out of ten of the families lived in communal houses. This may be attributed to high poverty rates in Kenya, just like other developing countries. About a quarter of them lived in bungalows which is evidence of high inequality gap between the rich and the poor in developing countries. In regard to house ownership, the results established that majority of the proprietors of micro and small enterprises in the area of the study lived in rented houses, an indicator of low human development index.

4.1.2 4.3.3 Electricity Connections and Monthly Income

The study sought to investigate the number of employees and average monthly income of the enterprises whose proprietors took part in the survey. These pieces of information were considered key indicators of household wellbeing. Equally, duration since electricity was connected in the enterprises was sought.

Table 4.4: Duration in Years since Electricity Connection

Duration (years)	Number of Respondents	Percentage
0-4	135	44%
5-9	110	35.8%
Over 10	62	20.2%

Almost two-fifth of the respondents had had their electricity connection within the last four years with only about a fifth of them who had had electricity for over ten years as indicated in Table 4.4. The revelation that a majority of the households only had electricity connections within the last four years is not surprising given that Rural Electrification Authority (REA), was established in 2006 slightly over ten years to accelerate the pace of rural electrification in Kenya.

Table 4.5: Average Monthly Income (Kshs.)

Income (Kshs.)	Number of Respondents	Percentage
Up to 50,000	208	67.8%
50,001-100,000	84	27.4%
100,001-500,000	15	4.8%

More than two thirds of proprietors of MSEs who participated in the survey earned an average income of less than Ksh. 50,000 monthly as shown in Table 4.5. This finding oscillate with the results of Lee, Miguel and Wolfram (2016) who posit that rural electrification in Kenya may reduce social welfare as the costs of grid expansion significantly outweigh its benefits. Since the costs are transferred to the consumer, MSEs may be incurring high electricity costs that consumes a sizeable share of their income.

4.4 Results of Diagnostic Tests

4.4.1 Reliability Test Results

The reliability for multi-item opinion items were computed separately for all the six subscales in the MSEs proprietors questionnaires, as shown in Table 4.6. The Cronbach's alpha coefficient revealed that the instruments had adequate reliability for the study.

Table 4.6: Cronbach's Alpha Results

Scale	No. Items	Cronbach's alpha	Conclusion
Skills and Knowledge Application	12	.841	Reliable
Access to Healthcare	10	.882	Reliable
Income Level	10	.855	Reliable
Employment Status	10	.868	Reliable
Electricity Supply	9	.803	Reliable
Household Well-Being	8	.865	Reliable

The subscale skills and knowledge application composed of 12 items had good internal consistency, $\alpha = .841$; all the items of this subscale were worth of retention. Deleting any of the items in this subscale would not result to an increase in Cronbach's alpha. This implies that deleting any of the items would not cause improvement in the internal consistency. It was also noted that all items correlated with the total scale to a good degree. On the same note, the internal consistencies for the other subscales in the questionnaire were adequate enough for the study. All the subscales had Cronbach's alpha of greater than 0.7, which is adequate (Pallant, 2007). These findings show that the questionnaires were generally suitable for data collection because they adequately measured the constructs for which they were intended to measure.

4.4.1 4.4.2 Validity Test Results

Although pilot study was done to improve external validity of the instruments, internal validity of the constructs was tested by subjecting the survey data to suitability tests using the Kaiser-Meyer-Oklin measure of sampling adequacy (KMO Index) and the Bartlett's Test of Sphericity. This is a prerequisite condition for a factor analysis. Before the extraction of factors, the suitability of the questionnaire data set for factor analysis was assessed for each sub-scale and the result was summarized as in Table 4.7.

Table 4.7: KMO and Bartlett's Test

Subscale	**Kaiser-Meyer-Olkin (KMO index)**	**Bartlett's Test for Sphericity**		
		Approx. Chi-Square	**Df**	**Sig.**
Skills and Knowledge Application	.944	25551.633	66	.000
Access to Healthcare	.891	1177.124	45	.000
Income Level	.878	1128.777	45	.000
Employment Status	.881	1189.656	45	.000
Electricity Supply	.865	631.400	36	.000
Household Wellbeing	.899	910.693	28	.000

The result of the Kaiser-Meyer-Oklin measure of sampling adequacy (KMO Index) and the Bartlett's Test for Sphericity for each subscale of the questionnaire are presented in Table 4.7. Kaiser (1974) asserts that the Kaiser-Meyer-Oklin measure of sampling adequacy index ranging > .6 is of adequate internal validity and is considered suitable for factor analysis. The Bartlett's Test for Sphericity on the other hand relates to the significance of the study and indicates the validity of responses obtained in relation to the problem that the study seeks to address. Creswell (2014) observes that Bartlett's Test of Sphericity test statistic should be less than .05. In the current study, the value of Bartlett's test for Sphericity is significant ($p<.001$, $p=.000$) for all the subscales of the questionnaire. In addition, the Kaiser-Meyer-hold Olkin indexes are all > .6 which is a threshold for sufficient internal validity. Creswell (2014) asserts that if the Bartlett's test for Sphericity is significant, and if the Kaiser-Meyer-Olkin measure is greater than .6, then factorability is assumed and hence use of factor analysis is attainable. Thus, based on the results, it was appropriate to proceed with factor analysis on assumption of adequate internal validity, which is an indication that all the subscales had suitable data.

4.4.3 Normality Test Results

Normality of data were tested through the use of formal test using Kolmogorov-Smirnov and Shapiro-Wilk tests, as shown in Table 4.8. Initial tests on the variables indicate violation of normality; hence all the independent variables had to be transformed first to remove moderate skewness that was observed in the original data.

Table 4.8: Tests of Normality

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	**Df**	**Sig.**	**Statistic**	**Df**	**Sig.**
Skills and Knowledge Application	.292	307	.230*	.775	307	.252
Access to Healthcare	.153	307	.054	.882	307	.056
Income Level	.152	307	.068	.765	307	.057
Employment Status	.183	307	.355*	.812	307	.140
Electricity Supply	.119	307	.310*	.852	307	.074
Household Wellbeing	.271	307	.134	.841	307	.116

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Normality tests in Table 4.8 shows the results after transformation. Although normality test by SPSS concurrently indicate both Kolmogorov-Smirnov (K-S) and Shapiro-Wilk test results, this study used the S-W to interpret the normality of the variables. Garson (2012) recommends that Shapiro-Wilk's test should be used for small and medium samples up to n = 2000. Shapiro-Wilk is comparable to the correlation between a given data and its corresponding normal scores, with S-W = 1 when their correlation is perfectly normal. This means that a significantly ($p<.05$) smaller S-W than 1.0 imply that the normality is not met. Hence, the data is normal when Shapiro-Wilk (S-W) >.05. All the variables follow normal distribution given that there were no statistical significant differences noted in any of the variables with their corresponding normal scores as shown in Table 4.8.

4.4.4 Test of Assumptions of Multi-collinearity

Correlation analysis was done to investigate the degree of relationship between variables that appear as explanatory. Researchers must test for and remove multi-collinearity if present in the study (Hair, Celsi, Money, Samouel & Page, 2003). Leech, Barrett and Morgan (2005) assert that multi-collinearity is excessively high level of inter-correlation among the independent variables, such that the effect of independent variables on dependent variable cannot be easily detached from each other. The study used correlation matrix to investigate the pattern of inter-correlation among all the variables, as shown in Table 4.9. From the correlation matrix, all correlation coefficients were less than 0.8. Huck (2010) recommends that inter-correlation among independent variables beyond 0.8 is a sign of multi-collinearity and should be put to further scrutiny. The fact that all coefficients were < .8 implies that the population data was free of singularity, meaning multi-collinearity assumption was not violated. However, Leech, Barrett and Morgan (2005) observed that use of correlation matrix to indicate signs of lack of multi-collinearity among variables is not adequate. Hence, this study further assessed multi-collinearity issues by examining Tolerance and Variance Inflation Factor (VIF) which are collinearity diagnostic factors. Table 4.9 shows SPSS output indicating Tolerance and Variance Inflation Factors.

Table 4.9: Tolerance and Variance Inflation Factor (VIF) Statistics

Model		Collinearity Statistics	
		Tolerance	VIF
1	Skills and Knowledge Application	.789	1.267
	Access to Health	.360	2.779
	Income Level	.388	2.574
	Employment Status	.374	2.674
	Electricity Supply	.784	1.132

a. Dependent Variable: Household Well-being

Tolerance is the amount of percentage of variance in the predictor that cannot be accounted for by the other predictors. Therefore, a small value indicates that a predictor is useless, and tolerance values that are less than .10 may require further investigation. The variable's tolerance is $1-R^2$, while VIF is its reciprocal. Hence, a variable whose VIF value is greater than 10 may also need to be investigated. A small tolerance value indicates that the variable under consideration is almost a perfect linear combination of other independent variables already in the equation and that it should not be added to the regression equation. Collinearity conditions were met, given that each of the variables had adequate tolerance (tolerance value > .10) and Variance Inflation Factor (VIF <10) as shown in Table 4.9. These findings indicate that there was no violation of multi-collinearity assumptions which is a requirement for multiple regression analysis, which the study used.

4.4.5 Test for Independence of Observations

One of the assumptions of regression is that the observations are independent. The Durbin-Watson test was used to check if the assumptions of regression that the observations are independent were met, as indicated in Table 4.10.

Table 4.10: Test of Independence: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.639[a]	.408	.398	.43665	1.827

a. Predictors: (Constant), Electricity Supply , Skills and Knowledge Application, Employment Status, Income Level, Access to Health

b. Dependent Variable: Household Well-being

Marquardt (2012) indicate that if there is no autocorrelation (where subsequent observations are related), the Durbin-Watson statistic should be between 1.5 and 2.5. Table 4.10 shows that the Durbin-Watson statistic is 1.827 which is between 1.5 and 2.5,

implying that the data was not auto-correlated. This indicates that the assumption of independence was not violated.

4.4.6 Heteroscedasticity and Homoscedasticity

The study also investigated the assumption of homoscedasticity. Homoscedasticity describes a situation in which the error term is the same across all values of the independent variables. Kennedy (2010) points out that if a model is well-fitted, there should be no pattern to the residuals plotted against the fitted values. If the variance of the residuals is non-constant then the residual variance is said to be heteroscedastic. This study used graphical method to show this by fitting residuals versus fitted (predicted) values, as shown in Figure 4.1.

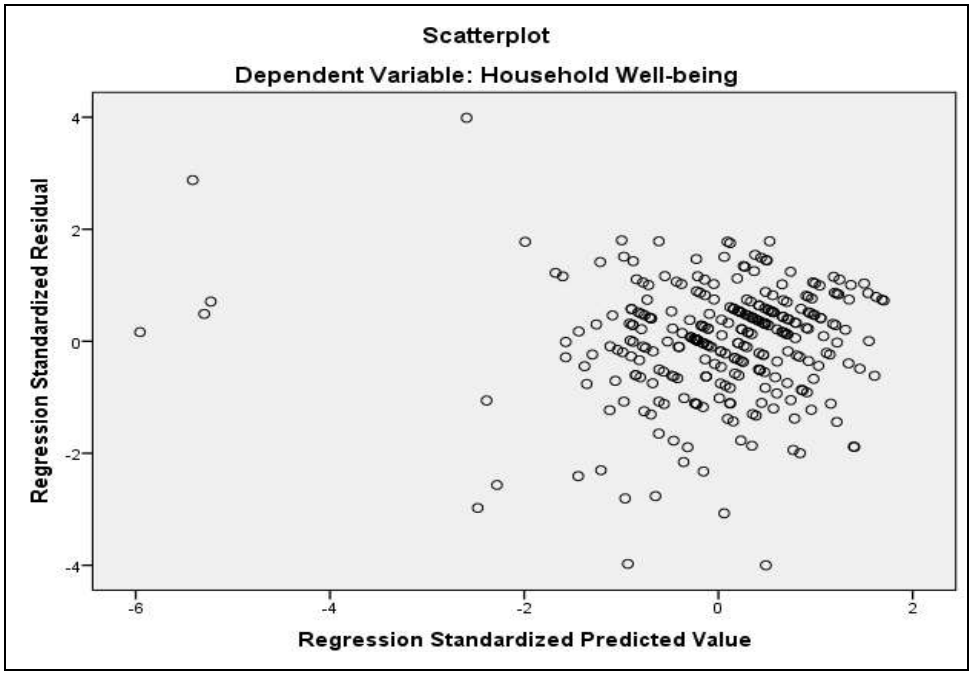

Figure 4.1: Scatterplot of residuals against predicted values

Heteroscedasticity is implied when the scatter is not even; fan and butterfly shapes are common patterns of violations. Even though Figure 4.1 shows that the pattern of the data points were getting a little concentrated towards the right end, an indication of mild

heteroscedasticity, the data points (residuals) largely formed a pattern less cloud of dots indicative of homoscedasticity. Therefore, the assumption of homoscedasticity, which refers to equal variance of errors across all levels of the independent variables, was not significantly violated. This means that it was assumed that errors were spread out consistently between the variables, indicating that the variance around the regression line was the same for all values of the predictor variables.

4.5 Household Well-being

The study sought to determine socio-economic effects of rural electrification on the household well-being among proprietors of micro and small enterprises in Kenya. The dependent variable in this study was household well-being. There were two measures of household well-being namely access to basic human needs and meeting social obligations. These measures were explored through descriptive analysis and factor analysis. In the conceptual framework, it was postulated that household well-being is influenced by socio-economic effects of rural electrification namely skills and knowledge application, access to healthcare, income level and employment status. In addition, electricity supply was considered a moderating variable.

4.5.1 Descriptive Statistics for Household Well-Being

Household well-being was assessed by two measures namely access to basic human needs and meeting social obligations. A five point rating scale was used to collect the views of proprietors of MSEs. Respondents were presented with eight constructs as indicators of household well-being where they responded to the statements on a five Likert scale from strongly agree (5) to strongly disagree (1), where 5 was translated to indicate very high level of household well-being and 1 to represent very low level of household well-being. Further, this data was rigorously interrogated on the basis of percentage frequencies of responses. The interrogation was done thematically and the results were summarized as shown in Table 4.11.

Table 4.11: Household Well-being

	Opinion Statement	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
1.	Enhanced business income due to electrification leads to improved nutrition for households.	29.3%	38.8%	6.7%	11.7%	13.4%
2.	Part of the business profit as a result of electricity use is used to improve household housing.	23.1%	33.6%	8.8%	16.6%	17.9%
3.	Longer opening hours in health facilities due to electricity supply enhances the level of healthcare.	31.3%	23.5%	8.8%	20.8%	15.6%
4.	Some of the business income gained owing to electricity use is used to buy clothing for members of the household.	22.5%	21.5%	15.0%	20.5%	20.5%
5.	Income from businesses enhanced as a result of electricity use helps pay school fees for members of households.	31.6%	13.0%	13.4%	32.2%	9.8%
6.	Income from business enhanced as a result of electrification enables proprietors to gain membership of social groups.	31.3%	20.2%	17.5%	17.6%	13.4%
7.	Improved profit levels due to electricity supply leads to ownership of valuable assets.	30.3%	30.3%	12.0%	19.9%	7.5%
8.	Improved income status provides confidence to members of a household to participate in community decision making process	19.2%	27.0%	15.0%	17.3%	21.5%
	N = 307					

From Table 4.11, respondents generally agreed that socio-economic effects of rural electrification had a positive effect on household well-being. For instance, respondents were in agreement that enhanced business income due to electrification led to improved nutrition for households. This was confirmed by about 58% of the respondents who participated in the survey. This is in line with the assertion by Watson, Pichler and Wallace (2010) that material advantage, such as good housing quality is strongly associated with high level of well-being and the assertion by McGregor (2007) that a household's well-being is judged from a combination of what people possess (material), how they are able to use it (relational) and the level of satisfaction or subjective quality of life that they derive from it.

