INFLUENCE OF CHARCOAL TRADE ON LIVELIHOOD OF RURAL COMMUNITIES: A CASE OF MITAMISYI LOCATION IN KUSYO DISTRICT OF KITUI COUNTY

BY

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DECLARATION

This research project report is my original work and has not been presented for a degree in any other university or any other award.

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This research project report has been presented for examination with my approval as university supervisor.

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DEDICATION

This project is dedicated to my dear wife Judy, my sons Alvine, Edwin and daughter Edith.

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ABBREVIATIONS AND ACRONYMS

ASALS	Arid and Semi-Arid Lands
FCC	Forest conservation Committee
FD	Forest Department
GoK	Government of Kenya
KEFRI	Kenya Forestry Research Institute
KFMP	Kenya Forest Master Plan
KFS	Kenya Forest Service
AFREA	Africa Renewable Energy Access
EIA	Environmental Impact Assessment
CFAS	Community Forest Associations
KIPPRA	Kenya Institute for Public Policy Research and Analysis
ESMAP	Energy Sector Management Assistance Programme

ABSTRACT

The study sought to find out the influence of charcoal trade on the livelihoods of the community in Mitamisyi Location, Kitui County, Kenya. The objectives that guided the study were earnings from charcoal, the technology and environment in charcoal production and the challenges faced by charcoal producers. The target population for the study was the charcoal producers in charcoal producer associations in the location. They were all one thousand five hundred in number. The simple random sampling method was used to pick the charcoal producers population. The sample size for the charcoal producers was ten percent of the population. The study employed the descriptive survey design. Data was collected by use of questionnaires. Data was analyzed using descriptive statistics and inferential statistics and thereafter presented by use of statistical means. The results were subjected to statistical tests which entailed chi-square tests and spearman rank correlation order tests. The study found out that the charcoal producers considered the earnings from charcoal as inadequate to meet their daily needs. They considered the environment that they worked in as not adequate to guarantee them of sustainability in their industry and they had myriad challenges which included transport and the statutory regulations among others. The study thus concluded that the charcoal producers considered the earnings from the industry as inadequate. The technology they employed was equally considered as not up to the current standards and the regulatory framework was considered as an impediment to the growth of the industry. The study recommended that the charcoal producers should exploit their numbers in terms of the membership of the associations to better their fortunes. They should equally engage in massive reafforestation and employ the current best practices as regards the carbonization practices to have the best quality charcoal at minimal costs.

CHAPTER ONE: INTRODUCTION

1.1 Background Information

It is estimated that globally about 2.5 billion people depend on traditional biomass as source of fuel for cooking and most of them come from developing countries (Assmann, 2012, and Njong & Johannes, 2011). In Sub-Saharan Africa, more than 75% of energy consumption is from biomass. This indicates that biomass is the main source of domestic energy. Among all forms of biomass energy nearly 85% of wood, in form of firewood and charcoal, is used as fuel for household cooking needs (Njong & Johannes, 2011). Use of biomass from wood source accounts for about 66% in Latin America, 81% in Asia and 89% in Africa of total wood consumption (AREA, 2011).

Studies reveal that there is increased demand of charcoal as compared with firewood in developing countries due to number of reasons. While gas and electricity seems to be the most convenient source of domestic fuel, a few households can easily afford them and therefore charcoal is an alternative source of fuel. Charcoal provides unique characteristics that other fuels do not have which make it a preferred option in many households. In addition, the quality of charcoal and its energy value compares relatively well with other energy sources and besides this, handling and transport cost of it is relatively cheaper compared with that of firewood (Mugo & Ong, 2006).

In developing nations, statistics indicate that charcoal acts as a major source of energy in most of the urban households. For instance, in Zambia about 68% of national energy needs is supplied by wood fuel with an estimated 0.7 tonnes of charcoal being used every year and approximately 85% of households in urban areas making use of it (Mugo & Ong, 2006). In Uganda, about 90% of entire energy consumption is from biomass with charcoal usage in urban centers increasing at a rate of 6% every year.

About 230,000 tonnes of charcoal is used annually in Ethiopia's towns. This covers about 70% of total household energy demands (Mugo & Ong, 2006). Similarly, 80% of charcoal produced in Tanzania is used in urban households. In Kenya, 34% of charcoal is used in rural settings while urban households (Ibid) utilize about 80% of charcoal.

It was estimated that in the year 2007, the charcoal industry in Sub-Saharan Africa (SSA) had a value of close to USD 8 billion with at least seven million people depending on this sector for their livelihood AFREA, 2011. By 2030, it is anticipated that charcoal industry based on the current consumption may have value that exceeds USD 12 billion and will employ more than eleven million people (Ibid). In most of Sub-Saharan Africa countries biomass fuel particularly wood-based create employment with regular source of income for over hundreds of people.

Recent studies in Malawi indicate that about 100,000 people carry out charcoal trade as part of their livelihood (Kambewa, Mataya, Sichinga & Johnson, 2007). A study conducted in Uganda reveals that about 200,000 people have permanent earnings from charcoal. In addition those households that are involved in charcoal production, they are less likely to fall below poverty line compared with their counterparts not involved in charcoal trade (Khundi, Jagger, Shively & Sserunkuuma, 2010). More studies indicate that charcoal trade plays a significant role in people's livelihood. For example, in Ghana charcoal trade creates livelihood for about three million persons (Mombu & Ohemeng, 2008). In Kenya, charcoal industry has created employment to charcoal producers, wood producers, vendors and transporters. In a study carried out by Sustainable Development Africa (ESDA) in 2005, there were about 200,000 charcoal producers and approximately 500,000 people were serving as vendors and

transporters in Kenya. In addition, these people in charcoal trade (Mugo, Ngugi, Wanjiru & Kamau, 2011) supported about 2.5 million dependants during this time.

Even though charcoal trade is a source of livelihood to many, those who are engaged in charcoal activities such as producers, transporters or traders often operates in small scale and do not get maximum benefit from the trade (Mugo & Ong, 2006). Also, despite the fact that wood fuels has a major contribution in local economic development, government of Kenya has not been able to reap maximum benefits associated with charcoal trade due to traders evading licensing fees as well as transport levies. Charcoal production posses a big threat to existing natural forests as it uses specific preferred species, which leads to unsustainable harvesting. In arid and semi-arid areas where capacity to regenerate cut trees is relatively low, if charcoal activities are not well regulated, they may lead to increased desertification (Mugo & Ong, 2006).

In Kenya, the arid and semi-arid lands (ASALs) cover about 80% of the country's total land area, which translates into about 473,000 square kilometers (KEFRI, 2005). ASALs support about 20% of the Kenya's population and more than half of its livestock (Ibid). These regions are characterized by low and unreliable rainfall. Scarcity of water is the biggest limiting factor for plant growth that poses challenges for forestry.

ASALs areas are known to be highly susceptible to drought. In presence of perennial crop failure, the communities, which live in these regions, result in charcoal production as an alternative source of livelihood that in turn creates increased demands for forestry products. Due to the fact that there is a low national forest cover in Kenya of about less than 2%, it is estimated that nearly over 75% of an average 2 million tonnes of charcoal used within the country every year is unsustainably

harvested from these arid and semi-arid lands (Republic of Kenya, 2002). Most of the wood harvested from the ASAL areas has relatively lower regeneration capacity and in presence of increased charcoal production, there are negative environmental implications (KEFRI, 2005).

Therefore, despite charcoal being a major preferred source of domestic energy and its production activities creating an alternative source of livelihood for communities that live in arid and semi arid parts of Kenya, charcoal production and trade if not controlled is likely to have negative implications on Kenya's natural resources and environment (Mugo & Ong, 2006). Such implication may include deforestation, wasteful use of wood, land degradation, environmental pollution. In addition, most of those involved in charcoal production continues to remain poor and work in poor conditions (Ibid).

1.2 Statement of the Problem

In the year 2009 in Kitui, which is one of the arid and semi-arid regions in Kenya, felling of naturally growing trees of indigenous nature to produce charcoal was alarming and unsustainable (Practical Action Consulting Eastern Africa, 2010). They stated that there is inadequate support for commercial tree farming which can sustain charcoal production as a commercial venture. Besides this, use of poor charcoal production techniques such as traditional charcoal kilns, which have an efficiency of about 10%, contribute to wastage of limited available tree resources.

There are limited studies that provide information if charcoal is a reliable and sustainable source of community livelihood or it is an environmental degrading venture among communities that live in arid and semi-arid areas. Also, there lacks adequate information on the influence of the charcoal trade on community livelihoods and associated challenges (Mugo & Ong, 2006). In Kitui, a lot of charcoal is

produced but the producers continue to be poor. Therefore, the study was conducted to establish the influence of charcoal trade on the livelihood of communities in Mitamisyi Location in Kyuso District. The location is where most of the charcoal comes from and where the leaders have expressed concerns over environmental impact brought about by the charcoal trade.

1.3 Purpose of the study

The purpose of this study was to establish the influence of charcoal trade on livelihood of communities in Mutamisyi location in Kyuso District.

1.4 Objectives of the Study

Specific objectives of the study are to-

1. Determine how the monthly earnings from charcoal influence the livelihood for the charcoal producers from Mitamisyi Location, Kyuso District
2. Assess how the type of charcoal production techniques used influences the livelihood of the charcoal producers in Mitamisyi Location, Kyuso District
3. Establish how challenges encountered in charcoal production influences the livelihood of the charcoal producers in Mitamisyi location, Kyuso District
4. Assess how environmental implications associated with charcoal production influences the livelihood of the charcoal producers in Mitamisyi Location, Kyuso District

1.5 Research Questions

The study was guided by the following research questions:-

1. How do the monthly earnings influences the livelihood for the charcoal producers from Mitamisyi Location, Kyuso District

2. To what extent does the type of charcoal production techniques used influence the livelihood of the charcoal producers in Mitamisyi Location, Kyuso District
3. How do the challenges encountered in charcoal production influence the livelihood of the charcoal producers in Mitamisyi location, Kyuso District
4. To what extent does environmental implications associated with charcoal production influences the livelihood of the charcoal producers in Mitamisyi Location, Kyuso District

1.6 Significance of the Study

The Kenya Forest Act No. 7 of 2005 and the subsequent charcoal rules of gazette notice 186 of 2005 introduced a new approach to charcoal management. Even so, the Kenya Forest Service has not conducted any research to establish the impacts on livelihoods brought about by the enacted rules. It is hoped that the study will help in bringing out the possible livelihood improvement opportunities to the communities, which rely on charcoal as a means of their livelihoods. The results of the study will therefore provide a platform for the formulation of programme by the stakeholders for management and utilization of the forest resources in relation to charcoal trade. The study will also prompt further research in this area.

1.7 Assumptions of the study

The study is based on the assumption that the charcoal sold within Mitamisyi location and the charcoal producers comes from the location. It is also assumed that the charcoal producers and the registered groups of charcoal producers willing to adhere to the requirements stipulated in the charcoal rules and regulation to maximize their profits and protect the environment.

1.8 Limitations of the study

Due to limitation in terms of time and budget, a sample of the population was taken as opposed to carrying out a census, which would have been the ideal method of carrying out the study. The study also covers only one location within Kyuso district due to time and financial constraints. Results that are more convincing would have been obtained by taking samples from several locations within Kyuso district since charcoal production is still ongoing.

1.9 Delimitation of the study

The study focused on how charcoal trade is carried out. The issue of charcoal has been an emotive issue, which attracts a lot of interests both social and political. The study was carried out in Mitamisyi location, which is an area, which is reputed to have the best charcoal. The study was delimited to the Mitamisyi location which is where the charcoal trade has been rife.