4.5.2 Factor Analysis Results for Household Well-being

Factor analysis using Principal Components Method (PCM) approach helped the researcher to cluster the common factors and to retain a small number of factors which had the highest influence, as explained by Oso and Onen (2009). According to Kennedy (2010), analysis of principal components is a method which describes interdependencies among the items of a variable and is usually aimed at sorting a few factors which explains most of the information on the variable construct. The extraction of the factors followed the Kaiser criterion where an eigenvalue of 1 or more indicates a unique factor. All the eight household wellbeing indicators were subjected to factor analysis which was conducted using Principal Components Method (PCM) approach. The results are presented in Table 4.12.

Table 4.12: Total Variance Explained for Household Well-being

Component	Initial Eigenvalues.			Extraction Sums of Squared Loadings.		
	Total.	Variance. (%)	Cumulative. (%)	Total.	Variance (%)	Cumulative (%)
1.	4.181	52.264	52.264	4.181	52.264	52.264
2.	.762	9.528	61.792			
3.	.643	8.039	69.832			
4.	.592	7.394	77.226			
5.	.569	7.106	84.332			
6.	.483	6.034	90.366			
7.	.406	5.081	95.447			
8.	.364	4.553	100.000			

Extraction Method: Principal Component Analysis.

Eigenvalues associated with each linear component were listed before extraction, after extraction and after rotation as shown in Table 4.12. Before extraction, SPSS had identified eight linear components within the data set. The eigenvalues associated with each factor represents the variance explained by that particular linear component and it is displayed in terms of percentage of variance explained. The eight measures of household well-being were subjected to factor analysis and seven items attracted

coefficients of more than 0.4. Therefore, the seven (7) statements were retained for analysis. According to Rahn (2010) a factor loading equal to or greater than 0.4 is considered adequate. Further the results showed that there was only one critical factor influencing household well-being which accumulated to 52.264% of the total variance in this construct.

The main loadings in the single component were from items on access to basic family needs and meeting social obligations both of which measured the degree to which the socio-economic effects of rural electrification had addressed the objective of household well-being among proprietors of MSEs. The two initial sub-concepts on access to basic family needs and meeting social obligations were combined to form 'household well-being'. The single component was therefore named 'household well-being'. The results demonstrate that household well-being which entailed improved nutrition for households, better household housing conditions, enhanced level of healthcare for households and participation in community decision making process forms the main measure of household well-being among proprietors of MSEs in Kenya.

Table 4.13: Rotated Component Matrix for Household Well-being

Statement	Household Well-being
1. Enhanced business income due to electrification leads to improved nutrition for households.	.751
2. Part of the business profit as a result of electricity use is used to improve household housing conditions.	.744
3. Longer opening hours in health facilities due to electricity supply enhances the level of healthcare.	.676
4. Some of the business income gained owing to electricity use is used to buy clothing for members of the household.	.741
5. Income from businesses enhanced as a result of electricity use helps pay school fees for members of households.	.735
6. Income from business enhanced as a result of electrification enables proprietors to gain membership of social groups.	.694
7. Improved profit levels due to electricity supply leads to ownership of valuable assets.	.736
8. Improved income status provides confidence to members of a household to participate in community decision making process	.702

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

From the rotation matrix in Table 4.13, there was only one major factor combining the two initial sub-concepts of access to basic family needs and meeting social obligations. This therefore implies that well-being is a composite concept that cannot be broken further. This factor had eight items with very high loadings and significance. The mean of the scales constructed on the basis of the single factor of household well-being, was checked using univariate descriptive under factor analysis. The results are presented on a scale of 1.0 to 5.0 in Table 4.14.

Table 4.14: Analysis of the Mean for Household Well-being

Definition	**Mean**	**SD**
Enhanced Well-being	3.32	.64750

Key: 1.00-1.80 = Strongly Disagree; 1.81-2.60 = Disagree; 2.61-3.40 = Neither Agree nor Disagree; 3.41-4.20 = Agree; 4.21-5.0 = Strongly Agree

The finding indicate that respondents were ambivalent about the effect of rural electrification on well-being which includes increased access to basic family needs and meeting social obligations as indicated by a mean score of 3.32 which lies on the neither agree nor disagree on the ranking scale. This is not a surprise since the study was carried out in a rural set-up where a majority of poor people in developing countries like Kenya live (Sachs, 2005). The finding is in line with that by Lee, Miguel and Wolfram (2016) that rural electrification in Kenya may reduce social welfare as the costs of grid expansion significantly outweigh its benefits. The finding also resonate with Neelsen and Peters (2013) who explored the impact of electrification on fishing communities near Lake Victoria and did not find any significant difference between communities with or without access to electricity. Bensch, Kluve, and Peters (2011) also find no effect of rural electrification on income and children's home study using data from Rwanda.

4.6 Access to Healthcare and Well-being

The first objective of this study was to determine the effect of access to healthcare due to rural electrification on household well-being among proprietors of micro and small enterprises in Kenya. To achieve this objective, access to healthcare was assessed through three main measures namely service time, service quality and service cost. Ten constructs that underlie the three measures were subjected to factor analysis. Overall, effect of access to healthcare on household well-being was analyzed through descriptive statistics, factor analysis, correlation analysis and regression analysis.

4.6.1 Descriptive Statistics for Access to Healthcare

Table 4.15 shows the statistical results for access to healthcare based on 10 opinion statements. The proprietors of micro and small enterprises rated the items using: 1= strongly disagree, 2= disagree, 3=neither agree nor disagree, 4=agree and 5=strongly agree. The Likert scale responses were converted to continuous scale data by computing the percentages in each item.

Table 4.15: Access to Healthcare

Opinion Statement	Strongly Agree	Agree	Neither Agree nor Disagree	Strongly Disagree
1. Electricity provides quality lighting at night for performing medical operations.	64.5%	24.8 %	7.8%	0.3%	2.6%
2. Availability of electricity enables health centers to operate for longer hours.	38.1%	51.8 %	6.8%	1.0%	2.3%
3. Availability of electricity enables faster medical emergency response especially at night.	44.3%	42.0 %	9.1%	2.3%	2.3%
4. Access to electricity helps to attract more qualified medical staff to work in health facilities.	43.6%	46.5 %	6.3%	1.9%	1.7%
5. Use of electricity in health facilities reduces the cost of energy leading to reduced cost of healthcare services.	23.5%	49.8 %	15.3%	8.5%	2.9%
6. Electricity enables storage of vaccines and medicines requiring refrigeration.	44.3%	44.6 %	7.8%	1.3%	2.0%
7. Use of electricity-dependent medical equipment after electrification reduces costs previously incurred on referrals.	35.8%	45.0 %	12.3%	4.9%	2.0%
N = 307					

Table 4.15 reveals that rural electrification had a considerable effect on access to healthcare resulting to improved well-being of households. For instance, 90 percent of the respondents agreed that access to electricity helped to attract more qualified medical staff to work in local hospitals. One of the recommendations made by World Health Organization to assist in attraction and retention of healthcare workers in rural areas is to improve living conditions for health workers and their families and invest in infrastructure and services such as electricity as this has a significant influence on a health worker's decision to locate to or remain in rural areas (WHO, 2010). Similarly, World Health Organization (2015) also report that health facilities with electricity may be better positioned to attract and retain skilled health workers, especially in rural areas. In Tanzania there are health facilities with no single health worker and one of the contributing factors is the unavailability of electricity with health workers even opting to quit employment when they are assigned to work in remote rural areas where electricity is a challenge (IEA, 2014).

These findings concur with those of the World Health Organization (2015) that observed that electricity may have a significant impact on some key health service indicators such as: prolonging night-time service provision; attracting and retaining skilled health workers to a facility; and providing faster emergency response, including for childbirth emergencies and the assertion of Van Leeuwen (2014) that the powering of emergency medical equipment, storage of blood and vaccines, and performing of basic health procedures, especially after dark, are all contingent on reliable electricity supplies.

4.6.2 Factor Analysis for Access to Healthcare

Factor analysis was used to investigate items with greater significance on access to healthcare and to examine their dimensionality on the variable. Principal Components Method (PCM) approach, which was used as a method of factor analysis, enabled the researcher to identify the common factors and to retain a small number of factors which had the highest influence, as held by Oso and Onen (2009). The extraction of the factors followed the Kaiser criterion where an eigenvalue of 1 or more indicates a unique factor.

All the 10 items describing access to healthcare were subjected to factor analysis. The results are presented in Table 4.16.

Table 4.16: Total Variance Explained for Access to Healthcare

	Initial Eigenvalues.			Extraction Sums of Squared Loadings.			Rotation Sums of Squared Loadings		
Component	Total	Variance (%)	Cumulative (%)	Total	Variance (%)	Cumulative (%)	Total	Variance (%)	Cumulative (%)
1.	3.364	48.063	48.063	3.364	48.063	48.063	2.453	35.045	35.045
2.	1.023	14.618	62.681	1.023	14.618	62.681	1.935	27.636	62.681
3.	.646	9.234	71.915						
4.	.601	8.590	80.505						
5.	.550	7.863	88.368						
6.	.460	6.570	94.937						
7.	.354	5.063	100.000						

Extraction Method: Principal Component Analysis.

The eigenvalues associated with each linear component (factor) before extraction, after extraction and after rotation are shown in Table 4.16.. Before extraction, SPSS had identified seven linear components within the data set. The eigenvalues associated with each factor represents the variance explained by that particular linear component and it is displayed in terms of percentage of variance explained. The seven measures of access to healthcare were subjected to factor analysis and six (6) items attracted coefficients of more than 0.4. Therefore, the six (6) statements were retained for analysis. According to Rahn (2010) a factor loading equal to or greater than 0.4 is considered adequate. Using factor analysis, only two factors were identified to have significant influence on

explaining characteristics of access to healthcare with cumulative variance of 62.681%. Only these items had an eigenvalue greater than 1 and had significant influence on access to healthcare characteristics, explaining 48.063% and 14.618% totaling to about 62.681% of variance on the variable as shown in Table 4.16.

The main loadings in the two components were from items on service time, service quality and service cost, all of which measured the degree to which access to healthcare had influenced household well-being among proprietors of MSEs. The three initial sub-concepts of service time, service quality and service cost were reduced to form affordable healthcare and quality healthcare. The results demonstrate that enhancing affordable healthcare and quality healthcare forms the main measure of access to healthcare due to rural electrification on household well-being among proprietors of MSEs in Kenya.

Table 4.17: Rotated Component Matrix for Access to Healthcare

Statement	Affordable Healthcare	Quality Healthcare
1. Electricity provides quality lighting at night for performing medical operations.	.727	.222
2. Availability of electricity enables health centers to operate for longer hours.	.836	.192
3. Availability of electricity enables faster medical emergency response especially at night.	.681	.230
4. Access to electricity helps to attract more qualified medical staff to work in health facilities.	.344	.697
5. Use of electricity in health facilities reduces the cost of energy leading to reduced cost of health services.	.091	.849
6. Electricity enables storage of vaccines and medicines requiring refrigeration.	.748	.186
7. Use of electricity-dependent medical equipment after electrification reduces costs previously incurred on referrals.	.278	.744

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

The rotated component matrix (Table 4.17) shows the factor loadings for each of the retained factors under access to healthcare. The main loadings in component one (1) were mainly from the initial sub-concepts of service time and service cost. Component one (1) was therefore named affordable healthcare. The main loadings in component two

(2) were items from the initial sub-concept of service quality. Component two (2) was therefore named quality healthcare. Therefore, the components identified to have the highest influence are; affordable healthcare and quality healthcare.

A descriptive analysis of the two factors of access to healthcare that were identified through rotation was undertaken by estimating the mean of the scales of each factor and the results are presented in Table 4.18.

Table 4.18: Analysis of the Mean for Access to Healthcare

Definition	Mean	SD
Timely Response	4.2575	.68983
Quality Healthcare	4.3467	.74554

Key: 1.00-1.80 = Strongly Disagree; 1.81-2.60 = Disagree; 2.61-3.40 = Neither Agree nor Disagree; 3.41-4.20 = Agree; 4.21-5.0 = Strongly Agree

From Table 4.18, it was observed that quality healthcare owing to rural electrification was the most important issue in access to healthcare as indicated by a mean score of 4.3467, which is equivalent to strongly agree on the ranking scale. It was also noted that affordable healthcare owing to rural electrification was equally an important concern for access to healthcare as indicated by a mean score of 4.2575, which is equivalent to strongly agree on the ranking scale. Poor energy infrastructure can affect the quality of service: for example, reduced operating hours resulting in an un-served population, reduced capacity for laboratory tests, night-time safety concerns and decline in staff morale (USAID, 2012). Electricity can, as a result, work in multiple ways to improve quality of healthcare, as well as the ability of health workers to provide certain services in the first place. Majority of the benefits for healthcare tend to either arise by way of extended opening hours or through having equipment that requires electricity (IEG, 2008).

This is consistent with the finding by World Health Organization (2015) that electricity may have a significant impact on attracting and retaining skilled health workers to a facility and by Noor *et al*. (2006) that rural electrification makes health facilities to be strategically available reducing the distance travelled to seek medical services. This is also in resonance with the finding by Van Leeuwen (2014) that the powering of emergency medical equipment, storage of blood and vaccines, and performing of basic health procedures, especially after dark, are all contingent on reliable electricity supplies and by World Health Organization (2015) that electricity may have a significant impact on some key health service indicators such as: prolonging night-time service provision and providing faster emergency response, including for childbirth emergencies.

4.6.3 Correlation Analysis for Access to Healthcare and Well-being

A Pearson Product Moment Correlation Coefficient was computed, with scores on access to healthcare due to rural electrification as independent variable and household well-being among proprietors of micro and small enterprises as dependent variable. The scores for both variables, which were collected in form of frequencies, were converted into ratio scaled data by computing mean responses per respondents, where high scale ratings implied high access to healthcare and high household well-being and vice versa. The correlation analysis result was shown in SPSS output, as indicated in Table 4.19.

Table 4.19: Access to Healthcare and Well-being

		Household Well-being
Affordable Healthcare	Pearson Correlation	.526**
	Sig. (2-tailed)	.000
	N	307
Quality Healthcare	Pearson Correlation	.530**
	Sig. (2-tailed)	.000
	N	307

**. Correlation is significant at the .01 level (2-tailed).

The finding showed that there was a moderate positive (r=.526, n=307, p<.05) relationship between affordable healthcare and household well-being among proprietors of micro and small enterprises. Prolonged opening hours of healthcare facilities may reduce the costs incurred by the poor in seeking emergency medical services at night. There was also a moderate positive (r=.530, n=307, p<.05) relationship between quality healthcare and household well-being among proprietors of micro and small enterprises. Reduced energy costs may translate to reduced cost of healthcare for households of proprietors of MSEs. The findings resonates well with the assertion by Noor *et al*. (2006) that rural electrification enables health facilities to be strategically located, offer uniquely affordable services that are universally acceptable, adequately available and evenly distributed to easily access healthcare services.

4.6.4 Regression Analysis for Access to Healthcare and Well-being

To estimate the effect of access to healthcare due to rural electrification on household well-being among proprietors of micro and small enterprises, a coefficient of determination was computed. This was done using regression analysis and the results were as shown in Table 4.20.

Table 4.20: Model Summary for Access to Healthcare and Well-being

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.604[a]	.365	.361	.51775

a. Predictors: (Constant), Affordable Healthcare, Quality Healthcare

From Table 4.20, it can be seen that R-value is 0.604. Therefore, R-value (.604) for access to healthcare suggested that there is a strong influence of affordable healthcare and quality healthcare on household well-being among proprietors of MSEs. It can also be observed that the coefficient of determination, the R-square (R^2) value is 0.365, which represents 36.5% variation of household well-being among proprietors of micro and small enterprises owing to access to healthcare. To determine whether access to

healthcare was a significant predictor of household well-being among proprietors of micro and small enterprises, Analysis of Variance (ANOVA) was computed as shown in Table 4.21.

Table 4.21: ANOVA – Access to Healthcare and Well-being

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	46.8	2	23.4	87.291	.000[b]
	Residual	81.493	304	.268		
	Total	128.293	306			

a. Dependent Variable: Household Well-being

b. Predictors: (Constant), Affordable Healthcare, Quality Healthcare

From Table 4.21, it can be noted that access to healthcare was a significant predictor of household well-being among proprietors of micro and small enterprises [$F(2, 304) = 87.291$, $p < .05$)]. This means that access to healthcare due to rural electrification was a significant predictor of household well-being among proprietors of micro and small enterprises. From the results it is clear that access to healthcare explained a significant amount of the variance in the level of household well-being among proprietors of micro and small enterprises. To show the strengths of the relationship between access to healthcare and household well-being among proprietors of micro and small enterprises, a partial regression analysis was done. Analysis of the regression model coefficients is shown in Table 4.22.

Table 4.22: Regression Coefficients for Access to Healthcare

Coefficients					
Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
1	**B**	**Std. Error**	**Beta**		
(Constant)	.806	.093		8.691	.000
Affordable healthcare	.321	.051	.342	6.352	.000
Quality healthcare	.303	.047	.349	6.477	.000

a. Dependent Variable: Household well-being

Model : $Y=0.806+0.342X_2+0.349X_3$

From Table 4.22, there was a positive beta co-efficient of 0.342 and 0.349 as indicated by the co-efficient matrix with a p-value = .000 <.05 and a constant of 0.692 with a p-value = .000 < .05. Therefore, both the constant, affordable healthcare and quality healthcare contribute significantly to household well-being. Consequently, the model can provide the information needed to predict household well-being from access to healthcare. The regression equation is presented as follows: $Y=0.806+0.342X_2+0.349X_3$ Where Y = household well-being, X_2 is affordable healthcare and X_3 is quality healthcare.

The findings agree with a study by Youssef, Lannes, Rault and Soucat (2016) that there exists a unidirectional Granger causality from energy consumption to life expectancy in Kenya. As Kenya develops, income per capita increases allowing more per capita energy consumption. Energy consumption permits better sanitation, more heating and warm food, less indoor pollution and better medicine conservation. This finding is in line with a study by Ramji, Patnaik, Mani, and Dholakia (2017) aimed at investigating the synergy between access to electricity and delivery of healthcare services in India. The findings revealed that power cuts in the evenings significantly reduced service delivery in public health centers. Access to regular electricity also enables access to regular water

supply for many health centers. The lack of adequate and quality water supply compromises the ability to provide basic, routine services such as child delivery and weakens the ability to prevent and control infections (WHO, 2015).

Electricity may have a significant impact on prolonging night-time service provision and providing faster emergency response, including for childbirth emergencies (WHO, 2015). Without electricity for refrigeration, health clinics cannot safely administer vaccines or a number of other medicines. Without a constant source of quality lighting, which is not achievable using candles or other non-electrified sources, doctors cannot safely perform operations or even adequately examine a patient at night. Many doctors and nurses simply won't serve at health clinics that don't have outdoor lighting to provide for their safety.

An improved health status in the population impacts positively on productivity which has positive implications on, for example, MSEs output (European Commission, 2006). Sickness absenteeism is a major occupational health problem in developing countries where a majority of the working population are engaged in MSEs. This can lead to loss of working hours, a reduction in productivity and even workplace disputes (Tadesse *et al*, 2015). Whilst improved healthcare access cannot prevent accidents, it can help access to relevant treatment which we may assume can improve recovery and household well-being. The results agree with the findings by Noor *et al*. (2006) that rural electrification may lead to new facilities that are strategically located, offer uniquely affordable services, adequately available and evenly distributed for the poor in rural areas to easily access healthcare services.

4.7 Employment Status and Well-being

The second objective of the study was to evaluate employment status owing to rural electrification on household well-being among proprietors of micro and small enterprises in Kenya. To attain this objective, employment status was assessed through three main measures namely cost of labor, employee effectiveness and availability of labor. Ten constructs that underlie the three measures were subjected to factor analysis. Generally, employment status due to rural electrification on household well-being were analyzed through descriptive statistics, factor analysis, correlation analysis and regression analysis.

4.7.1 Descriptive Statistics for Employment Status

Employment status was explored by use of a ten-itemed Likert-scaled questionnaire, where the proprietors of MSEs rated the items from strongly agree (5) to strongly disagree (1). Their views were computed and described in percentages, frequencies and means. Table 4.23 shows the summary of views of the respondents on employment status as a result of rural electrification.

Table 4.23: Descriptive Statistics for Employment Status

	Opinion Statement	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
1.	Use of electricity-dependent machinery enhances labor efficiency.	55.4%	37.5%	4.2%	1.3%	1.6%
2.	Electrification leads to business diversification that requires employees with varied skills.	28.0%	61.2%	7.5%	2.0%	1.3%
3.	Access to electricity enhances self-employment.	37.8%	51.1%	8.1%	1.0%	2.0%
4.	Electrification allows firms to plan for flexible working hours for her employees.	32.6%	52.4%	11.7%	1.3%	2.0%
5.	Electrification increases demand for labor in newly established electricity-dependent businesses.	28.7%	54.7%	11.3%	3.3%	2.0%
6.	Access to electricity increases non-farm wage employment.	33.1%	52.4%	10.3%	7.2%	2.0%
7.	Use of electricity allows household members to reallocate labor from household tasks to formal wage labor.	24.1%	53.1%	13.3%	7.2%	2.3%
	N = 307					

Rural electrification had a considerable amount of influence on creating employment which triggered a rise in general well-being of households among proprietors of MSEs as presented in Table 4.23. For example, more than 85% of the respondents agreed that access to electricity increases non-farm wage employment. After electrification, changes of labor allocation across activities might occur and lead to higher level of employment and productivity. Here, it is particularly the shift from agricultural to non-agricultural activities that is associated with employment and productivity increases. Shifts in labor from agricultural to non-agricultural activities encompasses productive appliance usage, changes in the main occupation and firm creation after electrification. It is important to emphasize that the vast majority of households in rural Kenya are farmers and do not pursue any nonagricultural activity. These findings agree with the findings by Van de Walle *et al*. (2013) that having access to electricity creates opportunities to generate income within the home and allows for new types of jobs outside the home, thus potentially increasing self-employment and labor demand.

4.7.2 Factor Analysis for Employment Status

Factor analysis was used to investigate items with greater significance to employment status and to determine their dimensionality on the variable. Principal Components Method (PCM) approach used as a method of factor analysis enabled the researcher to identify the factors with high statistical significance and to retain a small number of factors which had the highest influence (Oso & Onen, 2009). Analysis of principal components describes interdependencies among the items of a variable with an aim of identifying few factors which explains most of the information on the variable construct (Kennedy, 2010). The extraction of the factors followed the Kaiser criterion where an eigenvalue of 1 or more indicates a unique factor. All the 10 items describing employment status were put on factor analysis, whose results were presented in Table 4.24.

Table 4.24: Total Variance Explained for Employment Status

Component	Initial Eigenvalues. Total	% of Variance	Cumulative %	Extraction Sums of Squared Loadings Total	% of Variance	Cumulative %	Rotation Sums of Squared Loadings Total	% of Variance	Cumulative %
1.	3.323	47.472	47.472	3.323	47.472	47.472	2.883	41.179	41.179
2.	1.238	17.691	65.163	1.238	17.691	65.163	1.679	23.984	65.163
3.	.636	9.090	74.252						
4.	.533	7.613	81.866						
5.	.469	6.702	88.567						
6.	.411	5.878	94.446						
7.	.389	5.554	100.000						

Extraction Method: Principal Component Analysis.

Table 4.24 indicates the eigenvalues associated with each linear component (factor) before extraction, after extraction and after rotation. Before extraction, SPSS identified seven linear components within the data set. The eigenvalues associated with each factor represents the variance explained by that particular linear component and it is presented in terms of percentage of variance explained. The seven measures of access to healthcare were subjected to factor analysis and six (6) of them attracted coefficients of more than 0.4. Therefore, the six (6) statements were retained for analysis. According to Rahn (2010), a factor loading equal to or greater than 0.4 is considered adequate. Using factor analysis, only two factors were identified to have a significant influence on explaining characteristics of employment status with cumulative variance of 65.163%. Only these items had an eigenvalue greater than one (1) and had a significant influence on employment status characteristics, explaining 47.472% and 17.691% totaling to about 65.163% of variance on the variable as shown in Table 4.24.

The main loadings in the two components were from items on cost of labor, supply of labor and demand for labor, all of which measured the degree to which employment status had influenced household well-being among proprietors of MSEs. The three initial sub-concepts of cost of labor, supply of labor and demand for labor were reduced to form employee effectiveness and availability of labor. The results demonstrate that employee effectiveness and availability of labor forms the main measure of employment status on the household well-being among proprietors of MSEs in Kenya.

Table 4.25: Rotated Component Matrix for Employment Status

Statement	Employee Effectiveness	Availability of Labor
1. Use of electricity-dependent machinery enhances labor efficiency.	.731	.186
2. Electrification leads to business diversification that requires employees with varied skills.	.791	.132
3. Access to electricity enhances self-employment.	.782	.044
4. Electrification allows firms to plan for flexible working hours for her employees.	.802	.118
5. Electrification increases demand for labor in newly established electricity-dependent businesses.	.650	.344
6. Access to electricity increases non-farm employment.	.151	.860
7. Use of electricity allows household members to reallocate labor from household tasks to formal wage labor.	.147	.867

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

The rotated component matrix (Table 4.25) shows the factor loadings for each of the retained factors under employment status. The main loadings in component one (1) were mainly from a combination of the initial sub-concepts of cost of labor and demand for labor. Component one (1) was therefore named employee effectiveness. The main loadings in component two (2) were items from the initial sub-concept of supply for labor. Component two (2) was therefore named availability of labor. Therefore, the components identified to have the highest influence were; employee effectiveness and availability of labor. A descriptive analysis of the two factors of employment status that were identified through rotation was undertaken by estimating the mean of the scales of each factor and the results are presented in Table 4.26.

Table 4.26: Analysis of the Mean for Employment Status

Definition	Mean	SD
Employee Effectiveness	4.1920	.60251
Availability of Labor	3.8900	.81558

Key: 1.00-1.80 = Strongly Disagree; 1.81-2.60 = Disagree; 2.61-3.40 = Neither Agree nor Disagree; 3.41-4.20 = Agree; 4.21-5.0 = Strongly Agree

It was observed that employee effectiveness was the most significant issue regarding employment status as indicated by a mean score of 4.1920, which is equivalent to agree on the ranking scale as shown in Table 4.26. It was also noted that availability of labor as a result of rural electrification was similarly an important concern in employment status as indicated by a mean score of 3.8900, which is equivalent to agree on the ranking scale.

Electricity provision can affect employment through different channels. First, it can be thought of as a technological shock that improves household production. Second, it implies a larger time endowment because everyone can work during the night (and not only during the day). Third, it could promote the start off of new businesses by allowing households to produce goods and services that require appliances (Dasso & Fernandez,

2013). This is consistent with the finding by Van de Walle *et al*. (2013) that having access to electricity creates opportunities to generate income within the home and allows for new types of jobs outside the home, thus potentially increasing self-employment and labor demand. Similarly, the results also resonate with the finding by Torero (2015) that rural electrification leads to a shift from agriculture-based to non-agriculture-based activities that are associated with growth in productivity and thus, increases in income and by Grogan and Sadanand (2013) that household electrification frees up women's time spent in collecting and preparing fuel, and increases the productivity of household tasks through improved technology.

4.7.3 Correlation Analysis for Employment Status and Well-being

A Pearson Product Moment Correlation Coefficient was computed, with scores on employment status as independent variable and household well-being among proprietors of micro and small enterprises as dependent variable. The scores for both variables were converted into continuous data (ratio scaled data) by computing mean responses per respondent, where high scale ratings implied high employment status and high household well-being and vice versa. The correlation analysis result was shown in SPSS output, as indicated in Table 4.27.

Table 4.27: Employment Status and Household Well-being

		Household Well-being
Employee Effectiveness	Pearson Correlation	.632**
	Sig. (2-tailed)	.000
	N	307
Availability of Labor	Pearson Correlation	.577**
	Sig. (2-tailed)	.000
	N	307

**. Correlation is significant at the 0.01 level (2-tailed).

The results of the survey confirmed that there was a strong positive (r=.632, n=307, p<.05) relationship between employee effectiveness and household well-being among proprietors of micro and small enterprises. Rural electrification is believed to attract skilled labor in rural areas due to improved living standards. This may further lead to production and demand for high quality goods and services in rural areas. The finding also revealed a moderate positive (r=.577, n=307, p<.05) relationship between availability of labor and household well-being among proprietors of micro and small enterprises. Rural electrification may spur development of nonfarm businesses that consequently form the genesis of urbanization and industrialization in rural areas. This findings are in harmony with Jimenez (2017) assertion that access to electricity leads to a 25 percent increase in labor market participation on average, with a median of 20 percent.

4.7.4 Regression Analysis for Employment Status and Well-being

To estimate the level of influence of employment status owing to rural electrification on household well-being among proprietors of micro and small enterprises, a coefficient of determination was computed. This was done using regression analysis and the results were as shown in Table 4.28.

Table 4.28: Employment Status and Well-being

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.645[a]	.416	.412	.49648

a. Predictors: (Constant), Employee Effectiveness, Availability of Labor

From Table 4.28, it can be seen that R-value is 0.645. Therefore, R-value (.645) for employment status suggested that there is a strong effect of employee effectiveness and availability of labor on household well-being among proprietors of MSEs. It can also be observed that the coefficient of determination, the R-square (R^2) value is 0.416, which represents 41.6% variation of household well-being among proprietors of micro and

small enterprises as a result of employment status due to rural electrification. However, to determine whether employment status as a result of rural electrification was a significant predictor of household well-being among proprietors of micro and small enterprises, Analysis of Variance (ANOVA) was computed as shown in Table 4.29.

Table 4.29: ANOVA – Employment Status and Well-being

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	53.358	2	26.679	108.234	.000[b]
	Residual	74.935	304	.246		
	Total	128.293	306			

a. Dependent Variable: Household Well-being

b. Predictors: (Constant), Employment Status

Employment status was a significant predictor of household well-being among proprietors of micro and small enterprises [F (2, 304) = 108.234, $p < .05$)] as shown in Table 4.29. This means that employment status was a significant predictor of household well-being among proprietors of micro and small enterprises. From the results it was clear that employment status explained a significant amount of the variance in the value of household well-being among proprietors of micro and small enterprises.

To show the strengths of the relationship between employment status owing to rural electrification and household well-being among proprietors of micro and small enterprises, a partial regression analysis was done. Regression model coefficients are shown in Table 4.30.

Table 4.30: Regression Coefficients for Employment Status and Well-being

Coefficients Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
1		**B**	**Std. Error**	**Beta**		
	(Constant)	.626	.099		6.289	.000
	Employee Effectiveness	.624	.051	.580	12.304	.000
	Availability of Labor	.111	.037	.139	2.955	.003

a. Dependent Variable: Household well-being

Model: $Y=0.626+0.580X_6+0.139X_7$

From Table 4.30, there was a positive beta co-efficient of .580 and .139 as indicated by the co-efficient matrix with a p-value = .000 < .05 and a constant of .626 with a p-value = .000 < .05 as shown in Table 4.30. Therefore, the constant, employee effectiveness and availability of labor contributed significantly to household well-being. Consequently, the model can provide the information needed to predict household well-being from employment status. The regression equation is presented as follows: $Y=0.626+0.580X_6+0.139X_7$; Where Y = household well-being, X_6 is employee effectiveness and X_7 is availability of labor.

The finding is in line with a study by Kirubi *et al.* (2009) on community-based electric micro-grids' contribution to rural development in Kenya. The study revealed that access to electricity enables the use of electric equipment and tools by small and micro enterprises, resulting in significant improvement in demand and or productivity per worker (100–200% depending on the task at hand). This finding is also in line with that by Dasso and Fernandez (2015) that among males, rural electrification program increases hours of work and diminishes the likelihood of having a second occupation. Among females, the program raises employment and earnings and increases the probability of working outside the agricultural sector in rural Peru. This may be due to business diversification as a result of electrification that involve switching from low

value crop production to a high value crop, livestock and non-farm activities (Escobal, 2001). Business diversification meant to cushion the effects of economic hardship cuts across the formal sector (public/private sector), as well as, in the informal sector (Minot *et al*., 2006; Schgtman *et al*., 2006).