1.10 Definition of significant terms as used in the study

Charcoal: Is a light black residue consisting of carbon and any remaining ash obtained by removing water and other volatile constituents from animal and vegetation substances

Charcoal Trade: It's the activity of buying and selling of charcoal between people or countries

Livelihood of Community: A set of activities involving securing basic necessities food, water, shelter and clothing and the capacity to acquire above necessities working either individually or as group using

	endowments (both human and material) for meeting the requirements of the self and his /her household on a sustainable basis with dignity.
Mitamisyi Location:	This is a region in Kyuso district within Kitui County in Kenya where charcoal trade is main activity.
Technology in charcoal production	This is the making, modification usage and knowledge of tools, machines, techniques, crafts, systems and methods of organization in order to solve a problem, improve a pre-existing solution to problem to achieve a goal in charcoal production.
Challenges in charcoal production	Are new or difficult encounter, task faced by charcoal producer in their daily activity in charcoal production.
Monthly earnings from charcoal	This are monthly payments or money earned from

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The purpose of this study is to establish the influence of charcoal trade on livelihood of the communities in Mutamisyi location in Kyuso District. In this chapter, the review of literature has been done under the following sub-headings: Charcoal as source of households' biomass energy**,** charcoal production as a livelihood, arid and semi-arid forestry and sustainable charcoal production, charcoal policy and legal framework in Kenya, techniques used in production of charcoal and environmental pollution caused by charcoal production. Research gaps identified during literature review are presented in this chapter. In addition, theoretical and conceptual framework of the study has been discussed.

2.2 Charcoal as source of households' biomass energy

It is estimated that nearly half of population globally continues to depend on biomass energy particularly in form of fuel wood and charcoal for cooking. In Sub-Saharan Africa, about 81% of the households also depend on charcoal and fuel wood for cooking (AFREA, 2011). It is projected that even though biomass fuels are likely to increase in developing countries such as India and China among others, in Sub-Saharan Africa use of charcoal is relatively higher and is expected to increase further in future. The World Energy Outlook approximates that by 2030 individuals using biomass energy from fuel wood and charcoal will likely reach to about one billion in Sub-Saharan Africa (IEA, 2010).

In Kenya, 80% of the population is dependent on firewood and charcoal for cooking and other energy needs (Republic of Kenya, 2008). KIPPRA (2010) suggested that renewable technology is the way forward to Kenya's energy security but the energy production from renewable sources has been limited to small scale consumption and

household cooking in the country. An analysis of fuel types in Kenya by KIPPRA (2010) observed that the most popular household fuel types in terms of their various uses are: kerosene (80%), followed by charcoal (60), fuel wood (55%), electricity (37%) and LPG (21%).

Charcoal is a preferred household energy source due to its affordability. It is the cheapest urban household cooking fuel currently costing about Kenya shillings (Ksh.) 12,000 per household per year, compared to Ksh. 31,760 for liquid petroleum gas (LPG) and Ksh. 59,200 for electricity. Charcoal can be purchased in small quantities of 1.5 kilograms costing between Ksh. 30-50, therefore low income households and businesses find it affordable to buy charcoal every day in small quantities. In comparison, the current (June 2011) price of LPG is Ksh 2,500 for a 13 kilograms cylinder or Ksh 1,000 for a 6 kilograms cylinder (Pisces, 2011).

Kalua (2011) decried that the 9,500 secondary schools in Kenya rely heavily on charcoal and firewood for their energy needs, leading to massive loss of forest cover. The school's average consumption of wood fuel is equivalent to 5.3 medium-sized trees on a daily basis, which translates to a loss of 18.3 million trees per annum through secondary schools alone. The Republic of Kenya (2011) estimated that 20,000 institutions are consuming an average of 270 tonnes of firewood per annum, which translates to an absolute loss of 5.4 million trees per annum because the institutions rarely re-plant trees.

Industrial consumption of charcoal in Kenya has remained low, despite the knowledge that Brazil industrial consumption of charcoal to fire its steel industry is at 32% (co-firing with coal at 68%). Agricultural sector industrialists such as KTDA and edible oils manufacturers continue to depend heavily on firewood, with the 65 KTDA-managed tea factories consuming a peak average of 20 tonnes of firewood daily (over

260,000 tonnes annually) and the three major edible oils manufacturers in Thika, Nakuru and Mombasa combining to consume more than 200 tonnes daily. Firewood has less than 50% of the calorific values and transport costs posted by charcoal, but due to the bulk density of charcoal and inconsistent, highly volatile supply, it does not even remotely come up as an energy option to these industrialists.

Among the available sources of energy for domestic use such as electricity, kerosene and gas, charcoal forms the best alternative among these in most of the households in developing world especially in Africa. Charcoal has relatively cheaper cost and does not need complicated devices to use it. Besides this, it has special unique properties suitable for cooking which make many individuals prefer it in presence of other viable alternative sources of household energy (Mugo & Ong, 2006). Charcoal is widely used as energy source by urban households. For instance, in Zambia, 85% of the urban households use charcoal as their source of energy while in Ethiopia about 70% of charcoal production is used in urban towns by households (Ibid). Similarly, in Tanzania, 80% of the charcoal made is utilized by urban households. In Kenya, 80% of the urban households used charcoal as source of energy for cooking (Mugo & Ong, 2006). It is estimated that in every year about two million tones of charcoal are used in Kenya (ESDA, 2005).

In some SSA countries, the proportion of people with access to electricity is actually declining (Venro, 2009), and access to electricity is not expected to replace wood-based fuel use for cooking because the cost of cooking using electricity or other alternatives such as liquefied petroleum gas (LPG) is often prohibitive. Hovorka, et al., (2008) established that in SSA countries, urban households use modern energy sources in addition to rather than instead of solid fuels. For example, half the total firewood demand in Harare is from households with access to electricity (Chambwera

& Folmer, 2007), while in Kampala, 83% of the top quintile in urban areas use biomass as the primary cooking fuel (Bacon et al., 2010). This demonstrates that biomass consumption often continues to increase under conditions of economic development and fossil fuels are simply added to the energy mix, satisfying additional energy demand, but not substituting for wood energy.

A survey carried out for World Bank's Energy Sector Management Assistance Programme (ESMAP) in 45 cities in 12 countries between 1984 and 1993 (Price, 2000) showed that a decrease in the use of wood fuel and a shift to petroleum products is clearly related to improvement in incomes, as well as to new policies and programmes established by governments. In a later study, the World Bank (2011) found that switching from wood-based energy in Sub-Saharan Africa (SSA) will not necessarily be a matter only of improving the economic situation of consumers. In fact, if the price of alternative fuels continues to rise and supply remains erratic, households have little incentive to switch to them. It is also not only the amount of household available income that determines such choices but rather how the income stream is structured, i.e. how frequent and reliably income is generated.

Given the often erratic and unreliable income streams to SSA urban households, it is generally more rational to buy small quantities of fuel with the cash available even if an analysis of total fuel expenses per month reveals higher expenses for charcoal compared to alternative fuel, such as LPG. The World Bank (2011) further established that a doubling of typical urban household incomes would only reduce the number of those depending on biomass energy for cooking by 16%. While it is predicted that by 2030 energy derived from wood in Africa will still account for an estimated three quarters of total residential energy consumption serving about 1

billion people, it currently only accounts for about 10% of the global energy supply (IEA 2006 and 2008).

2.3 Charcoal Production as a Livelihood

Production of charcoal and its trade has significant contribution to country's economy. It creates employment, rural incomes and government tax revenues besides saving country's foreign exchange that would have been used to import such fuel (Mugo & Ong, 2006). Generally, fuel wood and charcoal in biomass energy sector creates significant workforce. For instance, a survey conducted in Tanzania, Dar-es-Salaam indicated that charcoal production and trade provided employment to hundred thousand of locals. Among these, most of them were the poorest in the community who had lacked any other alternative source of livelihoods (Sepp, 2008). In Ghana, about 3 million individuals have their source of livelihood in charcoal sector with more than 50% of these individuals being women (Mombu, and Ohemeng, 2008).

Approximately 2,000,000 individuals in Uganda have permanent source of earning from charcoal activities. In addition, it was found that households involved in charcoal production and trade were likely to evade falling below poverty line (Khundi et al., 2010).

In Kenya, charcoal sector has employed more than 700,000 individuals who have more than two million dependants (Mugo, Ngugi, Wanjiru & Kamau, 2011). It is further estimated that charcoal industry in Kenya has a market value of KSH 32 billion annually making it compare favorably with tea and horticultural industry which had annual revenue of KSH 42.4 billion and 43.8 billion respectively in the year 2005 (Ibid).

A policy brief that was prepared by the World Agroforestry Center in 2005 suggested that in presence of adequate source of wood an individual can operate a medium scale charcoal production with earnings between KSH 240,000 and KSH 720,000 annually (Mugo, Ngugi, Wanjiru & Kamau, 2011). Despite high potential that is in charcoal sector in creating source of livelihoods to people particularly the poor and earning government significant revenue, negative perception in charcoal industry has continued to persist. This has led it continue operating informally and unsustainably (Ibid).

Researchers have suggested that charcoal is a poor man's enterprise. Mutimba (2005) found that despite the huge entrepreneurial potential, small scale charcoal producers in Tanzania and Kenya do not produce charcoal as some sort of business, but simply do it for survival. Likewise, Mugo and Poulstrup (2003) suggested that the lack of alternative forms of livelihood has forced many charcoal burners in Kenya to take up the trade on a subsistence basis.

However, Khundi, et al. (2010) demonstrated that participation in charcoal production leads to higher household incomes in Uganda by approximately $319 per annum. Participation in charcoal production was found to reduce the likelihood of households falling below a poverty line by approximately 14%.

In Uganda, charcoal trade provides a livelihood to a large number of people who produce it, distribute it and sell it. Cattle farming and charcoal production are the two economic activities where rural people can get quick cash from, but given the two options, farmers are not willing to sell cattle where charcoal is readily available (Knoepfle, 2004). The core statement is that although there are only few possibilities to get cash from, charcoal is the vulnerable priority when it comes to realizing quick and easy cash. It may therefore be argued that charcoal production is prevalent among

the poor as it presents a very easy access to cash resources, rather than being the only option to raise cash. Chambers and Leach (1987) found that where local markets for fuel wood exists; trees are assets which could be cut and sold at short notice to meet urgent household financial needs.

The poor state of environment in Mkuranga district in Tanzania has been attributed to the poor socio-economic base, poor agricultural production and marketing and lack of alternative sources of income (Minja, 2006).

However, Minja argues that the sorry state of affairs has largely been contributed by uncontrolled tree cutting for charcoal production, this being perceived as the easy route out of poverty. It remains in doubt whether unsustainable charcoal production can, in fact, be a route out of poverty. In spite of this arguable link, Khundi, et al. (2010) did not find evidence to suggest that charcoal production is the domain of the poorest households. On the contrary, poverty rates appeared to be lower among charcoal producers, and it was hypothesized that this is a direct result of their participation in the charcoal trade.

The literature demonstrates that while overall the charcoal business is lucrative because of the high demand and existence of a very comprehensive distribution network (Müller, et al. 2011), not all players in the charcoal value chain benefit financially. The World Bank (2009) found that charcoal producers, small-scale transporters, and retailers (who far outnumber more powerful wholesalers and transporters) receive a very small share of the final market price. Charcoal producers, who are the subject of majority of the poverty-theory studies, are the segment in the supply chain that is pawned to acquire the commodity illegally, and are the segment that has no capacity whatsoever to invest in afforestation and reforestation.

2.4 Arid and semi-arid forestry and sustainable charcoal production

Arid and semi -arid lands (ASALs) forms about 80% of Kenya's total land surface area. This land is estimated to host 25% of Kenya's population (Geller, McConnell & Wanyiri, 2007). Majority of this population are close to two million people who experience chronic food insecurity. They rely on emergency relief in order to get their basic needs for survival. ASALs contain key biodiversity habitats and source of domestic energy resources. As an attempt by the government of Kenya to address challenges faced by people living in these areas, ASALs Policy has been formulated with strategies such as a 10-year program to fight against hunger, a 15-year investment plan to increase infrastructure and services and programme to manage natural resources among others (Ibid).