4.8 Income Level and Well-being

The third objective of the study was to examine the effect of income level due to rural electrification on household well-being among proprietors of micro and small enterprises in Kenya. To achieve this objective, income level was assessed through three main measures namely cost of production, revenue change and profit levels. Ten constructs that underlie the three measures were subjected to factor analysis. Generally, effect of income level on household well-being was analyzed through descriptive statistics, factor analysis, correlation analysis and regression analysis.

4.8.1 Descriptive Statistics for Income Level

To examine the effect of income level on well-being, a ten-itemed Likert scaled questionnaire was used as shown in Table 4.31. The proprietors of MSEs rated the items using: 1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree and 5=strongly agree. The Likert-scale responses were converted to continuous scale data by computing the mean response in each item. This enabled the researcher to compute means per item for comparison between the items of the subscale.

Table 4.31: Income Level

Opinion Statement	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
1. Use of electricity enhances income due to reduced business costs.	45.3 %	31.3%	10.7%	6.8%	5.9%
2. Use of electricity-dependent equipment enhances income due large scale production	21.8 %	63.5%	10.5%	2.6%	1.6%
3. Reliable electricity supply enhances income due to reduced cost of energy.	29.6 %	49.8%	14.7%	2.6%	3.3%
4. Use of electric machines enhances income due to improved quality products and services.	37.8 %	46.3%	12.7%	1.6%	1.6%
5. Electrification leads to diversification of businesses that enhances income for households.	31.6 %	51.5%	14.0%	2.6%	0.3%
6. Electrification enhances income by attracting/retaining more people in rural areas due to ready market for goods and services.	36.2 %	48.5%	11.7%	2.0%	1.6%
7. Availability of electricity enables value addition of agricultural products that enhances profitability.	27.7 %	53.1%	13.4%	4.2%	1.6%

N = 307

From Table 4.31, the respondents were in agreement that rural electrification led to an increase in income level. For instance, respondents were in agreement that availability of electricity enabled enterprises to operate for more hours leading to enhanced business turnover as evidenced by about 85% of those who participated in the survey. Electrification might affect the household's total working hours due to quality lighting and security. Wages might then increase, also leading to increases in purchasing power. The study results above are in agreement with Khandker *et al.* (2013) who reiterated that electricity access boosted household employment, income, or both that had a positive effect on well-being.

4.8.2 Factor Analysis for Income Level

Factor analysis was used to investigate items with greater significance to income level and to explore their dimensionality on the variable. Principal Components Method (PCM) approach used as a method of factor analysis enabled the researcher to identify the common factors and to retain a small number of factors which had the highest influence, as held by Oso and Onen (2009). Equally, Kennedy (2010) points out that analysis of principal components describes interdependencies among the items of a variable with an aim of identifying few factors which explains most of the information on the variable construct. The extraction of the factors followed the Kaiser criterion where an eigenvalue of 1 or more indicates a unique factor. All the ten items describing income level were subjected to factor analysis. The results were presented in Table 4.32.

Table 4.32: Total Variance Explained for Income Level

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
	3.198	45.680	45.680	3.198	45.680	45.680	2.482	35.460	35.460
	1.193	17.041	62.721	1.193	17.041	62.721	1.908	27.261	62.721
	.728	10.398	73.119						
	.545	7.789	80.908						
	.533	7.615	88.524						
	.417	5.959	94.482						
	.386	5.518	100.000						

Extraction Method: Principal Component Analysis.

Eigenvalues associated with each linear component (factor) before extraction, after extraction and after rotation are indicated in Table 4.32. Before extraction, SPSS identified seven linear components within the data set. The eigenvalues associated with each factor represents the variance explained by that particular linear component and it is presented in terms of percentage of variance explained. The seven measures of income level were subjected to factor analysis and six (6) of them attracted coefficients of more than 0.4. Therefore, the six (6) items were retained for analysis. According to Rahn (2010), a factor loading equal to or greater than 0.4 is considered adequate. Using factor analysis, only two factors were identified to have the significant influence on explaining characteristics of income level with cumulative variance of 62.721%. Only these items had an eigenvalue greater than one (1) and had the significant influence on income level characteristics, explaining 45.680% and 17.041% totaling to about 62.721% of variance on the variable as shown in Table 4.33.

The main loadings in the two components were from items on cost of production, revenue change and profit level, all of which measured the degree to which income level had influenced household well-being among proprietors of MSEs. The three initial sub-concepts of cost of production, revenue change and profit level were reduced to form business turnover and cost reduction. The results demonstrate that enhancing business turnover and cost reduction forms the main measure of income level on the household well-being among proprietors of MSEs in Kenya.

Table 4.33: Rotated Component Matrix for Income Level

Statement	Business Turnover	Cost Reduction
1. Use of electricity enhances income due to reduced business costs.	.019	.837
2. Use of electricity-dependent equipment enhances income due large scale production	.273	.795
3. Reliable electricity supply enhances income due to reduced cost of energy.	.398	.671
4. Use of electricity-dependent equipment enhances income due to improved quality products and services.	.716	.132
5. Electrification leads to diversification of businesses that enhances income for households.	.754	.211
6. Electrification enhances income by attracting and or retaining more people in rural areas due to ready market for goods and services.	.746	.239
7. Availability of electricity enables value addition of agricultural products that enhances profitability.	.782	.078

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.

The factor loadings for each of the retained factors under income level are shown in the rotated component matrix Table 4.33. The main loadings in component one (1) were mainly from a combination of the initial sub-concepts of profit levels and revenue change. Component one (1) was therefore named business turnover. The main loadings in component two (2) were items from the initial sub-concept of cost of production. Component two (2) was therefore named cost reduction. Therefore, the components identified to have the highest influence were; business turnover and cost reduction. A descriptive analysis of the two factors of access to healthcare that were identified through rotation was undertaken by estimating the mean of the scales of each factor and the results are presented in Table 4.34.

Table 4.34: Analysis of the Mean for Income Level

Definition	**Mean**	**SD**
Business Turnover	4.1125	.62308
Cost Reduction	4.0133	.83039

Key: 1.00-1.80 = Strongly Disagree; 1.81-2.60 = Disagree; 2.61-3.40 = Neither Agree nor Disagree; 3.41-4.20 = Agree; 4.21-5.0 = Strongly Agree

From Table 4.34, it was observed that business turnover as a result of rural electrification was the most important concern in income level as indicated by a mean score of 4.1125, which is equivalent to agree on the ranking scale. It was also noted that cost reduction as a result of rural electrification was equally an important issue in income level as indicated by a mean score of 4.0133, which is equivalent to agree on the ranking scale.

Electricity can provide direct income benefits to households by enabling productivity gains in mechanical tasks and providing opportunities for expanding or setting up new businesses. For instance, quality lighting allows longer working hours and boosts security for businesses. This is consistent with the findings by Peters, Vance, and Harsdorff (2011) that firms created after electrification, amongst them some highly

dependent on electricity for their operations, exhibited profits that are considerably higher than non-connected firms and by Mayer-Tasch, Mukherjee and Reiche (2013) that firms established after electrification may be new types of business, offering goods and services that were previously imported from elsewhere or simply been unavailable. This is also in line with the findings by Scott, Darko, Lemma and Rud (2014) that reliance on generators for electricity during outages can be expected to increase the cost of electricity, and the effect on cost-competitiveness is related to the proportion of total costs accounted for by electricity leading to reduced firm income.

4.8.3 Correlation Analysis for Income Level and Well-being

A Pearson Product Moment Correlation Coefficient was computed, with scores on income level as independent variable and household well-being among proprietors of micro and small enterprises as dependent variable. The scores for both variables, which were collected in frequencies and percentage, were converted into ratio scaled data by computing mean responses per respondent, where high scale ratings implied high income level and high household well-being and vice-versa. The correlation analysis result was shown in SPSS output, as indicated in Table 4.35.

Table 4.35: Income Level and Well-being

		Household Well-being
Business Turnover	Pearson Correlation	.510**
	Sig. (2-tailed)	.000
	N	307
Cost Reduction	Pearson Correlation	.535**
	Sig. (2-tailed)	.000
	N	307

**. Correlation is significant at the 0.01 level (2-tailed).

The finding indicated that there was a moderate positive (r=.510, n=307, p<.05) relationship between business turnover and household well-being among proprietors of micro and small enterprises. Increase in revenue was believed to contribute to improved quality of life among households of proprietors of MSEs. There was also a moderate positive (r=.535, n=307, p<.05) relationship between cost reduction and household well-being among proprietors of micro and small enterprises. Reduced energy costs was believed to enhance savings among proprietors of MSEs. The savings could then be invested in other poverty eradication programmes such as education and other business ventures. This finding concur with Grogan and Sadanand (2013) who posits that household access to electrification enhances household well-being through provision of income generation opportunities, alleviating poverty, improving children's health, reducing incidences of child labor, and enhancing status of the women and girls.

4.8.4 Regression Analysis for Income Level and Well-being

To estimate the level of effect of income level on household well-being among proprietors of micro and small enterprises, a coefficient of determination (R Square) was computed. This was done using regression analysis and the results are tabulated in Table 4.36.

Table 4.36: Model Summary for Income Level and Well-being

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.615[a]	.379	.375	.51203

a. Predictors: (Constant), Business Turnover, Cost Reduction

From Table 4.36, it can be seen that R-value is 0.615. Therefore, R-value (.615) for income level suggested that there is a strong effect of business turnover and cost reduction on household well-being among proprietors of MSEs. It can also be observed that the coefficient of determination, the R-square (R^2) value is 0.379, which represents

37.9% variation of household well-being among proprietors of micro and small enterprises as a result of income level. However, to determine whether income level was a significant predictor of household well-being among proprietors of micro and small enterprises, Analysis of Variance (ANOVA) was computed as shown in Table 4.37.

Table 4.37: ANOVA – Income Level and Well-being

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	48.594	2	24.297	92.676	.000[b]
	Residual	79.700	304	.262		
	Total	128.294	306			

a. Dependent Variable: Household Well-being

b. Predictors: (Constant), Business Turnover, Cost Reduction

From Table 4.37, it can be seen that income level was a significant predictor of household well-being among proprietors of micro and small enterprises [$F(2, 304) = 92.676$, $p < .05$)]. This implies that income level was a significant predictor of household well-being among proprietors of micro and small enterprises. Income level explained a significant amount of the variance in the value of household well-being among proprietors of micro and small enterprises.

To show the strengths of the relationship between income level and household well-being among proprietors of micro and small enterprises, a partial regression analysis was done. Regression model coefficients are shown in Table 4.38.

Table 4.38: Regression Coefficients for Income Level and Well-being

Coefficients					
Model	**Unstandardized**		**Standardized**		
	Coefficients		**Coefficients**	**t**	**Sig.**
1	**B**	**Std. Error**	**Beta**		
(Constant)	.692	.100		6.940	.000
Business Turnover	.353	.052	.340	6.735	.000
Cost Reduction	.299	.039	.384	7.611	.000

a. Dependent Variable: Household well-being

Model : $Y=0.692+0.340X_4+0.384X_5$

From Table 4.38, there was a positive beta co-efficient of 0.340 and 0.384 as indicated by the co-efficient matrix with a p-value = .000 < .05 and a constant of 0.692 with a p-value = .000 < .05. Therefore, the variables business turnover and cost reduction contribute significantly to household well-being. Consequently, the model can provide the information needed to predict household well-being from income level. The regression equation is presented as follows: $Y=0.692+0.340X_4+0.384X_5$; Where Y = Household well-being, X_4 is business turnover and X_5 is cost reduction.

The finding confirms that by Kirubi *et al.* (2009) on community-based electric micro-grids' contribution to rural development in Kenya. The study revealed that access to electricity enables the use of electric equipment and tools by small and micro enterprises, resulting in a corresponding growth in income levels in the order of 20–70%, depending on the product made. Rural households in many developing countries like Kenya have been found to diversify their income sources that allow them to reduce income related risks and maintain their profit levels at the same time reducing costs

(Reardon et al., 1992). This is often necessary in the agriculture based economies where various types of risks exist such as variability in soil quality, crop diseases, price shock, unpredictable rainfall and other weather related events which leads to low productivity, low output and invariably low income which continually trap them in the vicious cycle of poverty. Increasing the sources of income through profit from MSEs, therefore, has become an important component of livelihood strategies among rural households. According to the portfolio theory of diversification, households generally trade-off relatively high mean profitability of one activity to reduce risk/costs and maximize utility/profit. Income diversification refers to an increase in the number of sources of income or the balance among the different sources. It means, on the one hand, that total income of a household accrues to more than one source such as agriculture and on the other hand, no one source is much dominant compared to the other sources (Joshi *et al*., 2003).

This result resonates with the findings by Torero (2015) that there are numerous ways in which rural electrification might affect income of newly connected households spanning from direct effects through home business activities to better job prospects in newly connected enterprises in the locality and by Grimm, Lange and Lay, (2011) that tailors in Burkina Faso with access to electricity had revenues 51% higher with an improved household well-being than tailors without electricity, and attributed this to the use of electric sewing machines and longer working hours.

3.9 Skills and Knowledge Application and Well-being

The fourth objective of the study was to investigate the effect of skills and knowledge application owing to rural electrification on household well-being among proprietors of micro and small enterprises in Kenya. To attain this objective, skills and knowledge application was assessed through three main measures namely productive efficiency, value addition and effective communication. Twelve constructs that underlie the three measures were subjected to factor analysis. Largely, effect of skills and knowledge

application on household well-being was analyzed through descriptive statistics, factor analysis, correlation analysis and regression analysis.

3.9.1 Descriptive Statistics for Skills and Knowledge Application

Effect of skills and knowledge application was explored using a twelve-itemed Likert scaled questionnaire, where the proprietors of MSEs rated the items from strongly disagree (1) to strongly agree (5). Their views were computed and described in percentage frequencies and means. Table 4.39 gives the summary of responses as frequencies.

Table 4.39: Skills and Knowledge Application

Opinion Statement	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Electrification enables use of ICT that enhances the level of knowledge and skills of members of a household.	40.4%	31.9%	21.2%	3.9%	2.6%
Electrification attracts population with a higher level of education and exposure leading to increased demand for new and innovative products.	28.3%	45.9%	12.1%	10.4%	3.3%
Exposure to media due to electrification makes businessmen more professional and successful in business.	30.9%	33.6%	19.5%	12.1%	3.9%
Skills acquired due to exposure to electronic equipment makes employees more productive at work.	27.7%	45.0%	12.3%	12.4%	2.6%
Knowledge and skills acquired through electronic media are necessary for business record keeping	29.9%	37.1%	20.0%	10.4%	2.6%
Use of computers due to electrification enhances effectiveness of employees.	27.0%	39.7%	15.3%	12.7%	5.3%
Electricity enables startup of micro processing firms that adds value to agricultural products.	26.1%	38.1%	20.5%	12.4%	2.9%
Availability of electricity has resulted in improved quality of business products/services.	29.3%	39.7%	16.4%	10.7%	3.9%
Electrification enhances exposure to social media that helps proprietors appreciate quality products and services.	25.7%	41.4%	20.8%	9.5%	2.6%
Use of electricity powered gadgets makes communication with service providers more efficient.	38.8%	33.9%	14.3%	10.1%	2.9%
Electricity supply is necessary for e-business.	34.2%	37.8%	16.0%	8.1%	3.9%
Access to electricity encourages internet use necessary for networking in business.	35.2%	38.8%	11.7%	11.7%	2.6%

N = 307

From Table 4.39, it is evident that skills and knowledge application had a positive effect on the household well-being among proprietors of MSEs. A case in point is where respondents agreed that population with a higher level of education and exposure increased demand for new and innovative products as represented by almost 74% of those who participated in the survey. Knowledgeable and skilled individuals are required to expedite delivery of improved value-added goods and services together with the competences to build consumers' trust and confidence. A more skilled and knowledgeable workforce is associated with a more productive and innovative economy.

The finding largely concurs with the assertion by Chowdhury *et al.* (2013) that educated people are creative and innovative and are always looking for something unique to fulfill a need or want and by Amesi (2011) that attainment of knowledge and skills makes entrepreneurs professional learners and successful in business. Equally, Van and Versloot (2008) had asserted that acquired knowledge plays a critical role in business performance, integration and accumulation of new knowledge as well as the adaptation to new situations.

4.9.2 Factor Analysis for Skills and Knowledge Application

Factor analysis was used to investigate items with greater significance to the subscale skills and knowledge application, and to establish their dimensionality on the variable. This was done by use of Principal Components Method (PCM) as a technique of factor analysis which enabled the researcher to identify and retain the factors with high statistical significance influence, as held by Oso and Onen (2009). Kennedy (2010) reiterates that analysis of principal components describes interdependencies among the items of a variable with an aim of identifying few factors which explains most of the information on the variable construct. The extraction of the factors follows the Kaiser criterion where an eigenvalue of 1 or more indicates a unique factor. All the twelve items describing skills and knowledge application were put on factor analysis, whose results are presented in Table 4.40.

Table 4.40: Total Variance Explained for Skills and Knowledge Application

	Initial Eigenvalues.			Extraction Sums of Squared Loadings.		
Component	**Total.**	**Variance. (%)**	**Cumulative. (%)**	**Total**	**Variance. (%)**	**Cumulative (%)**
1.	7.303	60.860	60.860	7.303	60.860	60.860
2.	.921	7.675	68.535			
3.	.682	5.682	74.217			
4.	.549	4.572	78.789			
5.	.440	3.669	82.458			
6.	.376	3.134	85.592			
7.	.373	3.105	88.697			
8.	.324	2.697	91.394			
9.	.311	2.591	93.985			
10.	.274	2.285	96.270			
11.	.259	2.160	98.430			
12.	.188	1.570	100.000			

Extraction Method: Principal Component Analysis.

Table 4.40 indicates the eigenvalues associated with each linear component (factor) before extraction, after extraction and after rotation. Before extraction, SPSS identified twelve linear components within the data set. The eigenvalues associated with each factor represents the variance explained by that particular linear component and it is presented in terms of percentage of variance explained. The twelve measures of skills and knowledge application were subjected to factor analysis and five of them attracted coefficients of more than 0.4. Therefore, the five (5) statements were retained for analysis. According to Rahn (2010), a factor loading equal to or greater than 0.4 is considered adequate. Using factor analysis, only one factor was identified to have the significant influence on explaining characteristics of skills and knowledge application with cumulative variance of 60.86%. Only this item had an eigenvalue greater than one (1) and had the significant influence on skills and knowledge application characteristics, explaining 60.86% of variance on the variable as shown in Table 4.40.

The main loadings in the single component were from items on productive efficiency, value addition and effective communication all of which measured the degree to which skills and knowledge application influenced household well-being among proprietors of MSEs. The three initial sub-concepts on productive efficiency, value addition and effective communication were combined to form skills and knowledge application. The single component was therefore named skills and knowledge application. The results demonstrate that enhancing skills and knowledge application forms the main measure the effect of skills and knowledge application on household well-being among proprietors of MSEs in Kenya.

Table 4.41: Rotated Component Matrix for Skills and Knowledge Application

Statement	Skills and Knowledge Application
Electrification enables use of ICT that enhances the level of knowledge and skills of members of a household.	.561
Electrification attracts population with a higher level of education and exposure leading to increased demand for new and innovative products.	.785
Exposure to media due to electrification makes businessmen more professional and successful in business.	.696
Skills acquired due to exposure to electronic equipment makes employees more productive at work.	.851
Knowledge and skills acquired through electronic media are necessary for business record keeping	.796
Use of computers due to electrification enhances effectiveness of employees.	.814
Electricity enables startup of micro processing firms that adds value to agricultural products.	.773
Availability of electricity has resulted in improved quality of business products/services.	.814
Electrification enhances exposure to social media that helps proprietors appreciate quality products and services.	.768
Use of electricity powered gadgets makes communication with service providers more efficient.	.812
Electricity supply is necessary for e-business.	.814
Access to electricity encourages internet use necessary for networking in business.	.834

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

From the rotation matrix in Table 4.41, there was only one major factor combining the three initial sub-concepts of productive efficiency, value addition and effective communication. This therefore implies that skills and knowledge application is a composite concept that cannot be broken further. The mean of the scales constructed on the basis of the single factor of skills and knowledge application, was checked using univariate descriptives under factor analysis. The results are presented on a scale of 1.0 to 5.0 in Table 4.42.

Table 4.42: Analysis of the Mean for Skills and Knowledge Application

Definition	Mean	SD
Skills and Knowledge Application	3.83000	.83664

Key: 1.00-1.80 = Strongly Disagree; 1.81-2.60 = Disagree; 2.61-3.40 = Neither Agree nor Disagree; 3.41-4.20 = Agree; 4.21-5.0 = Strongly Agree

The findings indicated that skills and knowledge application was an important factor as indicated by a mean score of 3.83000 which lies in agree on the ranking scale. Rural electrification may herald purchase of learning aids such as computers, television, mobile phones among others that enhance people's skills and knowledge. Access to modern energy solutions for cooking can reduce fuel collection times significantly, and can translate into increased time for research and technical efficiency. This is in line with the findings by Van, Praag and Versloot (2008), that firms that are young or even new and using electricity dependent appliances benefit from the presence of an educated workforce and/or educated consumers.

4.9.3 Correlation for Skills and Knowledge Application and Well-being

A Pearson Product Moment Correlation Coefficient was used, with scores on skills and knowledge application as independent variable and household well-being among proprietors of micro and small enterprises as dependent variable. The scores for both variables were converted into continuous scale by computing the mean responses per respondent, where high scale ratings implied high usage of skills and knowledge and

high household well-being and vice versa. The correlation analysis result was shown in SPSS output, as indicated in Table 4.43.

Table 4.43: Skills and Knowledge Application and Well-being

		Household Well-being
Skills and Knowledge Application	Pearson Correlation	.304**
	Sig. (2-tailed)	.000
	N	307

**. Correlation is significant at the 0.01 level (2-tailed).

There was positive (r=.304, n=307, p<.05) but weak correlation between skills and knowledge application and household well-being among proprietors of micro and small enterprises. This finding resonates with that by Radipere and Dhliwayo (2014) who found a positive correlation between knowledge level of business owners and survival of small businesses.

4.9.4 Regression for Skills and Knowledge Application and Well-being

To estimate the level of influence of skills and knowledge application on household well-being among proprietors of micro and small enterprises, a coefficient of determination (R Square) was computed. This was done using regression analysis and the results were as shown in Table 4.44.

Table 4.44: Skills and Knowledge Application and Well-being

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.304[a]	.093	.090	.61783

a. Predictors: (Constant), Skills and Knowledge Application

From Table 4.44, it can be seen that R-value is 0.304. Therefore, R-value (.304) suggested that there is a weak effect of skills and knowledge application on household well-being among proprietors of MSEs. It can also be observed that the coefficient of determination, the R-square (R^2) value is 0.093, which represents 9.3% variation of household well-being among proprietors of micro and small enterprises as a result of skills and knowledge application. However, to determine whether skills and knowledge application was a significant predictor of household well-being among proprietors of micro and small enterprises, Analysis of Variance (ANOVA) was computed as shown in Table 4.45.

Table 4.45: ANOVA – Skills and Knowledge Application and Well-being

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	11.871	1	11.871	31.100	.000[b]
	Residual	116.422	305	.382		
	Total	128.293	306			

a. Dependent variable: household well-being

b. Predictors: (constant), Skills and Knowledge Application

From Table 4.45, it can be seen that although skills and knowledge application had a small effect on household well-being among proprietors of micro and small enterprises, it is a significant predictor of [$F(1, 305) = 31.100$, $p < .05$)]. This implies that, despite the fact that the skills and knowledge application has a small influence, it is a significant predictor of household well-being among proprietors of micro and small enterprises.

To show the strengths of the relationship between skills and knowledge application and household well-being among proprietors of micro and small enterprises, a partial regression analysis was done. Analysis of the regression model coefficients is shown in Table 4.46.

Table 4.46: Regression Coefficients for Skills and Knowledge Application and Well-being

Coefficients					
Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
1	**B**	**Std. Error**	**Beta**		
(Constant)	1.453	.098		14.811	.000
Skills and Knowledge Application	.235	.042	.304	5.577	.000

a. Dependent Variable: household well-being
Model: $Y=1.453+0.304X_1$

From Table 4.46, there was a positive beta co-efficient of 0.304 as indicated by the co-efficient matrix with a p-value = .000 < .05 and a constant of 1.453 with a p-value =.000<.05. Therefore, both the constant and skills and knowledge application contribute significantly to household well-being. Consequently, the model can provide the information needed to predict household well-being from skills and knowledge application. The regression equation is presented as follows: $Y=1.453+0.304X_1$; Where Y = household well-being and X_1 is skills and knowledge application.

The findings support a study by Ochieng and Nyangosi (2017) on the effect of knowledge management practices on micro, small and medium enterprises performance in Migori County. Their study revealed that knowledge sharing through social media greatly affects the micro and small enterprises performance that enhances well-being. A similar study by Mwithiga, Kagwiria and Shano (2017) found that entrepreneurial skills such as marketing skills, financial management skills, human management skills, organizing skills among others had very strong influence on the growth of MSEs owned by women in Kenya.

The findings are also in line with a study by Mulugeta, Fisseha and Mengesha (2016) who analyzed the perception and competency among MSEs of the Dire Dawa Administration, Ethiopia, towards business, technical, entrepreneurial and interpersonal skills. The finding indicated that among the different set of skills, technical skills were perceived as more important for MSE's success followed by interpersonal skills, entrepreneurial and business skills. The finding also echoes the revelation of a study by Fatoki (2014) who investigated the level of financial literacy of the owners of new micro-enterprises in South Africa. The results suggested a low level of financial literacy by the owners of new microenterprises.

4.10 Electricity Supply and Well-Being

The last objective of this study was to assess the moderating effect of electricity supply on the relationship between socio-economic effects and household well-being among proprietors of micro and small enterprises in Kenya. To attain this objective, moderating effect of electricity supply was assessed through three main measures namely ease of electricity consumption, reliability of supply and affordability. Nine constructs that underlie the three measures were subjected to factor analysis.

4.10.1 Descriptive Statistics for Electricity Supply

To examine electricity supply, a nine-itemed Likert scaled questionnaire was used. The proprietors of MSEs rated the items using: 1=Strongly disagree, 2=Disagree, 3=Neither Agree nor Disagree, 4=Agree and 5=Strongly agree and their responses were converted into continuous scaled data by computing the mean response in each item. The findings were summarized as illustrated in Table 4.7.

Table 4.47: Electricity Supply

Statement	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Preference is given to less electricity-intensive businesses due to high tariffs.	50.5%	31.3%	11.6%	4.6%	2.0%
High electricity tariffs are the cause for cooking using solid and liquid fuels.	32.4%	53.4%	9.0%	2.9%	2.3%
The average monthly power bill exceeds 5% of the business income.	24.4%	52.1%	15.7%	5.2%	2.6%
Use of generators during outages increases the cost of electricity.	24.1%	45.3%	15.0%	9.4%	6.2%
Unreliable electricity supply has a negative effect on a firm's productivity.	34.5%	45.3%	14.0%	3.3%	2.9%
Interruption to power supply increases the cost of production through expenses of repair of damaged equipment.	65.5%	26.1%	3.2%	2.9%	2.3%
Electricity is used alongside other energy sources to optimize costs.	24.8%	60.6%	8.1%	5.5%	1.0%
There are other energy sources on standby in case of power blackout.	30.0%	51.8%	11.4%	5.25%	1.6%
Voltage fluctuation impacts negatively on business performance.	29.3%	57.3%	8.1%	3.3%	2.0%

N = 307

The respondents were in agreement that electricity supply had a positive influence on household well-being among proprietors of MSEs. Respondents generally agreed that high electricity tariffs are the cause for cooking using solid and liquid fuels as exemplified by about 85% of those who participated in the survey. Use of charcoal as the predominant fuel for cooking among households connected to electricity could be linked to the facts that; electricity tariffs are high relative to income, and or unreliable

electricity supply compelling households to seek out alternatives in order to maintain regular meal times. This agree with the finding by Neelsen and Peters (2013) that decisions by MSEs to connect to an electricity supply when it becomes available and their consumption of electricity are influenced by the costs involved.

4.10.2 Factor Analysis for Electricity Supply

The nine measures of electricity supply were subjected to factor analysis with principal component analysis as the extraction method. The method (PCM) as a technique of factor analysis approach enabled the researcher to identify and retain the factors with high statistical significance influence. Equally, PCM describes interdependencies among the items of a variable with an aim of identifying few factors which explains most of the information on the variable construct. The extraction of the factors follows the Kaiser criterion where an eigenvalue of 1 or more indicates a unique factor. The final results are presented in Table 4.48.

Table 4.48: Total Variance Explained for Electricity Supply

	Initial Eigenvalues.			Extraction Sums of Squared Loadings		
Component	Total	Variance (%)	Cumulative (%)	Total	Variance (%)	Cumulative (%)
	3.564	39.601	39.601	3.564	39.601	39.601
	.987	10.970	50.571			
	.854	9.489	60.060			
	.784	8.713	68.773			
	.698	7.753	76.526			
	.639	7.104	83.629			
	.537	5.962	89.591			
	.473	5.251	94.843			
	.464	5.157	100.000			

Extraction Method: Principal Component Analysis.

Eigenvalues associated with each linear component (factor) before extraction, after extraction and after rotation are shown in Table 4.48. Before extraction, SPSS had identified nine linear components within the data set. The eigenvalues associated with each factor represents the variance explained by that particular linear component and it is displayed in terms of percentage of variance explained. The nine measures of electricity supply were subjected to factor analysis and all the nine attracted coefficients of more than 0.4. Therefore, the nine (9) statements were retained for analysis. According to Rahn (2010) a factor loading equal to or greater than 0.4 is considered adequate. Further the results showed that there was only one critical factor influencing electricity supply which accumulated to 39.601% of the total variance in this construct.

The main loadings in the single component were from items on ease of electricity consumption, reliability of supply and affordability all of which measured the degree to which electricity supply influenced household well-being among proprietors of MSEs. The three initial sub-concepts on affordability, reliability of supply and ease of electricity consumption were combined to form electricity supply. The single component was therefore named electricity supply.

Table 4.49: Rotated Component Matrix for Electricity Supply

Statement	Electricity Supply
1. Preference is given to less electricity-intensive businesses due to high tariffs.	.615
2. High electricity tariffs are the cause for cooking using solid and liquid fuels.	.741
3. The average monthly power bill exceeds 5% of the business income.	.507
4. Use of generators during outages increases the cost of electricity.	.593
5. Unreliable electricity supply has a negative effect on a firm's productivity.	.687
6. Interruption to power supply increases the cost of production through expenses of repair of damaged equipment.	.674
7. Electricity is used alongside other energy sources to optimize costs.	.561
8. There are other energy sources on standby in case of power blackout.	.586
9. Voltage fluctuation impacts negatively on business performance.	.667

Extraction Method: Principal Component Analysis.
a. 1 components extracted.

From the rotation matrix shown in Table 4.49, there was only one major factor combining the three initial sub-concepts of affordability, reliability of supply and ease of electricity consumption. This therefore implies that electricity supply is a composite concept that cannot be broken further. The mean of the scales constructed on the basis of

the single factor of electricity supply, was checked using univariate descriptives under factor analysis. The results are presented on a scale of 1.0 to 5.0 in Table 4.50.