Managing of dry land forest resources need a different approach as compared with those employed in managing other types of forests. However, it seems that government of Kenya has not been proactive in responding to the needs related to managing dry land forests effectively.

Also, it needs to have special focus on ASAL communities who depend on these resources by supporting them. Among others priorities the government would need to undertake includes effective regulation, legal and sustainable charcoal industry, promotion of suitable technologies that can help sustain management of dry land forests and provision of extension services (Geller, McConnell & Wanyiri, 2007).

Often, charcoal production is done without producers paying for the raw material and they evade levies and licenses. This makes the final cost of end product to the consumer lower than the real value. Consequently, this result in producers and traders unable to invest in using improved conversion technology, create their own woodlots and undermines long-term sustainable forest management. For this reason, improving

charcoal regulatory frameworks is crucial if legally and sustainably produced charcoal has to compete with unregulated and unsustainable produced charcoal in the market (AFREA, 2011).

In order to realize sustainable wood for charcoal production there are three possible interventions which can be used namely: use of decentralized forest management approaches that embrace local stakeholders for sustainable natural forests, increased tree-plantations or woodlots and increased use of incentives of trees-outside forest by use of Agroforestry systems. Use of community-based forest management approaches provides best way in supplying increasing demands of wood for charcoal production. Community-based forest management model ensures involvement of the community in a sustainable management of natural forests and utilization of sustainable resources for commercial purposes (ESMAP, 2010).

2.5 Charcoal policy and legal framework in Kenya

In Kenya, there are policy documents that recognize charcoal as source of biomass energy. These policies address issues that revolve around charcoal production, transportation, trade and consumption. One of these policy documents is 'the Sessional Paper No.4 of 2004 on Energy Policy'. This policy advocates and promotes growing of trees, which are fast maturing. It encourages any person, institution or company to plant and manage fast growing species of trees which can be used for charcoal production. It also outlines that charcoal producers who are willing to grow trees be given a 10-year tax holiday to help them make good profit from their long term investment in producing charcoal (Mugo, Ngugi, Wanjiru & Kamau, 2011).

It further indicates expression of the government to issue 20-year lease on government land for commercial production of charcoal to interested individual, institution or company which would like to invest in growing of trees but has no land. It also

mandates licensing of charcoal trade as any other form of trade in order to encourage sustainable production. In addition, this policy promotes participation of private sector in charcoal production. This is aimed at encouraging private sector to invest in growing of trees for charcoal production or be engaged in sustainable management of natural woodlands for charcoal production (Mugo, Ngugi, Wanjiru & Kamau, 2011).

The second policy document is 'the Sessional Paper No.9 of 2005 on Forest Policy'. This policy empowers local communities through forming Community Forest Associations (CFAs) in order to manage forests and even planting woodlots to ensure adequate supply of wood resources to meet their needs and for commercial purposes. This policy also promotes sustainable production and efficient use of wood fuel by use of modern kilns during charcoal production and use of modern energy efficient stoves and energy saving methods.

Among other issues which have been addressed by this Sessional paper is control of charcoal production and marketing of Charcoal producers are required by the government to get licenses in order to transact in this business (Mugo, Ngugi, Wanjiru & Kamau, 2011).

On issue of environment, there is 'Environment policy, the Sessional Paper No. 6 of 1999 on Environment and Development'. It requires environmental impact assessment (EIA) to all projects that deal with thermal, hydro-electric and geothermal activities as well as those which involve growing or harvesting wood for charcoal production. This helps in making plans on how to reduce negative environmental impacts and maximize positive impacts in the project. It also advocates use of technologies in production of charcoal as well as in consumption by the end user (Ibid). Among other aspects highlighted in this policy document is that more researches in energy conservation and end use technologies are invited in order to

scale up efficiency in charcoal production and burn charcoal efficiently during consumption in a way that uses minimal amounts of charcoal. In agriculture Policy , 'the strategy for revitalizing agriculture 2004' individuals, company , cooperative or associations are encouraged to do commercial tree growing for charcoal as a business venture to ensure sustainability (Mugo, Ngugi, Wanjiru & Kamau, 2011).

There are legal instruments established by the government of Kenya, which acknowledges charcoal as valuable source of energy. These legal instruments address issues which relate to charcoal production, transportation, trade and usage. The Energy Act 2006 is one of such legal instruments. This Act promotes enabling framework that can help efficient and sustainable production of charcoal, its distribution as well as its marketing. It also encourages use of fast growing trees for energy production. Another legal instrument is 'the Forests Act of 2005'.

It creates provisions for Kenya Forest Service (KFS) to give forest extension services, which can help farmers, associations, and forest owners have sustainable management of forests. It also requires KFS among other things to collect revenue from the charcoal licenses and in movement permits issued (Mugo, Ngugi, Wanjiru & Kamau, 2011).

2.6 Techniques used in production of Charcoal

Charcoal is produced through a process known as pyrolysis which involves heating of wood in absence of oxygen (Adam, 2009). There are several techniques which uses this process to produce charcoal in Kenya and do vary in their efficiency. The most commonly used technique is traditional earth kiln. It involves arranging of wood on the ground in a pile, which is then covered using soil to cut off oxygen supply. An entry point is created for ignition which is on the windward side. It remains uncovered for a while until piled wood covered get to burn and then it is

covered completely. This method takes about seven days or more for the charcoal to be ready (Mugo & Ong, 2006). Improved earth kiln is another technique used to produce charcoal. This technique uses similar process as traditional earth kiln but has lesser contamination to the charcoal. In order to avoid contamination a metal sheet is used. It also uses chimneys that enhance control of the carbonization process. This technique is superior to traditional earth kiln in that charcoal produced is less contaminated and use of chimneys help to control carbonization process. However, it has extra production cost in buying chimneys and metal sheet.

Brick kilns form another technique used in charcoal production. They come in different shapes and sizes and they are versatile in their use. They can be used in small scale like in household charcoal production or even in industrial production (Adam, 2009). A good example of brick kiln is 'Half Orange Kiln'.

It has capacity of producing four to five bags of charcoal. There is also 'Duom Shaped Kilns' which are large sized as compared to Half Orange Kilns. Duom Shaped Kilns can be as huge as 6-7 diameters wide and can produce eighty to one hundred and twenty bags of charcoal. Retort kilns use better technology compared to earth-mound kiln or improved kilns. It is estimated that retort kilns have an efficiency of 35-40% and can reduce air pollution by about 75% (Adam, 2009). Wood gases in the retort kiln is returned back to the carbonization chamber and as the volatile particulate matter burns heat produced is used for carbonization process. This technique takes twenty four to thirty hours for the charcoal production to be complete.

2.7 Environmental pollution caused by charcoal production

It is evident that most charcoal producers use traditional earthen mound kilns, which produce emissions into the atmosphere during pyrolysis process contributing to greenhouse gas emissions. The problem worsens when these methods are used

without planting more trees (GEF, 2010). It estimated that annually carbon accumulate in the atmosphere at a rate of more than three billion metric tonnes. This is due to biomass combustion, deforestation and other associated land use changes (Mugo & Ong, 2006). For this reason, positive aspects to the environment related to charcoal production include reducing greenhouse gas in the atmosphere and replanting more trees (Mugo & Ong, 2006). A sustainable charcoal activity in a community producing approximately ten tones of charcoal can earn US450, 000 selling carbon credits (GEF, 2010). In addition, use of improved cook stoves, which have high efficiency in combustion, can help significantly reduce greenhouse gas emissions.

2.8 Theoretical framework

The Systems Theory advanced by the biologist Ludwig von Bertalanffy and later supported by Ross Ashby will be used for this study due to its relevance (Mwaniki, 2010). A system refers to a configuration of different parts, which are joined together by a unique network of relationships. According to this theory, real systems interact with their environments and are bound to acquire new qualitative properties by on-going evolution. Unlike reductionism approach, System Theory proposes that there is certain arrangement and relationship between different parts that make a whole. One of the principles in System Theory is that a system is not static and consists of a complex whole, which interact as a structured functional unit. Another principle is that there is information flow in different composites of the system.

Third principle is that systems consist of different entities, which seek an equilibrium state, and in the process they can manifest oscillation, exponential growth or decay (Mwaniki, 2010).

In this study, the System Theory helps explain better various components that work around intricate system of charcoal trade as a form of community livelihood. Knowledge sharing among local communities and the government through various relevant sectors on various aspects such as charcoal policies, legal framework and new technologies involved in the charcoal trade significantly may determine level of biomass energy- charcoal, exploitation in Kenya either into sustainable or unsustainable way. Local communities, entrepreneurs, government sector and private sector seem to form a pattern of complex system in charcoal production and trade. While the government imposes laws that seek to regulate unfair exploitation of forest resources from local communities' members, its conflicting directives and weak laws lead to making charcoal production and trade unsuccessful. In return, people resort in making illegal production of charcoal and evade levies imposed on the related activities. Communities that live in ASALs depend on charcoal production for their livelihood as a coping strategy when exposed to shocks during drought seasons. As such effective government support to these communities may help raise their standard of living while making charcoal production more acceptable by changing community perception of illegality of charcoal activity. This would in turn promote biomass energy sector and make the activity sustainable without compromising to negative environmental implications associated with unsustainable production of charcoal.

2.8.1 Conceptual framework

This study is based on the following conceptual framework.

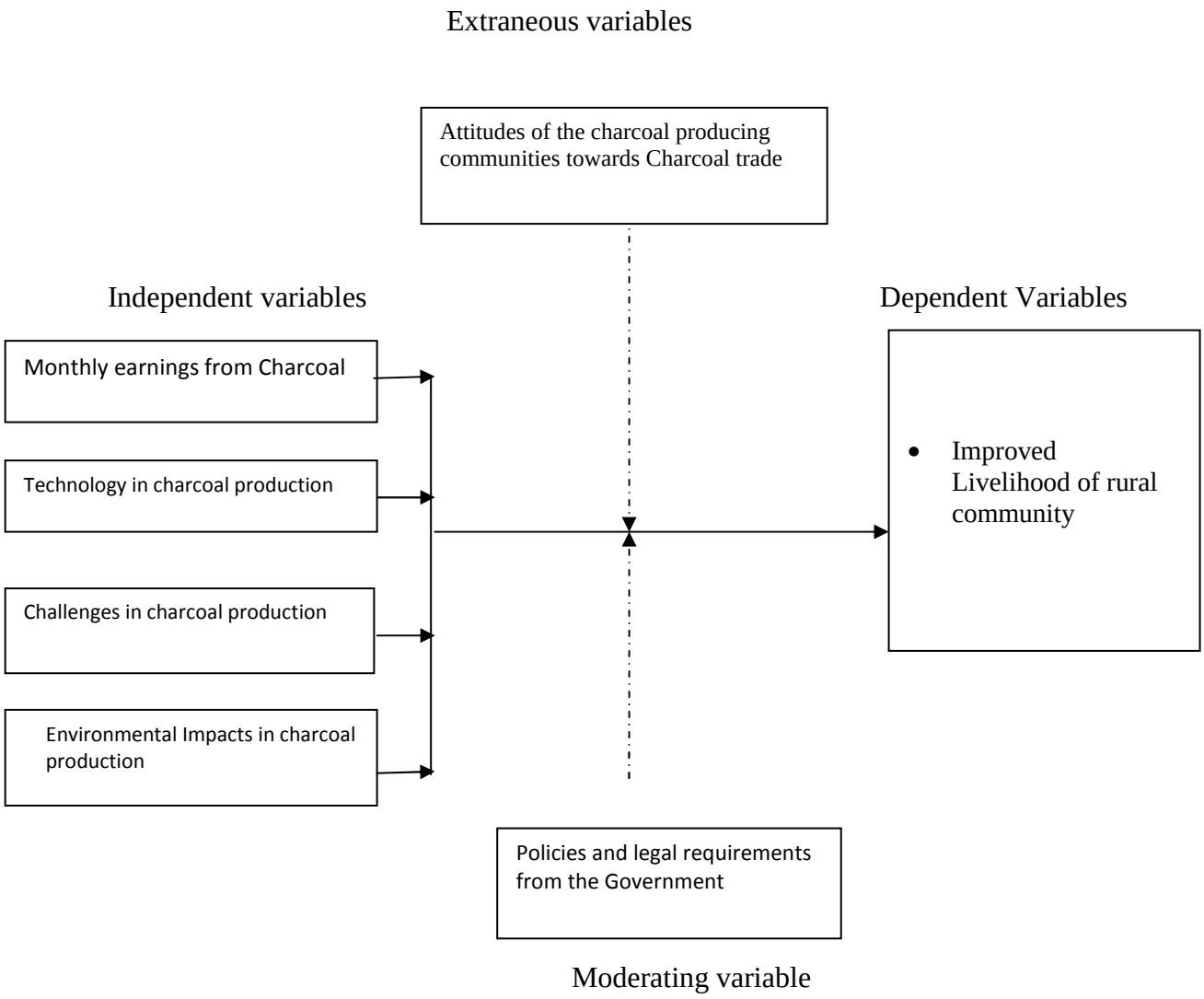

Figure I: Conceptual Framework

2.8.2 Influence of independent variable on the dependent variables

Monthly earnings from Charcoal will vary inversely proportionately with the level of earnings from charcoal. The lower the earnings, the higher will be the degradation due to the pressure exerted to fill income gaps from the same land resources plus the lack of capacity to meet the cost of care. While the quality of health will vary directly proportionately with earnings from charcoal. Higher earnings imply capacity to afford better healthcare, and vice versa. Access to education will vary directly proportionately with earnings from charcoal Higher earnings imply higher capacity to afford or support education, and vice versa.

Technology in charcoal production will vary inversely proportionately with rate of land degradation. The lower the technology, the higher will be the degradation of land due to high wastage of feedstock resulting in lower yields. Low yields will trigger higher extraction of feedstock to realize the same level of livelihood needs. The quality of health will vary directly proportionately with the technology in charcoal production. Better technology will result in lower pollution and less fatigue or physical strain, implying better health, and vice versa.

Challenges in charcoal production will vary directly proportionately with the rate of land degradation. The lower the challenges, the easier it becomes to produce charcoal sustainably and profitably. The quality of health will vary inversely proportionately with challenges encountered in charcoal production. Higher level of challenges will result in reduced capacity to afford good healthcare since scarce resources will be deployed to combat these challenges, and vice versa.

Environmental implications in charcoal production will vary directly proportionately with the rate of land degradation. The higher the degradation, the higher will be the

negative impacts in the long run due to the pressure exerted on the environment, but without adequate management of the environment.

2.9 Gaps in the literature

In eastern Africa, there exist conflicting directives and weak laws that govern charcoal production which have created major setback in charcoal business. In Africa there is lack of reliable information on charcoal production, trading and use. There is also inadequate information on the impacts of charcoal production on livelihoods of communities living in ASALs and on ASAL forestry.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the research design, target population, sample size and the sampling techniques. It also highlights research instruments that were used and ways to enhance study‘s validity and reliability. In addition, data collection procedures, data analysis techniques and research ethical considerations are discussed in this section.

3.2 Research Design

The research designs employed in the study were descriptive and were aimed at delivering answers to the research question outlined in the problem statement. Research design was the science (and art) of planning procedures for conducting studies so as to get the most valid finding. Research design provides the glue that holds the research paper together. The research design was used to structure the research, to show how all the major parts of the research project work together in trying to address the central research questions (Katon, 1983)

Descriptive survey design involves collecting data through administering questionnaires or use of interviews to sampled individuals (Orodho, 2008). It is informative and suitable for identifying variables. Through this study design, variables are studied in their natural settings. It facilitates procedures and variables to be described accurately (Miller, 1991). In addition, it assists in collecting extensive data within short period. Further, a descriptive survey design will enable the use of a questionnaire that will seek both qualitative and quantitative data. In this regard the research methodology adopted must be able to generate data that is objective, quantitative, and descriptive of constraints and challenges.(Cooper &Schindler) descriptive statistics discover and measure cause and effect relationships among

variables. The studies were guided by four independent variables; monthly earnings from charcoal, technology in charcoal production, challenges in charcoal production, and environmental impacts in charcoal production. The improved livelihoods of the rural community were dependent variable.

3.3 Target population

The sampling frame is the list of respondents from which the samples were drawn. It provides a complete listing of the whole population (Naoum, 2007). The target population for the study was community members who belonged to the six registered charcoal producers in Mitamisyi location.

Community members who did not belong into any of the six registered charcoal producers or had ceased to be a member of these charcoal producers were not included in the study. The six registered charcoal producers have an average of 250 individual producers who total to 1500 persons.

3.4 Sampling techniques and Sample Size

According to Fellows and Liu (1997), and Naoum (2007), sampling is necessary, it is almost impossible to examine the entire population. In order to obtain a good representation of the respondents, it is possible to use a sample of the population, which is much smaller than the total population, but sized and structured to be statistically representative. Clearly, the results from such sampling would not be exactly the same as if the whole population had been consulted, but the result is adequate for the purpose for which the information was required. Fellows and Liu (1997) assert that population parameters and sampling procedures are vital in the success of a study.

The study sample was determined using Fishers exact test formula (Mugenda & Mugenda, 2003) as follows:-

$$n = Z^2pQ/d^2$$

Where,

n= is required sample size

Z2= the standard normal deviate at the required confidence level (taken as 1.96 for 95% confidence level)

P= the proportion in the target population estimated to have characteristics being measured

Q= 1-p

d=level of precision at 5% (standard value of 0.05)

In Mitamisyi location about 1,500 persons are involved in charcoal production. Thus, the sample size required comprised about 150 persons, with a target of 25 selected from each of the six CPAs presently in pursuit of registration.

Adjusted figure for the final sample size as needed for population estimate less than 10,000 persons as given by Mugenda & Mugenda (2003) through this formula,

$$nf = n/ (1+n/N)$$

Where,

nf = Sample size (when the population is less than 10,000).

n = Sample size (when the population is more than 10,000)

N = Estimate of the population size

Systematic random sampling was used to draw the required sample size. A sampling frame was developed from the list of all members from six registered charcoal producers. Using this sampling frame, sampling intervals were calculated. The first participants were randomly selected and then using sampling interval participants were subsequently selected until required sample size was obtained.

3.5 Research instrument of the study.

Structured questionnaire was used to collect needed data for the study. Such data included participants' socio-demographic information, forms of livelihoods participants are engaged into, monthly income generated from charcoal activities, household food security status, affordability of basic services by the households, sources of raw materials for producing charcoal, types of charcoal production techniques used and sustainability strategies to ensure availability of raw material for charcoal production. It also collected data on community-based forest management approaches, availability, and nature of services given by Forest Extension Services through Kenya Forest Services. Data on legal formalities needed to run charcoal related activities in the region, possible environmental pollution related to charcoal production in the area and current approaches to mitigate them as well as challenges currently faced by participants in charcoal producing and selling business.

3.6 Pilot testing

A pilot testing was conducted to pre-test the research instrument to ensure that it yielded correct and necessary data during the actual study. It provides the researcher an opportunity to rectify questions that were misinterpreted or might not be necessary or contradictory with the objectives of the research to be undertaken. It was conducted in a different location other than Mitamisyi location where the actual study was carried out. The study sample to be included in the pilot survey was selected such that

it had similar characteristics as those of target population in the actual study. The sample drawn during the pilot study was not included in the final study. Findings of the pilot survey were used to adjust the research instrument appropriately to help gather needed data.

3.7 Validity of the instrument

Validity of the research study refers to the extent at which data collected actually represent the phenomenon under investigation (Orodho, 2005). In order to ascertain the content validity of the tools of data collection, experts in research methodology were sought. In addition, a pilot survey was conducted to help identify areas in the research instrument that might be ambiguous providing the intended responses (Katzenellenbogen & Joubert, 2007). Inadequacies identified during pilot survey were addressed to improve the quality of the research instrument and its validity.

3.8 Reliability of the instrument

Reliability of the research instrument in research study refers to an extent at which research instrument provides consistent data after repeated trials (Mugenda & Mugenda, 2003). If a research instrument is able to provide data or expected results consistently when used in repeatedly in the same population, it is considered reliable. In order to determine the reliability of the research instrument that was used, a pilot study was conducted. In order to enhance the reliability of the study, interviewers were trained on data collection skills. In addition, research subjects were encouraged to be honest when providing needed data and the confidentiality of the information given was assured to avoid desirability bias, which could have affected the reliability of the study findings (Katzenellenbogen & Joubert, 2007) The test -retest method was considered worth while for the confirmation of the reliability of the study instrument

which can be easily ascertained at the event of the participants giving similar answers in two consecutive times.

3.9 Data collection procedures

Study research assistants were recruited and undertaken through one day training and participated in the pretest of the research instruments. During the training accurate data recording and interviewing skills in respect to the questions in the structured questionnaire was covered. Randomly selected participants given their informed consent were interviewed using the structured questionnaire. During data collection, close supervision to the research assistants was done to ensure quality data was collected throughout the study.

3.10 Data Analysis techniques

After data collection exercise, data cross -checking was done to identify possible errors before data entry. Raw data was coded accordingly. This was followed by entering the coded data into MS-Excel spreadsheet and data cleaning done prior to data analysis. Statistical Package for Social Scientists (SPSS) computer package was used to analyze the data. Descriptive statistic such as percentages, mean, median and standard deviation were used to summarize entered data. Frequency tables, charts and graphs were used to present the data findings.

3.11 Ethical considerations

Before carrying out the study, permission was sought from the relevant authorities at Kyuso District. Randomly selected subjects of the study were given pertinent information in regard to the nature of the study. Their informed consent was obtained and participation in the study was voluntary. Actual identities of the study participants were kept anonymous throughout the study. Confidentiality of the data collected was assured to the study participants.

3.12 Operationalisation of the Variables in the Conceptual Framework

In any setting presence of government and private sector structures and processes significantly influences livelihood strategies of the community. They may empower the community to have dependable livelihoods through managing their livelihood assets effectively. Charcoal production and trade as a form of community livelihood depends on existing government laws and structures, which govern nature and scope of the charcoal activities. Private sector through providing new technologies on charcoal production and micro-finance among other aspects give a boost to the community to undertake this livelihood.

In the contexts where these processes and structure provide enabling environment and community feels supported, there will be positive influence associated with charcoal activity such as increased source of income, food security, reduced community vulnerability, and sustainable use of natural resources that does not lead to environmental degradation. In addition, government will get increased annual revenue from charcoal activities. However, where structures and processes are weak and non-supportive, most of community members will be tempted to engage themselves in unsustainable charcoal production, which lead to environmental degradation, more vulnerability to shock due to environmental assault and food insecurity.

The table below demonstrates the nature of influence that each independent variable has on the dependent variable

Table 3.1 Table of Operationalization of variables

Objective	**Indicator**	**Scales**	**Data Analysis**	**Data Collection**
i) Earnings from charcoal	Sustainable livelihoods	Nominal	Descriptive Qualitative	Questionnaire Secondary data analysis
ii)Technology used in charcoal production	Current best practices in production	Nominal	Descriptive Qualitative	Questionnaire Secondary data analysis
iii) Environmental impact attributed to charcoal production	Environmental conservation and reduced degradation	Nominal	Descriptive Qualitative	Questionnaire Secondary data analysis
iv) challenges in charcoal production	Hiccups in the charcoal supply chain	Nominal	Descriptive Qualitative	Questionnaire Secondary data analysis

CHAPTER FOUR: DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

The study was carried out in Mitamisyi Location, Kyuso District of Kitui County and it sought to find out the influence of charcoal trade on livelihood of rural communities: a case of Mitamisyi location in Kusyo District of Kitui County. Analysis employed descriptive statistics and inferential statistics whereby frequencies were obtained and expressed in percentage form and inferential statistics tabulated.