Table 4.50: Analysis of the Mean for Electricity Supply

Definition	Mean	SD
Electricity Supply	3.58000	.57323

Key: 1.00-1.80 = Strongly Disagree; 1.81-2.60 = Disagree; 2.61-3.40 = Neither Agree nor Disagree; 3.41-4.20 = Agree; 4.21-5.0 = Strongly Agree

The findings indicated that electricity supply was an important factor as indicated by a mean score of 3.5800 which lies in agree on the ranking scale. It's not surprising that electricity cost is an impediment to electricity consumption in developing countries like Kenya. The framework developed by the Sustainable Energy for All initiative considers 30 kWh a month to be the subsistence level for grid electricity. The framework considers electricity affordable if a household does not have to spend any more than 5 percent of its total monthly income to purchase it (IEA, 2015). A majority of the rural dwellers in Kenya are poor and may not afford to pay for electricity that is mistakenly considered a luxury due to the high tariffs. When a government policy seeks to promote access to renewable energy sources, it needs to influence factors such as: affordability, disposable income, availability and high quality of modern sources.

This is in line with the findings by Millien (2017) that frequent outages in Kenya may be the reason for reluctance among households to subscribe, because they may consider the cost of service too high given its erratic availability, regardless of their specific budget constraints and by Drazu, Olweny and Kazoora (2015) that use of charcoal as the predominant fuel for cooking was a significant revelation in households connected to mains electricity. This could be linked to two key factors: first, a perception that electricity tariffs are high (relative to income); second, the unreliable electricity supply compelling households to seek out alternatives in order to maintain regular meal times.

4.10.3 Correlation Analysis for Electricity Supply

A Pearson Product Moment Correlation Coefficient was used, with scores on electricity supply and household well-being among proprietors of micro and small enterprises. The scores for both variables were converted into continuous scale by computing the mean responses per respondent, where high scale ratings implied low electricity supply and high household well-being and vice versa. The correlation analysis result was shown in SPSS output, as indicated in Table 4.51.

Table 4.51: Electricity Supply and Well-being

		Household Well-being
Electricity Supply	Pearson Correlation	.698**
	Sig. (2-tailed)	.000
	N	307

**. Correlation is significant at the 0.01 level (2-tailed).

There was a strong positive (r=.698, n=307, p<.05) correlation between electricity supply and household well-being among proprietors of micro and small enterprises. This finding resonates with that by Millien (2017) who found a positive correlation between ability to connect to electricity and cost of installation in Kenya.

4.11 Overall Empirical Model

4.11.1 Regression Analysis for Socio-economic Effects and Well-being

The study sought to establish a linear model that could be used to describe the optimal level of household well-being among proprietors of micro and small enterprises in Kenya, factoring the variables of socio-economic effects of rural electrification. This was done by use of standard multiple regression analysis, where all the four independent variables were factored in the model at once. It was suitable because it could help to investigate how well the set of the independent variables was able to predict the level of household well-being, in line with the views held by Oso and Onen (2009). The analysis

provided information about the relative contribution of each of the variables that make up the model. Each independent variable was evaluated in terms of its predictive power, over and above that offered by all the other independent variables. It enabled the researcher to know how much unique variance, in the dependent variable, each of the predictor explained.

Standardized coefficients (without electricity supply) and p-value results in Table 4.52 show that quality healthcare, business turnover, cost reduction and employee effectiveness, which are measures of access to healthcare, employment status, and income level are significantly related to household well-being among proprietors of MSEs based on the regression coefficients and significance values (p-values). From the standardized coefficients (without electricity supply) results of the multiple regression shown in Table 4.52, the following regression equations were derived;

Model A: $Y = 0.409 + 0.121X_1 + 0.113X_2 + 0.202X_3 + 0.303X_4 + \varepsilon$

Model B: $Y = 0.162 + .107X_1 + .112X_3 + .158X_4 + .419X_5 + \varepsilon$

Where:

Y	= Household well-being
β_0	= Constant term
β_1, β_2, β_3 and β_4,	= Beta coefficients
X_1	= Quality Healthcare
X_2	= Business Turnover
X_3	= Cost Reduction
X_4	= Employee Effectiveness
X_5	= Electricity Supply
ε	= Stochastic disturbance error term

Table 4.52: Regression of Socio-economic Effects on Wellbeing

Model		Coefficients[a]			Coefficients[b]		
		Standardized Coefficients without Electricity Supply Beta	t	Sig.	Standardized Coefficients with Electricity Supply Beta	t	Sig.
1	(Constant)	.409	3.838	.000	.162	1.594	.112
	Skills and Knowledge Application	-.004	-.075	.940	-.018	-.414	.679
	Affordable Healthcare	.097	1.547	.123	.070	1.228	.220
	Quality Healthcare	.121	2.063	.040	.107	2.005	.046
	Business Turnover	.113	1.987	.048	.077	1.489	.137
	Cost Reduction	.202	3.834	.000	.112	2.285	.023
	Employee Effectiveness	.303	4.546	.000	.158	2.496	.013
	Availability of Labor	.046	.931	.352	-.010	-.217	.828
	Electricity Supply	-	-	-	.419	7.940	.000
	R	.698[a]			.759[b]		
	R Square	.487			.576		
	Adjusted R^2	.475			.565		
	ANOVA	[F (7, 299) = 40.567, p = .000)]			[F (7, 299) = 50.742, p = .000)]		

a. Regression without moderating variable

b. Regression with moderating variable

From Model A equation, the coefficients indicate how much household wellbeing among proprietors of MSEs varies with an independent variable when all other independent variables are held constant. It is evident from the results that employee effectiveness is the most important factor and is a measure of employment status hence revealing that employment status make the most strongest and significant contribution to household well-being among proprietors of MSEs. This further confirms the findings by Jimenez (2017) that access to electricity leads to a 25% increase in labor market participation on average, with women tending to benefit more.

Following in rank are cost reduction and business turnover which are measures of income level. This finding further means that income level has the second most strongest and significant effect on household well-being among proprietors of MSEs. The last in rank is quality healthcare which is a measure of access to healthcare hence revealing that access to healthcare makes the third most significant contribution to household well-being among proprietors of MSEs in Kenya. Overall, the results confirm that household well-being among proprietors of MSEs is influenced by socio-economic effects of rural electrification; access to healthcare, income level and employment status as conceptualized in the model. However, from the model, skills and knowledge application had a coefficient of estimate which was not significant implying that skills and knowledge application make no significant contribution to household well-being among proprietors of MSEs.

The R-square and the overall significance of the model were analyzed before and after introducing the moderating variable. The introduction of the moderating variable introduces an interaction effect on the prediction strength of the independent variable on the dependent variable. The interaction effect leads to either a stronger or weaker prediction power of the independent variable on the dependent variable. Model B equation show that quality healthcare, cost reduction, employee effectiveness and electricity supply which are measures of access to healthcare, employment status, income level and electricity supply are significantly related to household well-being among proprietors of MSEs based on the regression coefficients and significance values.

Table 4.52 shows the results of the R-square before involving the moderating variable and after incorporating the moderating variable to the independent variable. The results indicate that electricity supply has a positive moderating effect on household well-being (R squared change of 0.089) which translates to 18.3% change in the R-square. This means electricity supply moderates socio-economic effects positively and statistically significant.

4.11.2 Results of Hypotheses Test

The five null hypotheses in this study that were presented in Chapter one were tested through a multiple regression model as shown in Table 4.52. The hypothesis tests results are presented according to the hypotheses statements as follows:

Hypothesis one stated that *'Access to healthcare due to rural electrification has no effect on the household well-being among proprietors of micro and small enterprises in Kenya.'* According to Table 4.51, access to healthcare had coefficients of estimate which were significant basing on $\beta_3 = 0.121$ (p-value = .040 which is less than $\alpha = .05$). The null hypothesis was thus rejected and it was concluded that access to healthcare had a significant effect on household well-being. Consistently, Van Leeuwen (2014) argues that the powering of emergency medical equipment, storage of blood and vaccines, and performing of basic health procedures, especially after dark, are all contingent on reliable electricity supplies. This was also the case with Bazilian *et al*., (2011) who echoes that provision of reliable, secure and affordable energy services are central to addressing many of today's global development challenges including poverty, inequality, climate change, food security, health and education as well as wealth creation and economic development.

Hypothesis two postulated that *'Employment status owing to rural electrification has no effect on the household well-being among proprietors of micro and small enterprises in Kenya.'* According to Table 4.51, employment status had coefficients of estimate which were significant basing on $\beta_6 = 0.303$ (p-value = .000 which is less than $\alpha = .05$). The

null hypothesis was thus rejected and it was concluded that employment status had a significant effect on household well-being. Consistently, Grogan and Sadanand (2013) recognized that rural electrification affect labor market participation through freeing up women's time spent in collecting and preparing fuel, and increasing labor supply and engagement in market based work. Furthermore, Van de Walle *et al*., (2013) reiterated that having access to electricity creates opportunities to generate income within the home and allows for new types of jobs outside the home, thus potentially increasing self-employment and labor demand.

Hypothesis three stated that *'Income level due to rural electrification has no effect on the household well-being among proprietors of micro and small enterprises in Kenya.'* According to Table 4.51, income level had coefficients of estimate which were significant basing on $\beta_4 = 0.113$ (p-value = .048 which is less than $\alpha = .05$) and $\beta_5 = 0.202$ (p-value = .000 which is less than $\alpha = .05$). The null hypothesis was thus rejected and it was concluded that income level had a significant effect on household well-being. In line with the study findings, Scott, Darko, Lemma and Rud, (2014) posits that reliance on generators for electricity during outages can be expected to increase the cost of electricity, and the effect on cost-competitiveness is related to the proportion of total costs accounted for by electricity leading to reduced firm income. The results also supports the studies by Peters, Vance and Harsdorff (2011) who asserted that firms created after electrification, amongst them some highly dependent on electricity for their operations, exhibited profits that are considerably higher than non-connected firms.

Hypothesis four stated that *'Skills and knowledge application due to rural electrification has no effect on the household well-being among proprietors of micro and small enterprises in Kenya.'* According to Table 4.51, skills and knowledge application had a coefficient of estimate which was not significant basing on $\beta_1 = -0.003$ (p-value = .940 which is more than $\alpha = .05$). The null hypothesis was therefore not rejected and it was concluded that skills and knowledge application has no significant effect on household well-being. This differs with the observation of Maheran and Khairu (2009) that successful businesses seem to be those that persistently put prominence on skills and

knowledge of employees and that highly-experienced and skilled individuals are required to expedite delivery of high value-added goods and services together with the competences to build consumers' trust and confidence. The finding also differs with Radipere and Dhliwayo (2014) who reiterated that one of the success factors in small business is the knowledge level of the owner, which can assist the business to survive and manage a complex environment and maintain the profitability of the business.

Hypothesis five indicated that *'Electricity supply has no moderating effect on the relationship between socio-economic effect of rural electrification and household well-being among proprietors of micro and small enterprises in Kenya.'* According to Table 4.51, after introducing the moderating variable the results indicate that electricity supply has a positive moderating effect on household well-being (R squared change of 0.089) which translates to 18.3% change in the R-square. This means electricity supply moderates socio-economic effects positively and statistically significant. The null hypothesis was therefore rejected and it was concluded that electricity supply indeed had a moderating effect on the relationship between socio-economic effect of rural electrification and household well-being.

This finding supports a study by Abeberese (2012) on Indian manufacturing firms to show that in response to an exogenous increase in electricity price, firms reduce their electricity consumption and switch to industries with less electricity-intensive production processes, meaning that electricity constraints may lead firms to operate in industries with fewer productivity-enhancing opportunities. The finding also resonates with the assertion by Neelsen and Peters (2013) that decisions by MSEs to connect to an electricity supply when it becomes available and their consumption of electricity are influenced by the costs involved.

Table 4.53 presents summary of hypotheses testing results for socio-economic effects of rural electrification (skills and knowledge application, access to healthcare, income level and employment status) on household well-being based on the standard multiple coefficients.

Table 4.53: Summary of Research Hypothesis Test Results

	Null Hypothesis	Decision
1.	Access to healthcare due to rural electrification has no effect on the household well-being among proprietors of micro and small enterprises in Kenya.	The null hypothesis rejected and the alternative hypothesis accepted
2.	Employment status owing to rural electrification has no effect on the household well-being among proprietors of micro and small enterprises in Kenya.	The null hypothesis rejected and the alternative hypothesis accepted
3.	Income level due to rural electrification has no effect on the household well-being among proprietors of micro and small enterprises in Kenya.	The null hypothesis rejected and the alternative hypothesis accepted
4.	Skills and knowledge application due to rural electrification has no effect on the household well-being among proprietors of micro and small enterprises in Kenya.	The null hypothesis not rejected and the alternative hypothesis rejected
5.	Electricity supply has no moderating effect on the relationship between socio-economic effect of rural electrification and household well-being among proprietors of micro and small enterprises in Kenya.	The null hypothesis rejected and the alternative hypothesis accepted

4.12 Discussion of Key Findings

The general objective of this study was to investigate the socio-economic effects of rural electrification on the household well-being among proprietors of micro and small enterprises in Kenya. The study had four independent variables namely; access to healthcare, income level, employment status, and skills and knowledge application. In addition, electricity supply was considered as a moderating variable.

4.12.1 Access to Healthcare

This study sought to determine the effect of access to healthcare due to rural electrification on household well-being among proprietors of micro and small enterprises in Kenya. To test whether access to healthcare had a significant effect on household well-being among proprietors or not, a regression analysis was performed with two access to healthcare factors (affordable healthcare and quality healthcare) as independent variables against household well-being as the dependent variable.

Correlation results showed that there was a moderate positive relationship between both affordable healthcare and quality and household well-being among proprietors of micro and small enterprises. Partial regression analysis revealed that both affordable healthcare and quality healthcare contribute significantly to household well-being. Multiple regression results showed that only quality healthcare which is one of the measures of access to healthcare made a significant contribution to household well-being among proprietors of MSEs in Kenya. Analysis of Variance results revealed that both the two factors of access to healthcare (affordable healthcare and quality healthcare) were significant predictors of household well-being among proprietors of micro and small enterprises. The findings resonates well with the assertion by Noor *et al*. (2006) that rural electrification enables health facilities to be strategically located, offer uniquely affordable services that are universally acceptable, adequately available and evenly distributed to easily access healthcare services.

In view of the foregoing, rural clinics provided with electricity may lead to improvements in both quality of life and infant mortality. Electricity may also have a significant impact on some key health service indicators in rural areas where a majority of the poor live such as: prolonging night-time service provision; attracting and retaining skilled health workers; and providing faster emergency response, including for childbirth emergencies. This is consistent with the findings by Van Leeuwen (2014) that reliable electricity supply in medical facilities has a significant effect on quality of healthcare. The results were also in agreement with the assertion by Bazilian *et al*., (2011) that

provision of reliable, secure and affordable energy are important predictors of poverty reduction and well-being.

4.12.2 Employment Status

The study sought to evaluate the effect of employment status owing to rural electrification on household well-being among proprietors of micro and small enterprises in Kenya. This was tested by conducting a regression analysis on the two factors of employment status against household well-being. Correlation results showed that there was a strong positive relationship between employee effectiveness and household well-being among proprietors of micro and small enterprises. The finding also revealed a weak positive relationship between availability of labor and household well-being among proprietors of micro and small enterprises.

Analysis of Variance results revealed that both the two factors of employment status (employee effectiveness and availability of labor) of rural electrification were significant predictors of household well-being among proprietors of micro and small enterprises. Partial regression results indicated that both measures of employment status (employee effectiveness and availability of labor) contribute significantly to household well-being. However, multiple regression results showed that only employee effectiveness which is one of the measures of employment status made a significant contribution to household well-being among proprietors of MSEs in Kenya. This findings are in harmony with Jimenez (2017) assertion that access to electricity leads to a 25% increase in labor market participation on average, with a median of 20%.

Accordingly, household electrification may free up women's time spent in collecting and preparing fuel, and increase labor supply that results in more engagement in market based work. Access to electricity may also increase productive working hours and provide opportunities for self-employment, in particular for women in rural areas. This finding is in agreement with that of Grogan and Sadanand (2013) that rural electrification significantly affected labor market participation. The results also agree

with the findings by Van de Walle *et al*., (2013) that access to electricity has a significant effect on self-employment and labor demand in rural areas.