The study envisaged to find out how earnings from charcoal, technology, environment in charcoal production and the challenges in charcoal production influenced the improved income and access to better education of the charcoal producers in the location.

4.2 Response rate

The response which entailed the participation by the charcoal producers sampled in the study was as indicated in the following Table 4.1. A sample size of 150 was selected out of 1500 where the questionnaires were administered after pilot tests. Out of 150 questionnaires 140 were returned fully completed while 10 were not responded to. The response rate was 93% for completed questionnaires while 7% for not returned questionnaires.

Table 4.1: Charcoal producers' response rate

Response	Frequency	Percent
Number of questionnaires returned by respondents	140	93
Number of questionnaires not returned	10	7
Total	150	100

The response showed a very willing and effective participation from the sampled respondents. This can be attributed to a clear understanding of the instrument and willingness from the respondents

4.3 Charcoal producers' demographic data

Charcoal producers social demographic information was established by way of seeking to find out their genders, length of stay in business and their highest academic qualifications. It was tabulated as shown in the following tables.

Table 4.2 shows the charcoal producer's genders from the sampled respondents.

The study sought to find out the gender distribution among the charcoal producers.

97 of the respondents were male representing 69% of the total response while43 were female representing 31%.

Table 4.2 Charcoal producers' genders

97 out of the 140 respondents were male while 43 were female. This is represented by 69% and 31% respectively.

Gender	Frequency	Percent
Male	97	69
Female	43	31
Total	140	100

The descriptive statistics depicting the charcoal producers' genders were as shown in Table 4.3

Table 4.3 Charcoal producers' genders statistics

Respondents gender statistics		
N	Valid	140
	Missing	0
Mean		1.31
Median		1.00
Mode		1
Std. Deviation		.463

The response as shown in Table 4.2 and Table 4.2.1 shows a greater population of the male respondents serving as charcoal producers from the sampled population. This can be interpreted to mean that the charcoal producer's population has a higher male population than the female population. Majority of men are usually the bread winners in the households.

The academic qualifications charcoal producers were as indicated in Table 4.3

Table 4.4 Academic qualifications

Majority of the respondents 72 had acquired secondary education translating to 52% followed by 44 who had primary education at 31% then 22 had tertiary education at 16% and lastly 2 were graduate translating to 2%.

Academic qualification	Frequency	Percent
Primary	44	31
Secondary	72	52
Tertiary	22	16
Graduate	2	1
Total	140	100

The statistics for the academic qualifications of charcoal producers were as shown in Table 4.5

Table 4.5 Academic qualification charcoal producers statistics

Academic qualifications statistics		
N	Valid	140
	Missing	0
Mean		1.87
Median		2.00
Mode		2
Std. Deviation		.718

The response as shown in Table 4.4 and 4.5 shows that most of the sampled charcoal producers had secondary school levels of education. This depicts a good level of

exposure in terms of academic qualifications from the sampled respondents. A respondent with a secondary level education see more economic prospects in charcoal trade as compared to other respondents.

Table 4.6shows the charcoal producers' motivation to join the business

Table 4.6 Motivation to join charcoal selling business

Majority of the respondents 136 joined the charcoal selling business to make profits this translate to 97%, 3 joined because of need to while 1 respondent joined because of passion. This translates to 2% and 1% respectively.

Motivation	**Frequency**	**Percent**
Passion	1	1
Need to	3	2
Urge to make profits	136	97
Total	140	100

Table 4.7 shows the statistics for the charcoal producers' motivation to join the business

Table 4.7 Motivation to join charcoal selling business statistics

Statistics

Motivation to join charcoal selling business		
N	Valid	140
	Missing	0
Mean		3.96
Median		4.00
Mode		4
Std. Deviation		.291

Table 4.6 and table 4.7 depicted a situation whereby the need to make profits motivated most of the producers to join the business going by the response from the sampled respondents. Majority of the respondents join the charcoal trade to since there is anticipated good income which will lead to access to better education.

The responses on the respondents' length of being in the charcoal industry were as shown in Table 4.8.

Table 4.8 Length of being in the charcoal industry

Table 4.8 below summarizes the length of being in the charcoal industry whereby the respondents between the age of 1-5 years were 58 representing 41%, age 6-10 years were18 representing 13%, age 11-15 years were 46 translating to 46%.

Response	Frequency	Percent
1-5 years	58	41
6-10 years	18	13
11-15 years	64	46
Total	140	100

The statistics on response on the respondents' length of being in the charcoal industry were as shown in Table 4.9

Table 4.9 Length of being in the charcoal industry statistics

Descriptive Statistics			
	N	Mean	Std. Deviation
length of being in the charcoal industry	140	2.04	.936
Valid N (listwise)	140		

Table 4.5 and Table 4.5.1 reflect responses which showed that most of the charcoal producers had been in the business for a period of 11-15 years.

This can be interpreted to mean there is improved earning as once stays longer in the trade due to considerable experience and exposure gained by the charcoal producers.

Table 4.10 Responses on whether charcoal production is a part time or fulltime pursuit for the respondents

106 of the respondents are in charcoal production as part time. This is represented by 76%, while 34 of the respondents are on full time basis translating to 24%.

Response	Frequency	Percent
Part time	106	76
Full time	34	24
Total	140	100

Statistics on whether charcoal production is a part time or fulltime pursuit for the respondents were as captured in Table 4.11

Table 4.11 Statistics for responses on whether charcoal production is a part time or fulltime pursuit for the respondents

Descriptive Statistics			
	N	Mean	Std. Deviation
Whether charcoal production is fulltime or part time pursuit for the respondent	140	1.24	.430
Valid N (listwise)	140		

Table 4.10 and Table 4.11 show that most of the respondents were engaged in charcoal production on a part time basis. This can be interpreted to mean that most of the sampled respondents had other sources of income for their livelihoods and they

did not rely wholly on the charcoal trade for their daily sustenance. It means that access to better education is supplemented by other sources of income.

4.11 Responses on the fulltime occupation that the respondent is engaged in

Most of the respondents attested to having been involved in subsistence farming and commercial farming for their daily livelihoods as a source of their economic mainstay. Others were engaged in livestock keeping and commercial activities in retail and trading ventures. This depicts a situation whereby the community resident in the location had varied activities to engage in for their socio-economic upkeep as a means of earning a living. The responses on the number of bags of charcoal the respondents sell in one month were as captured in Table 4.7.

Table 4.12 Responses on the number of bags of charcoal the respondents sell in one month.

Table 4.12 summarizes on the number of bags of charcoal the respondents sell in one month as follows 73 of the respondents (52%) sell between 1-20 bags,58 of the respondents (42%) sell between 21-50 bags while 9 respondents (6%) sell between 51-100 bags.

Response	**Frequency**	**Percent**
1-20	73	52
21-50	58	42
51-100	9	6
Total	140	100

Statistics on the responses on the number of bags of charcoal the respondents sell in one month were as captured in Table 4.13

Table 4.13 Responses on the number of bags of charcoal the respondents sell in one month statistics

Descriptive Statistics			
	N	Mean	Std. Deviation
Number of bags of charcoal the respondent sells in one month	140	1.54	.616
Valid N (listwise)	140		

Table 4.12 and Table 4.13 indicate that most of the sampled respondents sold 1-20 bags of charcoal in a month.

This shows that many of the respondents were not large scale charcoal producers and it is a pointer to a situation whereby their conduct in the wake of carrying out the business activity may not be sustainable in the long run in terms of the economic returns derived from the activity. At the current market price of Kshs 300 per bag it shows that majority of the charcoal producers earn Kshs 6,000 per month which is inadequate to cater for social need and offer better access to education.

The responses on the approach used by the respondents to market their charcoal were as captured in Table 4.14

Table 4.14 Responses on the approach used by the respondents to market their charcoal.

Majority of the respondents 67 representing 48% market their charcoal through association, 20 respondents representing 14% market their charcoal through middlemen.53 of the respondents (38%) market their charcoal directly to the customers.

Response	Frequency	Percent
Through association	67	48
Middlemen	20	14
Directly to the customers	53	38
Total	140	100

Statistics on the responses on the approach used by the respondents to market their charcoal were as captured in Table 4.15

Table 4.15 Responses on the approach used by the respondents to market their charcoals statistics

Statistics		
How the respondents market their charcoal		
N	Valid	140
	Missing	0
Mean		1.90
Median		2.00
Mode		1
Std. Deviation		.924

Table 4.14 and Table 4.15 indicate that most of the sampled respondents used their association to market the charcoal. This shows that selling through association helps the producer to increase their incomes since they have better bargaining power. It also shows that many of the respondents equally sold directly to the customers and it was evident of reduced activity by the middlemen in the charcoal trade.

The responses on the approach used by the respondents to market their charcoal were cross-tabulated with the length of being in the charcoal industry and they were as shown in Table 4.16

Table 4.16 A cross tabulation on the approach used by the respondents to market their charcoal in relation to the length of being in the charcoal industry

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	69.792[a]	4	.000
Likelihood Ratio	91.523	4	.000
Linear-by-Linear Association	30.840	1	.000
N of Valid Cases	140		

a. 1 cells (11.1%) have expected count less than 5. The minimum expected count is 2.57.

Table 4.16 was a confirmation lack of a relationship between the length of stay in the charcoal industry and the marketing approach employed. Cross tabulation was done which gave a Chi-square value of χ^2 = 69.792 at a significance level of 0.000. The calculated statistic χ^2 = 69.792 was found to be less than the tabled critical value of χ^2 = 91.523. It can be interpreted that, statistically, there was no relationship between the respondents ways of marketing charcoal and the length of being in the charcoal

industry at $\alpha = 2.57$. This was a confirmation of the fact that regardless of the length of stay in the industry, the respondents had varied approaches of the mode of marketing employed. This shows that individual producers had no inclination on the mode of marketing dictated by their length of stay in the industry.

Table 4.17 shows the response of the charcoal producers stating their levels of agreement with attributes related to their earnings from charcoal.

Table 4.17 Respondents' earnings from charcoal in relation to length of being in the charcoal industry

		Length of being in the charcoal industry			
		1-5 years	6-10 years	11-15 years	Total
Earnings from charcoal are enough to sustain all my households daily needs	Strongly Disagree	0	0	9	9
	Disagree	58	0	35	93
	Agree	0	12	20	32
	Strongly Agree	0	6	0	6
Total		58	18	64	140
Earnings from charcoal are enough to meet all my health care needs	Disagree	53	11	39	103
	Undecided	0	0	2	2
	Agree	5	7	18	30
	Strongly Agree	0	0	5	5
Total		58	18	64	140
Earnings from charcoal guarantee my children of access to education	Strongly Disagree	5	0	2	7
	Disagree	53	0	42	95
	Agree	0	18	20	38
Total		58	18	64	140
Earnings from charcoal assure me of my future development needs	Strongly Disagree	45	0	20	65
	Disagree	13	0	26	39
	Undecided	0	0	18	18
	Agree	0	18	0	18
Total		58	18	64	140
Earnings from charcoal are not enough to meet my personal obligations	Agree	15	18	44	77
	Strongly Agree	43	0	20	63
Total		58	18	64	140

Table 4.17 shows that the respondents confirmed that earnings from charcoal were not enough to guarantee them access better education and related households daily needs. This was by way of most of them disagreeing to the fact that charcoal business would sustain their household's needs. The earnings from charcoal equally came out as not enough to meet healthcare needs. This was by way of most of the respondents

disagreeing to the fact that charcoal business had the capacity to sustain their healthcare requirements.

The respondents equally deemed the charcoal business as not having capacity to guarantee their children of access to education. This showed that the respondents had always to look out elsewhere for funds to pay their school fees even despite being in the charcoal business. The respondents were of the view that the earnings from the charcoal industry could not guarantee the assurance in meeting their developmental needs. This showed that they had to rely from other sources for their growth requirements. The responses mirrored a situation whereby the industry would not be viewed as having an assurance of allowing the individuals partaking in the charcoal business to have a fully assured and guaranteed sustenance with regard for their daily household needs, healthcare, education, future development and personal obligations. This shows that the individuals engaged in the business certainly had to look elsewhere to bridge their budgetary deficits.

The responses on whether the respondents' membership to a charcoal producer association helped influence the determination of the prices were as shown in Table 4.18

Table 4.18 Responses on whether the respondents' membership to a charcoal producer association helped influence the determination of the prices.

Majority of the respondents 77 translating to 55% agreed to a great extent that membership to a charcoal producer association helped influence the determination of the prices.43 of the respondents (31%) agreed membership help to a fair extent to influence the determination of the prices.20 of the respondents (14%) agreed membership to association does not at all influences the determination of the prices.

Response	Frequency	Percent
To a great extent	77	55
To a fair extent	43	31
Not at all	20	14
Total	140	100

The statistics on whether the respondents' membership to a charcoal producer association helped influence the determination of the prices were as shown in Table 4.19

Table 4.19 Statistics on the responses on whether the respondents' membership to a charcoal producer association helped influence the determination of the prices

Statistics		
Extent to how membership to a charcoal seller association helped influence the determination of prices		
N	Valid	140
	Missing	0
Mean		2.41
Median		3.00
Mode		3
Std. Deviation		.729

Table 4.18 and Table 4.19 was reflective of most of the respondents affirming that membership to charcoal producer association had helped the determination of prices. This can be interpreted to mean that the associations had greatly helped their members to have the bargaining power as regards the determination of prices. This showed that

the economies of scale in terms of a bigger marketing block in the name of the association played a major role in the determination of charcoal prices. A better price means improved income and thus more opportunities for better access to education.

4.4 Technology and environmental impact in charcoal production

The study sought to find out respondents consideration of the sustainability of the charcoal business with regard to the technology and environmental impact as a result of charcoal production.

The responses on the respondents' consideration of the charcoal production business being sustainable were as shown in Table 4.20

Table 4.20 Responses on the respondents' consideration of the charcoal production business as being sustainable.

From the data below 30 respondents (21%) very much agreed of the charcoal production business as being sustainable.50 of the respondents (36%) fairly agreed while 60 of the respondents (43%) does not agreed a tall of the charcoal business being sustainable.

Response	**Frequency**	**Percent**
Very much	30	21
Fairly	50	36
Not at all	60	43
Total	140	100

The statistics on the respondents' consideration of the charcoal production business being sustainable were as shown in Table 4.21

Table 4.21 Statistics on the respondents' consideration of the charcoal production business being sustainable

Statistics		
Consideration of the charcoal production business engaged in by the respondent as sustainable		
N	Valid	140
	Missing	0
Mean		1.79
Median		2.00
Mode		1
Std. Deviation		.775

Table 4.20 and Table 4.21 were reflective of most of the respondents viewing the charcoal production business as unsustainable. This points a bleak future to the industry as regards the respondent's outlook of its capacity to guarantee them sustained income and access to better education.

The responses on the availability of trees for harvesting to produce charcoal being hindrance to the respondents' business were as shown in Table 4.22

Table 4.22 Responses on the availability of trees for harvesting to produce charcoal being hindrance to the respondents' business.

Majority of the respondents 102 representing 73% agreed to a great extent that the availability of trees for harvesting to produce charcoal being a hindrance to their business.38 of the respondents (27%) agreed this will have a fair extent.

Response	Frequency	Percent
To a great extent	102	73
To a fair extent	38	27
Total	140	100

The statistics on the availability of trees for harvesting to produce charcoal being hindrance to the respondents' business were as shown in Table 4.23

Table 4.23 Statistics on responses on the availability of trees for harvesting to produce charcoal being hindrance to the respondents' business statistics

Availability of trees for harvesting to produce charcoal has been hindrance to respondents business		
N	Valid	140
	Missing	0
Mean		2.27
Median		2.00
Mode		2
Std. Deviation		.446

Table 4.22 and Table 4.23 reflect situations whereby all of the respondents viewed the availability of trees as a hindrance to the charcoal production business. This was a pointer to a situation whereby the availability of trees was a common challenge to all the charcoal producers sampled. This is a pointer that income for the charcoal producers will diminish with time as their raw materials are consumed. There is an urgent need to restore their tree resources.

The responses on whether the respondents' group has put in place re-a forestation measures to safeguard the future of their businesses were as shown in Table 4.24

Table 4.24 Re-afforestation measures put in place to safeguard the future of the charcoal producer business with the length of being in the charcoal industry.

From the data below 86 of the respondents (61%) agreed that re-afforestation measures are put in place to safeguard the future of the charcoal producer business with the length of being in the industry, while 54 of the respondents (39%) disagree.

Response	**Frequency**	**Percent**
Yes	86	61
No	54	39
Total	140	100

The above results show that the respondents have realized the danger of their diminishing tree resources. To safe guard their future source of income they have put afforestation measures in place.

Table 4.25 shows a cross tabulation on the Re-afforestation measures put in place to safeguard the future of the charcoal producer business with the length of being in the charcoal industry

Table 4.25 A cross tabulation on the Re-afforestation measures put in place to safeguard the future of the charcoal producer business with the length of being in the charcoal industry

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	44.420[a]	2	.000
Likelihood Ratio	52.444	2	.000
Linear-by-Linear Association	10.766	1	.001
N of Valid Cases	140		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.94.

Table 4.15 and Table 4.16 was a confirmation of most of the charcoal producers having had engaged in reafforestation activities. Cross tabulation was done which gave a Chi-square value of $\chi^2 = 44.420$ at a significance level of 0.000. The calculated statistic $\chi^2 = 44.420$ was found to be less than the tabled critical value of $\chi^2 = 52.444$. It can be interpreted that, statistically, there was no relationship between the length of stay in the industry and the carrying out of re-afforestation activities at $\alpha = 6.94$. This was a confirmation of the length of stay in the industry not being a critical factor in the carrying out of afforestation programmes.

4.4.1: Responses on the availability of special trees for charcoal production

The respondents confirmed the availability of special trees that they and members of the associations used and considered for charcoal production. They argued that the indigenous trees like the acacia had the best quality charcoal but was not sustainable with regard to guaranteeing the members of continuous production owing to the length of time it takes for the tree to mature.

Presence of exotic trees which are fast matures came out as a factor which greatly helped the local charcoal producer associations to have sustainable production. This was motivated by the short period of having the trees growing and maturing. It helped the members have more assured and sustainable production activities.

Table 4.26 Technology employed in charcoal production in relation to their academic qualification

		Academic qualifications				
		Primary	**Secondary**	**Tertiary**	**Graduate**	**Total**
Fast maturing trees are readily available to sustain the charcoal production industry	Strongly Disagree	17	0	0	0	17
	Disagree	27	25	3	1	56
	Agree	0	47	19	1	67
Total		44	72	22	2	140
I have access to the most reliable implements and tools to cut down trees	Disagree	44	31	22	0	97
	Agree	0	14	0	0	14
	Strongly Agree	0	27	0	2	29
Total		44	72	22	2	140
I practice the best possible carbonization technology in my charcoal production business	Strongly Disagree	0	27	0	0	27
	Disagree	44	24	22	1	91
	Undecided	0	10	0	0	10
	Agree	0	11	0	1	12
Total		44	72	22	2	140
My charcoal production association has access to reliable transport to ferry charcoal to the market	Strongly Disagree	0	0	13	0	13
	Disagree	40	30	0	2	72
	Undecided	4	2	0	0	6
	Agree	0	40	9	0	49
Total		44	72	22	2	140
Access to charcoal movement permits has been facilitated by the membership to charcoal production association	Strongly Disagree	8	39	0	1	48
	Disagree	36	0	0	0	36
	Agree	0	33	22	1	56
Total		**44**	**72**	**22**	**2**	**140**

Table 4.26 shows that the respondents confirmed that availability of fast maturing trees for sustainable charcoal production was not very assured. This showed that despite the afforestation measures in place their effects had not been felt on the ground as regards the supply of the raw materials for charcoal production. Access to the most reliable implements and tools and implements to cut down trees was not equally very assured. This was confirmed by way of most of the respondents

disagreeing to it and at the same time the practice of the current best practices with regard to carbonization technology by the charcoal producers was not assured. This showed that most of the respondents were certainly engaged in the archaic modes of production which affects the quality and quantity of charcoal produced which also has a bearing on the income.

Assurance with regard to reliable means of transport to ferry charcoal to the market was equally not confirmed. This was a confirmation of transport being a hindrance in the industry despite the members belonging to an association. The facilitation of charcoal movement permits was equally a hindrance to the growth of the industry which affects charcoal producer's incomes.

The membership to the association thus came out as not having the capacity to assure the producers sustainability in their industry as regards the access to fast maturing trees, implements to cut down trees and the current best practices as regards the carbonization technology. Access to the best mode of transport and charcoal movement permits was equally curtailed. This was a pointer to the need of the associations working harder to assure their memberships of sustainable incomes.

Table 4.18 responses on whether membership to the charcoal production association had aided adoption of the current best practices in the industry.

Table 4.27 Responses on whether membership to the charcoal production association had aided adoption of the current best practices in the industry.

Minority of the respondents 47 representing 34% agreed that membership to the charcoal production association had aided adoption of the current best practices in the industry. Majority of the respondents 93 which represent 66% disagree with the

above.

Response	Frequency	Percent
Yes	47	34
No	93	66
Total	140	100

Table 4.28 shows statistics on the responses on whether membership to the charcoal production association had aided adoption of the current best practices in the industry

Table 4.28 Statistics on the responses on whether membership to the charcoal production association had aided adoption of the current best practices in the industry

Statistics		
Membership to the charcoal production association has aided the respondent adopt the current best practices as pertains the charcoal industry		
N	Valid	140
	Missing	0
Mean		1.34
Median		1.00
Mode		1
Std. Deviation		.474

Table 4.27 and Table 4.28 was a confirmation of most of the members of charcoal producer associations not having had the capacity to adopt the current best practices despite their membership. This can be interpreted to mean that the associations need to scale up their efforts in terms of capacity building to aid their members adopt the current best practices which would improve on their income and better access to education.

4.5 Challenges in charcoal production

The study sought to find out the challenges that the charcoal producers encountered in the wake of carrying out business activities.

Table 4.29 shows the responses by the charcoal producers on the requirements for joining the charcoal producer association in their area

Table 4.29 Responses by the charcoal producers on the requirements for joining the charcoal producer association

84 of the respondents which translate to 60% agreed that the requirements for joining the charcoal producer association were to undertake charcoal production. The rest of the respondents 56(40%) agreed that interest in the charcoal value chain were a requirement for joining the charcoal producer association.

Response	Frequency	Percent
Undertaking charcoal production	84	60
Interest in the charcoal value chain	56	40
Total	140	100

Table 4.30 shows the statistics for the responses by the charcoal producers on the requirements for joining the charcoal producer association in their area

Table 4.30 Responses by the charcoal producers on the requirements for joining the charcoal producer association statistics

Statistics		
Requirements for joining the charcoal producer association in respondents area		
N	Valid	140
	Missing	0
Mean		1.40
Median		1.00
Mode		1
Std. Deviation		.492

The response as shown in Table 4.29 and Table 4.30 was an indicator of most of the respondents attesting to the fact that membership to the charcoal producer association was hinged on the ability of the individual to participate in the actual charcoal production to enable them increase their profits due to good bargaining power. Joining the association is also a statutory requirement as per the Forest ACT 2005.

4.5.1: Responses on the statutory requirements to the charcoal producer members associations were supposed to fulfill

The respondents alluded to the charcoal producer associations being required to fulfill the statutory requirements as regards their registration. This entailed having a bonafide leadership committee in place duly elected by the members and having a registration acquired from the registrar of societies as regards the membership and conduct of activities by the group. Other regulations like having an account in a registered financial institution were equally requisite to assure and confer formality to the groups.