4.12.3 Income Level

This study sought to examine the effect of income level due to rural electrification on household well-being among proprietors of micro and small enterprises in Kenya. To realize this objective, a regression analysis was conducted on the factors of income level against household well-being. The results revealed that both the two factors of income level namely cost reduction and business turnover emerged to have statistically significant relationship with household well-being among proprietors of micro and small enterprises.

Correlation results showed that there was a moderate positive relationship between both business turnover and cost reduction effects and household well-being among proprietors of micro and small enterprises. Analysis of Variance results revealed that both the two factors of income level (business turnover and cost reduction) were significant predictors of household well-being among proprietors of micro and small enterprises. Partial regression analysis indicate that both business turnover and cost reduction contribute significantly to household well-being. Similarly, multiple regression results showed that both business turnover and cost reduction which are measures of income level made a significant contribution to household well-being among proprietors of MSEs in Kenya. The emergence of the two income level factors to have a significant effect on household well-being means that income level due to rural electrification had a significant influence on household well-being among proprietors of MSEs in Kenya. This finding concur with Grogan and Sadanand (2013) who posits that household access to electrification enhances household well-being through provision of income generation opportunities, alleviating poverty, improving children's health, reducing incidences of child labor, and enhancing status of the women and girls.

Rural electrification may therefore enhance diversification to nonfarm livelihood strategies rather than relying only on subsistence farming. This may enable rural households to have better incomes, enhance food security and increase agricultural production by smoothing capital constraints. Better incomes may help in alleviating poverty, improving children's health, reducing instances of child labor, and improving status of women and girls. The findings are consistent with the studies by Scott, Darko, Lemma and Rud, (2014) that reliance on generators for electricity during outages has a significant effect on the total costs accounted for by electricity leading to reduced firm income. The results also supports the studies by Peters, Vance and Harsdorff (2011) whose findings revealed that firms created after electrification exhibited profits that were considerably higher than non-connected firms. The findings further agree with the results of Alby, Dethier and Straub (2011) that reliability of electricity supply was an important predictor of firms' total costs.

4.12.4 Skills and Knowledge Application

The study sought to investigate the effect of skills and knowledge application owing to rural electrification on household well-being among proprietors of micro and small enterprises in Kenya. The effect of skills and knowledge application on the household well-being was tested using regression analysis. Correlation results showed that there was a positive but weak correlation between skills and knowledge application and household well-being among proprietors of micro and small enterprises. Analysis of Variance results revealed that the only factor for skills and knowledge application of rural electrification was a significant predictor of household well-being among proprietors of micro and small enterprises. Partial regression results indicate that skills and knowledge application contribute significantly to household well-being. However, multiple regression results disclosed that skills and knowledge application did not make a significant contribution to household well-being among proprietors of MSEs in Kenya. This finding resonates with that by Radipere and Dhliwayo (2014) who found a positive correlation between knowledge level of business owners and survival of small businesses.

Consequently, use of internet as a result of rural electrification may increase the knowledge level of the owner, which can assist the business to survive and manage a complex environment and maintain profitability. Acquired knowledge and skills probably through social media may be an important factor affecting preferences for variety and innovative products and services. This is consistent with the results of Maheran and Khairu (2009) that technical efficiency among employees is an important predictor of success of businesses. The finding is also in line with Radipere and Dhliwayo (2014) whose result revealed that knowledge level of a business owner has a significant effect on the success of a business enterprise.

4.12.5 Electricity Supply

The study sought to examine the moderating effect of Electricity Supply on the relationship between socio-economic effects and household well-being among proprietors of micro and small enterprises in Kenya. To achieve this objective, significance tests were done to determine the effects of the predictor variables on the dependent variable. The overall significance of the model was analyzed before and after introducing the moderating variable to independent variable. Multiple regression results disclosed that electricity supply is the most important factor and is a moderating variable. Electricity supply therefore made the strongest and most significant contribution to household well-being among proprietors of MSEs in Kenya as a moderating variable. This finding resonates with that by Millien (2017) who found a positive correlation between ability to connect to electricity and cost of installation in Kenya.

Accordingly, the provisions of reliable, secure and affordable energy services in developing countries like Kenya may be key to addressing many of today‘s global development challenges including poverty, inequality, climate change, food security, health and education as well as wealth creation and economic development. This finding supports a study by Abeberese (2012) that revealed that the cost of electricity has a significant influence on its consumption. The finding also resonates with the result of a

study by Neelsen and Peters (2013) that the cost of electricity is an important predictor for MSEs to connect to an electricity supply when it becomes available.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents summary of the entire study grounded on the research objectives and hypotheses. Data obtained from respondents was analyzed to give the findings as presented in chapter 4, which forms the basis of this summary. Theoretical and empirical literature in chapter two was used to relate to the findings of this study and the conclusions made. On the basis of the conclusions and key implications drawn from this study, policy and practice recommendations are proposed as well as suggestions for further research.

5.2 Summary

Poverty rates in Kenya remain relatively high compared to other lower middle income countries indicating that household well-being has equally remained low (World Bank, 2018). The specific objectives of the study were to investigate the effect of; skills and knowledge application, access to healthcare, income level and employment status due to rural electrification on household well-being among proprietors of micro and small enterprises in Kenya. Several studies reveal that electrification lead to improved level of wellbeing of households (Tegene, Berhe and Teklemariam, 2015; Osanyinlusi, Awotide, Awoyemi, Ogunniyi, Adeyemi and Ogundipe, 2017; Bezerra, Callegari, Ribas, Lucena, Portugal-Perreira, Koberle, Sziko & Schaeffer, 2017; Jimenez, 2017). Most households in Kenya are willing and able to pay for improved energy services based on renewable energy resources (Kirubi *et al.*, 2009). This study therefore sought to establish whether rural electrification showed similar trends on the household well-being of proprietors of micro and small enterprises in Kenya.

In Chapter two, rural livelihoods approach has been used to examine the well-being of people and communities through measuring of capitals (Flora & Flora, 2013). The

capabilities approach also guided this study since the concepts of freedom emphasizes the importance of empowering people as the actors of their own development (Stiglitz, Sen & Fitoussi, 2009). Social exclusion theory and resource-based industrialization development theory have also been used to effectively highlight an important correlation between rural electrification and household well-being. From the empirical literature, it is clear that rural electrification plays a leading role in enhancing well-being of the rural poor by enhancing access to healthcare, employment status, income level and skills and knowledge application. The conceptual model illustrates the linkage for testing the causation between skills and knowledge application, access to healthcare, income level and employment status (independent variables), electricity supply (moderating variable) and household well-being as a dependent variable.

This study was conducted using a cross sectional survey research design to produce statistical information about the aspects of rural electrification that may interest policy makers and MSE proprietors. The study used primary data collected from eight counties (Kakamega, Bungoma, Nakuru, Busia, Bomet, Siaya, Kericho and Kirinyaga). The target population for this study was 172,554 rural registered micro and small enterprises in the selected counties in Kenya. The study adopted multistage sampling involving systematic and simple random sampling procedures due to the large target population involved. The study used a sample population of 418 respondents for data collection. A structured questionnaire was used for data collection since they can be send to a large number of people and thus save the researcher time and money. Pilot study using a sample of 30 respondents from proprietors of micro and small enterprises within Kakamega County, who did not make part of the sample population was carried out to evaluate the suitability of the questionnaires. To test the reliability of the instruments, a test-retest method was used after which a reliability index was calculated using the Cronchbach's alpha.

A total of 307 out of 418 questionnaires were returned for data analysis, which is equivalent to 73.44% response rate. All the subscales had Cronbach's alpha of greater than 0.8 which show that the questionnaires adequately measured the constructs for

which they were intended to measure. An exploratory factor analysis was performed to identify patterns in data, reduce the data table and number of items to a few interpretable linear combinations of the data, avoid multicollinearity and check the integrity of the key variables. The findings of this study reveal a positive and significant relationship between socio-economic effects of rural electrification and household well-being among proprietors of micro and small enterprises in Kenya. The results of this study show that employee effectiveness is the most important factor and is a measure of employment status hence revealing that employment status make the most strongest and significant contribution to household well-being among proprietors of MSEs. However, overall regression results indicate that skills and knowledge application had a coefficient of estimate which was not significant implying that skills and knowledge application make no significant contribution to household well-being among proprietors of MSEs.

5.2.1 Access to Healthcare and Well-Being

The first objective of this study was to determine the effect of access to healthcare due to rural electrification on household well-being among proprietors of micro and small enterprises in Kenya. Descriptive statistics showed that rural electrification had a considerable effect on access to healthcare resulting to improved well-being of households for instance by attracting and retention of healthcare workers and their families in rural areas. This enhanced both quality healthcare and timely healthcare service.

Factor analysis results showed that the first two factors explained most of the variance and were therefore most important. The two factors were affordable healthcare and quality healthcare. The two factors were from items on service time, service quality and service cost, all of which measured the degree to which access to healthcare had influenced household well-being among proprietors of MSEs. The emergence of affordable healthcare and quality healthcare implies that these services are inadequate in rural areas where a majority of the people are poor and their improvement is likely to enhance well-being. This is consistent with the observation by World Health

Organization (2015) that electricity may have a significant impact on some key health service indicators such as: prolonging night-time service provision, providing faster emergency response and attracting qualified staff to work in rural health facilities.

According to Pearson correlation analysis, there was a moderate positive correlation between both affordable healthcare and quality healthcare and household well-being among proprietors of micro and small enterprises. A standard multiple regression analysis revealed that only quality healthcare contributed significantly to the explanation of household well-being. Given that the regression results demonstrated the existence of significant relationship between access to healthcare and household well-being, the null hypothesis that access to healthcare due to rural electrification has no effect on the household well-being among proprietors of micro and small enterprises in Kenya was thus rejected and it was concluded that access to healthcare had a significant effect on household well-being. This therefore implies that an increase in both affordable healthcare and quality healthcare enhances the level of well-being among proprietors of micro and small enterprises. The results agree with the findings by Noor *et al*. (2006) that rural electrification may lead to new facilities that are strategically located, offer uniquely affordable services, adequately available and evenly distributed for the poor in rural areas to easily access healthcare services.

5.2.2 Employment Status and Well-Being

The second objective of this study was to evaluate the effect of employment status owing to rural electrification on household well-being among proprietors of micro and small enterprises in Kenya. Descriptive statistics showed that rural electrification had a substantial effect on employment status resulting to enhanced well-being of households. Since a majority of households in rural Kenya are farmers, a shift from agricultural to non-agricultural economic activities enhances both employment, wage levels and productivity.

Factor analysis undertaken using principal component analysis showed that the first two factors explained most of the variance and were therefore most important. The two factors were employee effectiveness and availability of labor. The two components were from items on cost of labor, supply of labor and demand for labor, all of which measured the degree to which employment status had influenced household well-being among proprietors of MSEs. The emergence of employee effectiveness and availability of labor suggests that these two determine the decision to hire employees by MSEs. This is consistent with the observation by Torero (2015) that rural electrification leads to a shift from agriculture-based to non-agriculture-based activities that are associated with growth in productivity and thus, increases in employment.

Pearson correlation analysis revealed that there was a strong positive correlation between employee effectiveness and household well-being and a moderate positive correlation between availability of labor and household well-being. A standard multiple regression analysis revealed that only employee effectiveness contributed significantly to the explanation of household well-being. Given that the regression results demonstrated the existence of significant relationship between employment status and household well-being, the null hypothesis that employment status of rural electrification has no effect on the household well-being among proprietors of micro and small enterprises in Kenya was thus rejected and it was concluded that employment status had a significant effect on household well-being. This therefore implies that an increase in employee effectiveness enhances the level of well-being among proprietors of micro and small enterprises. This is consistent with the findings by Van de Walle *et al*. (2013) that having access to electricity creates opportunities to generate income within the home and allows for new types of jobs outside the home, thus potentially increasing self-employment and labor demand.

5.2.3 Income Level and Well-Being

The third objective of this study was to examine the effect of income level due to rural electrification on household well-being among proprietors of micro and small

enterprises in Kenya. Descriptive statistics showed that rural electrification had a considerable effect on income level resulting to improved well-being of households. Availability of electricity enhanced business turnover since enterprises operated for longer hours, increased wages and purchasing power.

According to factor analysis results, the first two factors explained most of the variance and were therefore most important. The two factors were business turnover and cost reduction. The two factors were from items on cost of production, revenue change and business turnover, all of which measured the degree to which income level had influenced household well-being among proprietors of MSEs. The occurrence of business turnover and cost reduction implies that these factors are key in micro and small enterprise survival and growth. Most MSEs in rural areas are owned by the less privileged members of the society whose enterprise survival and growth contributes to their enhanced well-being. The study results above are in agreement with Khandker *et al.* (2013) who reiterated that electricity access boosted household employment, income, or both that had a positive effect on well-being.

Pearson correlation analysis revealed that there was a moderate positive correlation between both business turnover and cost reduction and household well-being among proprietors of micro and small enterprises. A standard multiple regression analysis revealed that both business turnover and cost reduction contributed significantly to the explanation of household well-being. Given that the regression results demonstrated the existence of significant relationship between income level and household well-being, the null hypothesis that income level due to rural electrification has no effect on the household well-being among proprietors of micro and small enterprises in Kenya was therefore rejected. It was thus concluded that income level had a significant effect on household well-being. This therefore implies that an increase in both business turnover and cost reduction enhances the level of well-being among proprietors of micro and small enterprises. This result resonates with the findings by Torero (2015) that there are numerous ways in which rural electrification might affect income of newly connected

households spanning from direct effects through home business activities to better job prospects in newly connected enterprises in the locality.

5.3.4 Skills and Knowledge Application and Well-Being

The fourth objective of this study was to investigate the effect of skills and knowledge application owing to rural electrification on household well-being among proprietors of micro and small enterprises in Kenya. Descriptive statistics showed that rural electrification had a substantial effect on skills and knowledge application resulting to enhanced well-being of households. Knowledge and skills are considered a prerequisite for expediting delivery of improved value-added goods and services in developing countries. A more skilled and knowledgeable workforce is associated with a more productive and innovative economy necessary for poverty reduction.

Factor analysis results indicated that the first one factor explained most of the variance and was therefore the most important. The single factor was skills and knowledge application. The single factor was from items on productive efficiency, value addition, and effective communication all of which measured the degree to which skills and knowledge application influenced household well-being among proprietors of MSEs. The emergence of skills and knowledge application suggests that for MSEs in rural areas to grow, there is need to embrace technology in their operations. This is consistent with the observation by Amesi (2011) that attainment of knowledge and skills makes entrepreneurs professional learners and successful in business and Versloot (2008) that acquired knowledge plays a critical role in business performance, integration and accumulation of new knowledge as well as the adaptation to new situations.

Results of Pearson correlation analysis revealed that there was a positive but weak correlation between skills and knowledge application and household well-being. A standard multiple regression analysis revealed that skills and knowledge application did not contribute significantly to the explanation of household well-being. Given that the regression results demonstrated lack of significant relationship between skills and

knowledge application and household well-being, the null hypothesis that skills and knowledge application has no effect on the household well-being among proprietors of micro and small enterprises in Kenya was thus not rejected and it was concluded that skills and knowledge application due to rural electrification had no significant effect on household well-being. This therefore implies that an increase in skills and knowledge application enhances the level of well-being among proprietors of micro and small enterprises. This echoes the findings by Grogan and Sadanand (2013) that adoption of labor saving household technologies (e.g. electric cookers, electric lights, refrigerators among others) leads to significant reduction of time spent on household activities as well as to a significant increase of time spent on economic activities.

5.2.5 Electricity Supply and Well-Being

The fifth objective of this study was to assess the moderating effect of electricity supply on the relationship between socio-economic effects and household well-being among proprietors of micro and small enterprises in Kenya. Descriptive statistics showed that electricity supply had a significant effect on household well-being. High electricity tariffs relative to income and or unreliable electricity supply compel poor households and MSEs to seek for alternative energy sources.