4.5.2 Response on the factors that limit the charcoal producers from selling directly to their destination markets

The respondents had varying reasons which limited them from selling to their destination markets. The reasons included high competition from the other players in

the industry, stringent statutory requirements as regards the charcoal movement permits and the quality of charcoal produced**.** The factors came out as having had the effect of highly limiting the producers from accessing their destination markets.

Responses on whether engagement with charcoal producer association has aided better marketing of products were as shown in Table 4.31

Table 4.31 Responses on whether engagement with charcoal producer association has aided better marketing of products

The table 4.31 below shows that 94 of the respondents which represent 64% agreed to a great extent that engagement with charcoal producer association has aided better marketing of products.38 of the respondents (27%) agreed to a fair extent while 8 of the respondents (6%) did not agreed at all.

Response	**Frequency**	**Percent**
To a great extent	94	67
To a fair extent	38	27
Not at all	8	6
Total	140	100

Table 4.32 shows the responses on whether engagement with charcoal producer association has aided better marketing of products statistics

Table 4.32 Statistics for the Responses on whether engagement with charcoal producer association has aided better marketing of products

Descriptive Statistics			
	N	Mean	Std. Deviation
Engagement with the charcoal producer association has aided the respondent better market his products	140	2.21	.534
Valid N (listwise)	140		

The response as shown in Table 4.31 and Table 4.32 was an indicator of most of the respondents affirming that engagement with the charcoal producer association had helped the members have the capacity to better market their products. This can be interpreted to mean that the membership to the charcoal producer associations had greatly helped grow the fortunes of the membership as regards to the marketing of the products. This was a confirmation of the capacity of the associations to profit the membership directly in the marketing function and supported them in getting better income.

The study sought to find out the charcoal producers levels of agreement with attributes regarding challenges faced by charcoal producers in relation to their academic qualifications. Their responses were as captured in Table 4.33

Table 4.33 The charcoal producers' levels of agreement with attributes regarding challenges faced by charcoal producers in relation to their academic qualifications

		Academic Qualifications				Total
		Primary	**Secondary**	**Tertiary**	**Graduate**	
Statutory regulations in the charcoal industry are a hindrance to the growth of the industry	Strongly Disagree	1	3	0	0	4
	Disagree	0	5	17	0	22
	Agree	43	50	5	1	99
	Strongly Agree	0	14	0	1	15
Total		44	72	22	2	140
Transport of the charcoal to the markets is a challenge owing to harassment by traffic police	Agree	33	41	22	1	97
	Strongly Agree	11	31	0	1	43
Total		44	72	22	2	140
Acquisition of forestry permits is a challenge owing to the stringent requirements	Disagree	0	6	0	0	6
	Undecided	0	20	0	1	21
	Agree	7	46	22	1	76
	Strongly Agree	37	0	0	0	37
Total		44	72	22	2	140
Pricing of the charcoal is a challenge owing to the high cost of production	Agree	25	72	19	2	118
	Strongly Agree	19	0	3	0	22
Total		44	72	22	2	140
Levies charged by the county government authorities are high thus eroding the profit margins	Agree	2	51	12	2	67
	Strongly Agree	42	21	10	0	73
Total		**44**	**72**	**22**	**2**	**140**

Table 4.33 shows that the respondents who have the opinion that the statutory regulations in the charcoal industry were a hindrance to the growth of the sector. They equally agreed that transport of charcoal to the markets was a challenge owing to the harassment by the traffic police. Acquisition of forestry permits was equally a challenge attributed to the stringent requirements required by the forestry department. The high cost of production equally came out as a challenge to the charcoal producers and it really affected the pricing regime.

The levies charged by the county government were confirmed as high and had the capacity to heavily erode the profit margins of the charcoal producer's thus minimal returns from their production.

Table 4.34shows the responses on whether membership to charcoal producer association had helped overcome the challenges in the industry

Table 4.34 Responses on whether membership to charcoal producer association had helped overcome the challenges in the industry

42 of the respondents representing 30%agreed that membership to charcoal producer association had helped them to overcome the challenges in the industry.98 of the respondents (70%) disagree that membership to charcoal producer association had helped them to overcome the challenges in the industry.

Response	**Frequency**	**Percent**
Yes	42	30
No	98	70
Total	140	100

Table 4.35 shows the responses on whether membership to charcoal producer association had helped overcome the challenges in the industry statistics

Table 4.35 Statistics for the responses on whether membership to charcoal producer association had helped overcome the challenges in the industry

Statistics		
Membership to the charcoal producers association has helped the respondent overcome the challenges in the industry		
N	Valid	140
	Missing	0
Mean		1.30
Median		1.00
Mode		1
Std. Deviation		.460

The response as shown in Table 4.34 and Table 4.35 shows that most of the respondents did not view their membership in the charcoal producer associations as having had helped them overcome the challenges in the industry. This shows that there is need for intensified capacity building of the charcoal producer association to help them meet the concerns of their members in terms of mitigating their needs.

Responses on the impact of charcoal producers' participation in the industry on their livelihoods were as shown in Table 4.36

Table 4.36 Responses on the impact of charcoal producers' participation in the industry on their livelihoods

The study showed that 68 of the respondents representing 49% agreed the impact of charcoal producer participation in the industry on their livelihoods was very much while 72of the respondents (51%) agreed the impact were fairly.

Response	Frequency	Percent
Very much	68	49
Fairly	72	51
Total	140	100

Table 4.37 shows the responses on the impact of charcoal producers' participation in the industry on their livelihoods statistics

Table 4.37 Statistics for the impact of charcoal producers' participation in the industry on their livelihoods

Statistics		
Participation in the charcoal industry has impacted on the respondent livelihood in terms of economic growth		
N	Valid	140
	Missing	0
Mean		2.49
Median		2.00
Mode		2
Std. Deviation		.502

The response as shown in Table 4.36 and Table 4.37 was an indicator of the respondents affirming that their participation in the charcoal producers associations had impacted positively on their livelihoods. This was a confirmation of the capacity of the charcoal producers associations to change the tide in terms of the fortunes of their members positively. It also confirms the capacity of the associations to exploit their economies of scale to shore up their members' livelihoods.

4.5.3. Response on how the charcoal industry can be better modeled to assure the producers of improved earnings

The respondents had varying suggestions on how the charcoal industry can be modeled to assure sustained growth and have the practitioners get better earnings from the industry. The respondents suggested that greater efforts should be made to have a forestation programmes in place to guarantee the industry of sustained growth taking into account that the core raw material for the industry is the trees felled for charcoal. The respondents equally proposed that efforts should be made to infuse the latest technology in terms of best practices to the membership of the industry. This will assure the players of capacity in terms of efficiency and the quality of the charcoal produced. Proposals were equally made to streamline the statutory obligations governing the conduct of the industry should be made. This is by way of having provisions guiding and governing the industry aligned to the reality on the ground and made industry friendly with regard to having capacity to attract and retain more players in the industry as opposed to putting possible entrants off.

4.6 Summary of Data Analysis

4.6.1 Earnings from Charcoal

The response shows that most of the respondents were engaged in charcoal production on a part time basis. This can be interpreted to mean that most of the sampled respondents had other sources of income for their livelihoods and they did not rely wholly on the charcoal industry for their daily sustenance.

Most of the respondents attested to having been involved in subsistence farming and commercial farming for their daily livelihoods as a source of their economic mainstay. Others were engaged in livestock keeping and commercial activities in retail and trading ventures. This depicts a situation whereby the community resident

in the location had varied activities to engage in for their socio-economic upkeep as a means of earning a living and getting access to better education.

The responses indicate that most of the sampled respondents sold 1-20 bags of charcoal in a month. This shows that many of the respondents were not large scale charcoal producers and it is a pointer to a situation whereby their conduct in the wake of carrying out the business activity may not be sustainable in the long run in terms of the economic returns derived from the activity. The income obtained is insufficient to cater for better access to education and their daily needs.

The response was reflective of most of the respondents having had a change in their earnings after joining the charcoal producer associations. This can be interpreted to mean that the membership to charcoal producer association helped the members to increase their earning due to increased bargaining power.

The responses were reflective of most of the respondents viewing the charcoal production business as unsustainable. This points a bleak future to the industry as regards the respondent's outlook of its capacity to guarantee them longevity in the business.

4.6.2 Technology and Environmental impact in Charcoal Production

The response reflects situations whereby all of the respondents viewed the availability of trees as a hindrance to the charcoal production business. This was a pointer to a situation whereby the availability of trees was a common challenge to all the charcoal producers sampled. This casts a dark cloud with regard to the capacity of the sustainability of their income.

The respondents confirmed the availability of special trees that they and members of the associations used and considered for charcoal production. They argued that the

indigenous trees like the acacia had the best quality charcoal but were not sustainable with regard to guaranteeing the members of continuous production owing to the length of having the tree grow to maturity.

Presence of exotic trees which are fast maturers came out as a factor which greatly helped the local charcoal producer associations to have sustainable production. This was motivated by the short period of having the trees growing and maturing. It helped the members have more assured and sustainable production activities.

The responses were a confirmation of most of the members of charcoal producer associations not having had the capacity to adopt the current best practices despite their membership. This can be interpreted to mean that the associations need to scale up their efforts in terms of capacity building to aid their members adopt the current best practices.

The response was an indicator that most of the respondents attesting to the fact that membership to the charcoal producer association was hinged on the ability of the individual to participate in the actual charcoal production and also as a statutory requirement. This was a confirmation of the associations being legitimate and fronting the interests of the industry.

4.6.3 Challenges in Charcoal Production

The respondents alluded to the charcoal producer associations being required to fulfill the statutory requirements as regards their registration. This entailed having a bonafide leadership committee in place duly elected by the members and having a registration acquired from the registrar of societies as regards the membership and conduct of activities by the group. Other regulations like having an account in a registered financial institution were equally requisite to assure and confer formality to

the groups. The respondents had varying reasons which limited them from selling to their destination markets. The reasons included high competition from the other players in the industry, stringent statutory requirements as regards the charcoal movement permits and the quality of charcoal produced**.** The factors came out as having had the effect of highly limiting the producers from accessing their destination markets.

The response was an indicator that most of the respondents engagement with the charcoal producer association had helped the members have the capacity to better market their products. This can be interpreted to mean that the membership to the charcoal producer associations had greatly helped grow the fortunes of the membership as regards the marketing of the products. This was a confirmation of the capacity of the associations to profit the membership directly in the marketing function.

CHAPTER FIVE: SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The following chapter gives a summary of the findings, discussions, conclusions and the recommendations proposed by the study. It also suggests areas for further research.

The study was carried out in Mitamisyi Location, Kyuso District, Kitui County and it sought to find out the influence of charcoal trade on livelihood of rural communities: a case of Mitamisyi location in Kusyo District of Kitui County

The study envisaged to find out how earnings from charcoal, technology, environmental impact and the challenges in charcoal production affected the livelihoods of the charcoal producers in the location

5.2 Summary of the study findings

The following is the summary of findings

5.2.1 Earnings from charcoal

The study found out that most of the charcoal producers were engaged in the enterprise on a part time basis. The study equally found out that most of the charcoal producers sold between 21-50 bags of charcoal on monthly basis and they marketed the charcoal through their association. They were of the opinion that the charcoal earnings were not enough to sustain their households' daily needs, access to education, future developments and personal obligations. Most of the respondents were of the opinion that the associations helped improve their net earnings and influenced the determination of prices.

5.2.2 Technology and environment in charcoal production

The study found out that most of the respondents did not consider the charcoal industry as sustainable and hence their source of sustained income was venerable. The availability of trees for harvesting to produce charcoal was considered as a hindrance by many of the respondents. Most of the respondents had put in place reafforestation measures to ensure the sustainability of the industry. They considered the fast maturing trees as an opportunity to guarantee them sustenance and growth in the industry hence economic empowerment. They deemed the implements and tools to cut down trees as inadequate and they considered the carbonization technology in the charcoal production business as inferior. The transport mode used by the association was equally considered as unreliable and access to the charcoal movement permits was a challenge to the charcoal producers.

5.2.3 Challenges in charcoal production

The respondents affirmed that the requirements for joining the charcoal producer association were the actual undertaking in charcoal production and as a statutory requirement The respondents were of the opinion that selling directly to the destination market was a challenge to the charcoal producers. They attributed this to stiff competition and the stringent regulations in the transportation of charcoal to the target markets. The respondents confirmed that their engagement to the charcoal producer association had aided them to better market their products. They were of the opinion that the statutory regulations, transport, acquisition of forestry permits, pricing regime and the levies charged by the county government were a challenge to the charcoal industry.

5.3 Discussions

The study confirms what had been deducted by Mugo, Ngugi, Wanjiru & Kamau, 2011 who showed that charcoal business supported about 2.5 million dependents by 2005. Those who are engaged in charcoal activities such as producers, transporters or traders often operates in small scale and do not get maximum benefit from the trade (Mugo & Ong, 2006).

The earnings by the producers was inadequate due to the small scale production being undertaken and the many challenges being experienced since the system of the charcoal industry is not well organize. Mutimba (2005) found that despite the huge entrepreneurial potential, small scale charcoal producers in Tanzania and Kenya do not produce charcoal as some sort of business, but simply do it for survival. Likewise, Mugo and Poulstrup (2003) suggested that the lack of alternative forms of livelihood has forced many charcoal burners in Kenya to take up the trade on a subsistence basis. The World Bank (2009) found that charcoal producers, small-scale transporters, and retailers (who far outnumber more powerful wholesalers and transporters) receive a very small share of the final market price.

The study showed that the technology used is the traditional kilns. This method takes about seven days or more for the charcoal to be ready (Mugo & Ong, 2006). This technology is very inefficient and has contributed to a lot of loss in revenue. This identifies with the position taken by (AFREA, 2011) which said that producers and traders are normally unable to invest in using improved conversion technology. This is an issue that must be addressed if the charcoal producers will improve their incomes.

The study clearly showed there are many challenges experienced by the producers. However, the Kenya Government has put in place various policy documents that recognize charcoal as source of biomass energy. These policies address issues that revolve around charcoal production, transportation, trade and consumption. One of these policy documents is 'the Sessional Paper No.4 of 2004 on Energy Policy'. This policy advocates and promotes growing of trees, which are fast maturing. This will always ensure that the access to raw materials for charcoal production is sustainable. Others like the charcoal rules and regulation gazette notice No. 186 outlines the procedures that need to be followed. But many producers are not aware and have not been fully sensitized. This confusion affects the charcoal industry and hence there is a major loss of income for the charcoal producers.

5.4 Conclusions of the study

The study concluded that the earnings from charcoal were deemed as inadequate by most of the respondents. The volumes of charcoal sold by the producers was not much and could not wholly guarantee the players in the industry a sustainable source of income and access to better education. The aspect of having most of the players engaged in the enterprise on a part time basis shows that the incomes from the charcoal trade is insufficient to maintain house hold needs for the charcoal producers.

The study can equally conclude that the technology applied in the industry was not sound enough to guarantee the players of sustainability and prospects in terms of future income generation. This came out clearly in terms of the carbonization capacity which was low and inefficient while using the traditional charcoal kilns. This identifies with the position taken by (AFREA, 2011) which said that producers and traders are unable to invest in using improved conversion technology, create their own

woodlots and undermining long-term sustainable forest management, creating the need for enhanced regulation of the charcoal production sector. For this reason, improving charcoal regulatory frameworks is crucial if legally and sustainably produced charcoal has to compete with unregulated and unsustainable produced charcoal in the market

The study equally formed the conclusion that the challenges in the charcoal production industry were enormous and they held a major sway with regard to holding down the growth and prospects of the industry. The challenges entailed aspects of production, statutory and pricing regimes. In Kenya, there are policy documents that recognize charcoal as source of biomass energy. These policies address issues that revolve around charcoal production, transportation, trade and consumption. One of these policy documents is 'the Sessional Paper No.4 of 2004 on Energy Policy'. This policy advocates and promotes growing of trees, which are fast maturing. This will always ensure that the access to raw materials for charcoal production is sustainable.

5.5 Recommendations of the study

The study made the following recommendations:-

I. The charcoal producers should always exploit the coming together in their associations to guarantee them of access to the power to exploit the economies of scale in terms of increasing their bargaining power and enabling them to have a greater say as regards the pricing of their commodities.

II. The government should equally put in place regulations governing the charcoal industry as regards the pricing regime to guarantee the producer of market rates which warrant their efforts.

This will ensure that the players in the sector get good earnings from their activities and it will guarantee the industry of sustained growth in a regulated manner.

III. The charcoal producers should exploit the current best practices as regards the technology employed in the production activity. This will ensure that they have access to modes of production which guarantee them of the best quality charcoal and minimal wastage in the production activity hence increases their income.

IV. The re-afforestation programmes should always be emphasized on by the forestry department to see to it that the production activity is not inhibited by lack of trees to ensure sustained production.

V. The government and the county governance structures should ensure that the statutory regulations governing the charcoal industry are adhered to in the best manner possible and they should also make the regulations industry friendly.

5.6 Suggestion for further studies

I. The study suggests that a similar study with a bigger scope like a district wide survey should be carried out to find out if the circumstances in Mitamisyi Location are similar to other parts of district.

II. The study further recommends that a study on the influence of the charcoal industry on the afforestation programmes should be carried out. This is with a view of finding out if the charcoal industry is carrying out its activities in a sustainable manner enough to guarantee the environment and forestry programmes of sustainability in terms of having the requisite forest cover maintained.

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APPENDICES

APPENDIX 1

INTRODUCTION LETTER

From: John M. Njoroge

C/o University of Nairobi,

School of Continuing and Distance Education,

Department of Extra-Mural Studies

Dear Respondent,

RE: REQUEST TO FILL QUESTIONNAIRE

I am a University of Nairobi student undertaking a Masters of Arts degree in Project Planning and Management. As part of the requirements for the course. I am carrying out a study on the influence of charcoal trade on livelihoods of rural communities in Mitamisyi location in Kyuso District of Kitui County, a study which I believe will go a long way in improving the livelihoods of rural communities.

The reason why I chose Mitamisyi location is because the area has Charcoal Producer Associations and a large quantity of charcoal comes from this location.

I am interested in your opinions and suggestions. Although I understand that your schedule is busy, I am hoping that you will take the little time required to respond to the questions contained in the questionnaire. I want you to know that your responses will be of great value to the completion of this study.

Please note that all the information provided will be treated with a lot of confidentiality and will only be used for the purposes of this study.

Yours sincerely,

John M. Njoroge

APPENDIX II

QUESTIONNAIRE FOR CHARCOAL PRODUCERS

The purpose of this questionnaire is to gather information on your views as regards on the influence of charcoal trade on the livelihoods of rural communities. Your response will be highly appreciated. Please do not indicate the name of the school.

Instructions

Please respond to the questions as accurately and as honest as possible and tick (√) one response as appropriate or fill the space provided.

Section A: Demographic information

1. Kindly indicate your gender

   Male ☐

   Female ☐

2. What are your highest academic qualifications

   Primary ☐

   Secondary ☐

   Tertiary ☐

   Graduate ☐

   Post-graduate ☐

3. What motivated you to join the charcoal selling business?

   Passion ☐

   Lack of choice ☐

   Need to satisfy society needs ☐

   urge to make profits ☐

4. How long have you been in the charcoal industry?

   Less than 1 yrs ☐

   1 – 5 years ☐

   6 – 10 years ☐

   11 – 15 years ☐

   Any other _____

5. How do you intend to stay in the charcoal industry?

   Not more than five years ☐

   Not more than ten years ☐

   Not more than twenty years ☐

Earnings from charcoal

6. Is charcoal production a part time or full time pursuit for you?

   Part time ☐

   Full time ☐

7. Kindly indicate the fulltime occupation that you are engaged in if you are in charcoal production on a part time basis.

   _____

   _____

8. On average how many bags of charcoal do you sell in one month?

   1 - 20 ☐

   21 - 50 ☐

   51 – 100 ☐

   Any other _____

9. How do you market your charcoal?

   Through association ☐

   Middlemen ☐

   Directly to the customers ☐

   Any other _____

10. Kindly indicate the following attributes as regards your earnings from charcoal where

Strongly Agree = SA, Agree = A, Undecided = U, Disagree = D and Strongly Disagree = SDA

	SA	A	U	DA	SDA
Earnings from charcoal are enough to sustain all my households daily needs	5	4	3	2	1
Earnings from charcoal are enough to meet al my health care needs	5	4	3	2	1
Earnings from charcoal guarantee my children of access of education	5	4	3	2	1
Earnings from charcoal assure me of my future development needs	5	4	3	2	1
Earnings from charcoal are not enough to meet my personal obligations	5	4	3	2	1

11. Has the membership to a charcoal sellers association helped improve your net earnings

    Yes ☐

    No ☐

12. Has the membership to a charcoal sellers association helped influence the determination of the prices?

    To a great extent ☐

    To a fair extent ☐

    Not at all ☐

Technology and environment in charcoal production

13. Would you consider the charcoal production business that you engage in as sustainable?

    Very much ☐

    Fairly ☐

    Not at all ☐

14. Has the availability of trees of harvesting to produce charcoal been hindrance to your business?

    To a great extent ☐

    To a fair extent ☐

    Not at all ☐

15. Has your group put in place re-afforestation measures to safeguard the future of your business?

    Yes ☐

    No ☐

16. Are there some special trees that you and members of your association consider and use for charcoal production? Kindly indicate which ones

    _____

    _____

17. Kindly indicate your level of agreement with the following attributes as regards the technology employed in charcoal production

Strongly Agree = SA, Agree = A, Undecided = U, Disagree = D and Strongly Disagree = SDA

	SA	A	U	DA	SDA
Fast maturing trees are readily available to sustain the charcoal production industry	5	4	3	2	1
I have access to the most reliable implements and tools to cut down trees	5	4	3	2	1
I practice the best possible carbonization technology in my charcoal production business	5	4	3	2	1
My charcoal production association has access to reliable transport to ferry charcoal to the market	5	4	3	2	1
Access to charcoal movement permits has been facilitated by the membership to charcoal production association	5	4	3	2	1

18. Has membership to the charcoal production association aided you adopt the current best practices as pertains the charcoal industry

    Yes ☐

    No ☐

Challenges in charcoal production

19. What are the requirements for joining the charcoal producer association in your area?

    Undertaking charcoal production ☐

    Interest in the charcoal value chain ☐

    previous experience in the charcoal industry ☐

    any other_____

20. What statutory requirements are the members of the charcoal producer association supposed to fulfill?

    _____

    _____

21. Are you able to sell directly to your destination markets?

    Yes ☐

    No ☐

22. What factors limit you from selling directly to your destination market?

    _____

    _____

23. Have your engagement with the charcoal producer association aided you to better market your products?

    To a great extent ☐

    To a fair extent ☐

    Not at all ☐

24. Kindly confirm the following attributes a regards the challenges faced by charcoal producers

Strongly Agree = SA, Agree = A, Undecided = U, Disagree = D and Strongly Disagree = SDA

	SA	**A**	**U**	**DA**	**SDA**
Statutory regulations in the charcoal industry are a hindrance to the growth of the industry	5	4	3	2	1
Transport of the charcoal to the markets is a challenge owing to harassment by traffic police	5	4	3	2	1
Acquisition of forestry permits is a challenge owing to the stringent requirements	5	4	3	2	1
Pricing of the charcoal is a challenge owing tot eh high cost of production	5	4	3	2	1
Levies charged by the county government authorities are high thus eroding the profit margins	5	4	3	2	1

25. Has the membership to a charcoal producers association helped you overcome the challenges in the industry?

    Yes ☐

    No ☐

26. Has your participation in the charcoal industry impacted on your livelihood in terms of economic growth?

    Very much ☐

    Fairly ☐

    Not at all ☐

27. How can the charcoal industry be better modeled to assure you of improved earnings? Kindly explain

    _____

    _____