According to factor analysis results, the first one factor explained most of the variance and was therefore the most important. The single factor was electricity supply. The single factor was from items on ease of electricity consumption, reliability of supply and affordability all of which measured the degree to which electricity supply influenced household well-being among proprietors of MSEs. The emergence of electricity supply suggests that for developing countries to realize the benefits of electrification as a driver of poverty reduction, there is need to find ways of reducing tariff levels and improving reliability of electricity supply. This is consistent with the observation by Neelsen and Peters (2013) that decisions by MSEs to connect to an electricity supply when it becomes available and their consumption of electricity are influenced by the costs involved and by Millien (2017) that frequent outages in Kenya may be the reason for

reluctance among households to subscribe, because they may consider the cost of service too high given its erratic availability, regardless of their specific budget constraints.

Pearson correlation analysis revealed that there was a strong positive correlation between electricity supply and household well-being. A standard multiple regression analysis revealed that electricity supply contributed significantly to the explanation of household well-being. Given that the regression results demonstrated a significant relationship between electricity supply and household well-being, the null hypothesis that electricity supply has no moderating effect between socio-economic effect of rural electrification and household well-being among proprietors of micro and small enterprises in Kenya was therefore rejected and it was concluded that electricity supply indeed had a moderating effect on the relationship between socio-economic effect of rural electrification and household well-being. This therefore implies that an increase in electricity supply enhances the level of well-being among proprietors of micro and small enterprises. This agrees with the finding by Neelsen and Peters (2013) that decisions by MSEs to connect to an electricity supply when it becomes available and their consumption of electricity are influenced by the costs involved.

5.3 Conclusions

Based on the finding of this study, it was concluded that MSEs were dominated by male actors, with females being only slightly more than four out of ten of the proprietors. The results also established that majority of the proprietors of micro and small enterprises in the area of the study lived in rented houses. This may be justifiable since a majority of the respondents were in their youthful ages. According to the study findings, a significant majority of enterprises only had electricity within the last nine years, with only about a fifth of them who had had electricity for over ten years.

The findings revealed that there was a moderate positive relationship between access to healthcare and household well-being among proprietors of micro and small enterprises. It was, therefore, concluded that there was indeed statistical significant relationship

between access to healthcare and household well-being among proprietors of micro and small enterprises, with increase in access to healthcare resulting to improvement in household well-being among proprietors of micro and small enterprises and vice-versa.

The findings of the study indicated that there was a moderate positive relationship between employment status and household well-being among proprietors of micro and small enterprises. It was, therefore, concluded that there was indeed statistical significant relationship between employment status and household well-being among proprietors of micro and small enterprises, with increase in employment status resulting into improvement in household well-being among proprietors of micro and small enterprises and vice-versa. Based on the findings it was concluded that employment status explained a significant amount of the variance in the value of household well-being among proprietors of micro and small enterprises.

The findings of the study disclosed that there was a moderate positive correlation between income level and household well-being among proprietors of micro and small enterprises. It was, therefore, concluded that there was statistical significant relationship between income level and household well-being among proprietors of micro and small enterprises, with increase in income level causing an improvement in household well-being among proprietors of micro and small enterprises. From the results it was concluded that income level was a significant predictor of household well-being among proprietors of micro and small enterprises.

According to the findings of the study, there was a negative but weak correlation between skills and knowledge application due to rural electrification and household well-being among proprietors of micro and small enterprises. It was, therefore, concluded that there is statistical significant relationship between the skills and knowledge application and household well-being among proprietors of micro and small enterprises, with increase in skills and knowledge application causing an improvement in household well-being among proprietors of micro and small enterprises. From the

results it was concluded that skills and knowledge application due to rural electrification has no effect on household well-being among proprietors of micro and small enterprises.

Findings of the study depicted that there was a moderate positive relationship between the moderating effect of electricity supply and household well-being among proprietors of micro and small enterprises. It was, therefore, concluded that electricity supply had indeed a positive significant moderating effect between socio-economic effects of rural electrification and household well-being among proprietors of micro and small enterprises.

5.4 Recommendations

The study is a justification of the fact that the role of rural electrification on micro and small enterprises in Kenya cannot be underestimated and has contributed to improved household well-being in Kenya. Based on the findings and conclusions of this study that have been drawn, both policy and management recommendations are made.

In view of the findings of the first objective of this study, it was concluded that there was a statistical significant relationship between access to healthcare and household well-being among proprietors of micro and small enterprises. It is therefore recommended that the Kenyan government should promote universal access to electricity in all health facilities to a higher level on the political agenda, supporting these commitments with strategic plans, clear policies and dedicated establishments. There is need for healthcare providers to take advantage of access to electricity in rural areas to diversify healthcare services including acquisition of electricity powered healthcare equipment and machines.

Based on the findings of this study, it was concluded that there was a statistical significant relationship between employment status and household well-being among proprietors of micro and small enterprises. It was therefore recommended that the government needed to review the Energy Act, 2006 that created Rural Electrification

Authority to accommodate micro and small enterprises as priority areas for rural electrification to attract more entrepreneurs in rural areas leading to more employment opportunities in these areas. Additionally, the government should ensure dedicated institutions and enabling policy and regulatory frameworks to make sure relevant institutions such as Rural Electrification Authority are strengthened, with a clear mandate, authority and resources to fulfil the mandate, and accountability for achieving that mandate. Reliable supply of electricity to micro and small enterprises, schools, clinics, hospitals, government offices, rural markets among others is essential to meeting the services that the rural populations need.

From the results of this study, it was concluded that income level was a significant predictor of household well-being among proprietors of micro and small enterprises. It was therefore recommended that electrification strategies should ensure a sustainable and affordable supply, and plan for enhancing access to electricity by all micro and small scale enterprises in rural areas. To maximize socio-economic benefits, there should be a policy framework to include micro and small enterprises as priority areas for electrification in addition to health centers and schools. Proprietors of micro and small scale enterprises should make use of rural electrification to embrace use of ICT equipment and services such as computers, online advertisement and purchasing among others to reduce the cost of production and enhance income level. Proprietors of micro and small enterprises should also take advantage of rural electrification to add value to their farm produce and introduce non-farm businesses to increase their income.

Based on the outcomes of this study, it was concluded that there is statistical significant relationship between the skills and knowledge application and household well-being among proprietors of micro and small enterprises. It was therefore recommended that the Kenyan government should provide a policy framework that requires mandatory online application for business licenses and other legal payments. There is also need to provide a policy on e-business including e-procurement in the private sector to include micro and small enterprises. Proprietors of micro and small enterprises need to embrace use of ICT in their operations including e-sourcing for raw materials, online advertisement, e-

banking, electronic information management and record keeping among others. Computer literacy skills are some of the basic skills for the success of micro and small enterprises in rural areas.

The study also concluded that electricity supply had a positive significant moderating effect between socio-economic effects of rural electrification and household well-being among proprietors of micro and small enterprises. It was therefore concluded that the cost of electricity should be reviewed downwards by reducing taxes or giving exemptions for small scale electricity consumers including micro and small enterprises. To enhance supply and reduce the cost of electricity, there is need to expedite the enactment of National Energy Policy to bring clarity on key issues such as the procedure for mini-grid - main-grid interconnection in order to reduce the regulatory burden for the mini-grid developers in part by providing guidelines for the use of national funds for mini-grid development and clarifying the national electrification strategy. There is also need to establish long term schemes to finance initial or upfront costs for acquiring grid electricity, which is an impediment to electrification in rural areas. Proprietors of micro and small enterprises should use energy saving appliances to reduce the cost of electricity bills.

5.5 Areas for Further Research

Multiple regression results of this study disclosed that skills and knowledge application due to rural electrification did not make a significant contribution to household well-being among proprietors of MSEs in Kenya. Future research should therefore be conducted in a different social setting to establish whether similar results would be obtained.

When electricity supply was introduced as a moderating variable, it had a positive significant moderating effect between socio-economic effects of rural electrification and household well-being and reduced the regression coefficients of the independent

variables. Future research should therefore be conducted in a different cultural setting to confirm whether the same findings would be obtained.

Lastly, overall results of this study confirm that household well-being among proprietors of MSEs is influenced by socio-economic effects of rural electrification based on data sampled from eight counties. Future research will need to be carried out in the other counties in order to ascertain if the link between socio-economic effects of rural electrification and household well-being can be generalized.

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APPENDICES

Appendix I: Introduction Letter for Data Collection

July, 2018

Dear Sir/Madam,

RE: PERMISSION FOR DATA COLLECTION

I am a post-graduate student pursuing a PhD. in Development Studies at Jomo Kenyatta University of Agriculture and Technology. I am carrying out a study on the Socio-Economic Effects of Rural Electrification on Household Well-being among Proprietors of Micro and Small Enterprises in Kenya. The study is designed for research purposes only. Your responses will be absolutely anonymous and confidential. You are therefore requested not to write your name on the questionnaire. Please complete all the items in the questionnaire.

Your honest responses will be highly appreciated.

Thank you.

BONIFACE IMBALI MUDI

Appendix II: Questionnaire

a) Contextual and Personal Data of Respondents

Please provide the following information. Be **frank** and **honest** in your responses. All your responses will be treated with **strict confidence**

1. Your sex. Male ( ) Female ( )
2. Your age. 20-24 ( ) 25-29 ( ) 30-34 ( ) 35-39 ( )

   40-44 ( ) 45-49 ( ) 50-55 ( ) 56-60 ( )

3. Household size 1–4 ( ) 5–7 ( ) 8–10 ( ) above 10 ( )
4. Type of house Communal ( ) Bungalow ( ) Flat ( ) Duplex ( )
5. Ownership status Owner ( ) Tenant ( )
6. Number of employees in your enterprise

   0-5 ( ) 6-10 ( ) 11-50 ( )

7. Duration since electricity connection in years

   0-4 ( ) 5-9 ( ) Over 10 ( )

8. Tick your highest educational qualifications attained.

   K.C.S.E. Certificate ( ) A Level Certificate ( )
   Diploma ( ) Bachelor's Degree ( ) Masters ( )
   PhD ( )

9. Average monthly income in Ksh.

   0-50,000 ( ) 50,001-100,000 ( )

   100,001-500,000 ( ) above 500,000 ( )

b) Access to Healthcare

Using a scale of 1-5, kindly tick appropriately as:

5. Strongly agree 4. Agree 3. Neither Agree nor Disagree 2. Disagree 1. Strongly disagree

	Access to Healthcare	5	4	3	2	1
1.	Electricity provides quality lighting at night for performing medical operations.					
2.	Availability of electricity enables health centers to operate for longer hours.					
3.	Availability of electricity enables faster medical emergency response especially at night.					
4.	Electricity powers laboratory equipment for diagnosis.					
5.	Use of electricity-dependent laboratory machines enhances health service quality.					
6.	Access to electricity helps to attract more qualified medical staff to work in health facilities.					
7.	Use of electricity in health facilities reduces the cost of energy leading to reduced cost of health services.					
8.	Electricity enables storage of vaccines and medicines requiring refrigeration.					
9.	Use of electricity-dependent medical equipment after electrification reduces costs previously incurred on referrals.					
10.	Electricity supply enhances the number of healthcare facilities reducing the inconvenience and cost of transporting patients for longer distances.					

c) Employment Status

Using a scale of 1-5, kindly tick appropriately as:

5. Strongly agree 4. Agree 3. Neither Agree nor Disagree 2. Disagree 1. Strongly disagree

	Employment Status	5	4	3	2	1
1.	Use of electricity-dependent machinery enhances labor efficiency.					
2.	Electrification leads to business diversification that requires employees with varied skills.					
3.	Access to electricity enhances self-employment.					
4.	Electricity supply enhances use of computers and internet for online jobs.					
5.	Electrification allows firms to plan for flexible working hours for her employees.					
6.	Electrification increases demand for labor in newly established electricity-dependent businesses.					
7.	Electrification frees up women's time used in collecting fuel.					
8.	Access to electricity increases non-farm wage employment.					
9.	Availability of electricity enables enterprises to operate for more hours.					
10.	Use of electricity allows household members to reallocate labor from household tasks to formal wage labor.					

d) Income Level

Using a scale of 1-5, kindly tick appropriately as:

5. Strongly agree 4. Agree 3. Neither Agree nor Disagree 2. Disagree 1. Strongly disagree

	Income Level	5	4	3	2	1
1.	Use of electricity enhances income due to reduced business costs.					
2.	Use of electricity-dependent equipment enhances income due large scale production					
3.	Use of information communication technology enhances income as a result of reduced wage bill.					
4.	Reliable electricity supply enhances income due to reduced cost of energy.					
5.	Use of machines enhances income due to improved quality products and services.					
6.	Availability of electricity enables enterprises to operate for more hours leading to enhanced income.					
7.	Electrification leads to diversification of businesses that enhances income for households.					
8.	Electrification enhances income by attracting/retaining more people in rural areas due to ready market for goods and services.					
9.	Use of electricity reduces operation costs that results to increased profit.					
10.	Availability of electricity enables value addition of agricultural products that enhances profitability.					

e) Skills and Knowledge Application

Using a scale of 1-5, kindly tick appropriately as:

5. Strongly agree 4. Agree 3. Neither Agree nor Disagree 2. Disagree 1. Strongly disagree

	Skills and Knowledge Application	5	4	3	2	1
1.	Electrification enables use of ICT that enhances the level of knowledge and skills of members of a household.					
2.	Electrification attracts population with a higher level of education and exposure leading to increased demand for new and innovative products.					
3.	Exposure to media due to electrification makes businessmen more professional and successful in business.					
4.	Skills acquired due to exposure to electronic equipment makes employees more productive at work.					
5.	Knowledge and skills acquired through electronic media are necessary for business record keeping					
6.	Use of computers due to electrification enhances effectiveness of employees.					
7.	Electricity enables startup of micro processing firms that adds value to agricultural products.					
8.	Availability of electricity has resulted in improved quality of business products/services.					
9.	Electrification enhances exposure to social media that helps proprietors appreciate quality products and services.					
10.	Use of electricity powered gadgets makes communication with service providers more efficient.					
11.	Electricity supply is necessary for e-business.					
12.	Access to electricity encourages internet use necessary for networking in business.					

f) Electricity Supply

Using a scale of 1-5, kindly tick appropriately as:

5. Strongly agree 4. Agree 3. Neither Agree nor Disagree 2. Disagree 1. Strongly disagree

	Electricity Supply	5	4	3	2	1
1.	Preference is given to less electricity-intensive businesses due to high tariffs.					
2.	High electricity tariffs is the cause for cooking using solid and liquid fuels.					
3.	The average monthly power bill exceeds 5% of the business income.					
4.	Use of generators during outages increases the cost of electricity.					
5.	Unreliable electricity supply has a negative effect on a firm's productivity.					
6.	Interruption to power supply increases the cost of production through expenses of repair of damaged equipment.					
7.	Electricity is used alongside other energy sources to optimize costs.					
8.	There are other energy sources on standby in case of power blackout.					
9.	Voltage fluctuation impacts negatively on business performance.					

g) Well-being

Using a scale of 1-5, kindly tick appropriately as:

5. Strongly agree 4. Agree 3. Neither Agree nor Disagree 2. Disagree 1. Strongly disagree

	Well-being	5	4	3	2	1
1.	Enhanced business income due to electrification leads to improved nutrition for households.					
2.	Part of the business profit as a result of electricity use is used to improve household housing.					
3.	Longer opening hours in health facilities due to electricity supply enhances the level of healthcare.					
4.	Some of the business income gained owing to electricity use is used to buy clothing for members of the household.					
5.	Income from businesses enhanced as a result of electricity use helps pay school fees for members of households.					
6.	Income from business enhanced as a result of electrification enables proprietors to gain membership of social groups.					
7.	Improved profit levels due to electricity supply leads to ownership of valuable assets.					
8.	Improved income status provides confidence to members of a household to participate in community decision making process					

Thank you for your cooperation