CHARCOAL VALUE CHAIN ANALYSIS IN UYUI DISTRICT AND TABORA MUNICIPALITY, TANZANIA

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS OF SOKOINE UNIVERSITY OF AGRICULTURE.MOROGORO, TANZANIA.

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ABSTRACT

This study sought to analyse charcoal value chain in Uyui District and Tabora Municipality. Specific objectives were to identify actors and assess their rolesin the chain; determine profitand marketing margins of various actors along the value chain and determine the factors influencing charcoalprofitability among actors.Both qualitative and quantitative data were collected.The sample of 114 respondents was drawn for interview from eight wards. Content analysis was used to analyse qualitative data while SPSS computer software was used for quantitative data analysis.The results showed that the major actors in charcoal value chain in the study areas were charcoal producers, transporters, wholesalers, retailers and consumers.The profit accrued along the value chain is small and unevenly shared. Wholesalers and/or transporters take a big share of total profit (84%) followed by retailers (11%) while producers only accrue 5% of the total profit. Charcoal producers are the least beneficiaries in the chain due to lack of business skills indicated by the way charcoal is priced and how charcoal production costs are estimated. Multiple regression analysis revealed that there was statistically significant($P<0.05$) relationship between socio-economic factors such as gender, level of education, the season charcoal business is done, number of charcoal bags sold at a time, category of respondent andthe district in which the actor carried out the business. However, other factors such as age, access to market information and experience in charcoal business were not statistically significant($P>0.05$) to charcoal profitability but showed a relationship with charcoal profitability. This study recommends that there should be an organised charcoal industry and market networks. Also, producers need training on business skills and charcoal should be charged at full price based on the total cost incurred in the whole spectrum of production and marketing.

DECLARATION

I, JumaKazimoto, do hereby declare to the senate of Sokoine University of Agriculture that this dissertation is a result of my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

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Prof. Y. M. Ngaga Date

(Supervisor)

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DEDICATION

I dedicate this work to Almighty God for his blessings; and giving me mental, moral and physical strength to accomplish this important endeavour.

To my parents, Mr and Mrs KazimotoBuyobe and my Late brother William Kazimotowhom together laid the strong foundation of my educationwith a lot of sacrifice.

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LIST OF ABREVIATIONS AND ACRONYMS

CHAPOSA	Charcoal Potential in Southern Africa
CVC	Charcoal Value Chain
DBH	Diameter at Breast Height
EMK	Earth Mound Kiln
FAO	Food and Agriculture Organisation (of the United Nations)
FBD	Forestry and Beekeeping Division
GMM	Gross Marketing Margin
Ha	Hectare
KES	Kenya Shilling
KFS	Kenya Forest Services
LPG	Liquefied Petroleum Gas
MLR	Multiple Linear Regression
MNRT	Ministry of Natural Resources and Tourism
NBS	National Bureau of Statistics
NMM	Net Marketing Margin
NTFP	Non Timber Forest Products
PM	Profit Margin
RIU	Research Into Use
SME	Small and Medium Enterprise
SPSS	Statistical Package for Social Sciences
SUA	Sokoine University of Agriculture
TASAF	Tanzania Social Action Fund

TaTEDO	Tanzania Traditional Energy Development Organisation
TDC	Tabora District Council
TFS	Tanzania Forest Services
TGMM	Total Gross Marketing Margin
TMC	Tabora Municipal Council
TP	Transit Pass
TR	Total Revenue
Tsh	Tanzanian Shilling
TTC	Tabora Town Council
TVC	Total Variable Cost
UNIDO	United Nations Industrial Development Organisation
URT	United Republic of Tanzania
USAID	United States Agency for International Development
USD	United States Dollar

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

It is known that wood energy is the dominant source of energy for over two billion people and 14% of world's total primary energy is provided by biofuels, especially fuel wood and charcoal but also crop residues and animal dung (FAO, 2010). Charcoal is a major source of energy for a vast number of people in African countries as well as a driving force of their economies.According to CHAPOSA (2002), in areas with reasonable accessibility, charcoal is the main forestry related cash crop of the rural households. Its production and use is often perceived as environmentally unsound, due to its contribution to land degradation and deforestation. Also, inefficient production technologies like traditional earth kilns and unimproved cook stoves that are used in charcoal production and consumption, contribute to the increased depletion of the already scarce wood resource (Pike, 2012).

A properly managed charcoal industry would create significant employment and income opportunities in Tanzania. According to CHAPOSA (2002) charcoal production forms an important source of monetary income to many people in rural and urban areas. It is an important and simple means of earning cash income; and in the production areas this income is more important than income from other alternatives such as agriculture. The income from the sale of charcoal was also found to be above the minimum wage paid to most of the government and private sectors employees (Mndeme, 2008).This has a consequence of attracting more people to engage in charcoal production.Charcoal trade provides income opportunities for many people in urban areas, through small scale retail businesses mostly run by women (Mndeme, 2008).

Charcoal value chain (CVC) starts where the tree grows and wood is cut and ends with its consumption and it includes all economic activities undertaken between these stages (KFS, 2013). Many different stakeholders participate in the value chain; right from wood production, carbonization of the wood, packaging and transportation of the charcoal, retailing and distribution, and consumption (KFS, 2013). The charcoal chain in Tanzania plays a significant role in the economy, employing at least part-time, several hundred thousand rural and urban people per year (World Bank, 2009). However, policy makers pay little attention to the ways in which charcoal is produced and sold, and whether wood used for charcoal burning is harvested in a sustainable fashion.

The government of the United Republic of Tanzania through Tanzania Forest Services (TFS) agency collects royalty from charcoal dealers. The latest new royalty rates for forest products which is currently operating is based on the Government Notice No. 351 published on 1st October, 2013 where a charcoalbag of 90 kg is charged at Tsh 14 400 (URT, 2013). According to the Local Government Act No. 9 of 1982, the local government authorities are entitled to charge cess fee of 5% of the royalties charged by TFS agency. These royalties are paid after a charcoal dealer fulfils harvesting conditions as stated in the Forest Act No. 14 of 2002 (URT, 2002).

1.2 Problem Statement and Justification

Charcoal is the most important domestic energy source in urban Tanzania (Kifukwe, 2013). It meets the energy needs for almost two-thirds of urban households for cooking (NBS and ICF Macro, 2011). The increase in consumption of charcoal is due to rapid urbanization, scarcity and the subsequent increase in the prices of conventional fuels such as kerosene, cooking gases and electricity. Charcoal is not only an essential, affordable

fuel source for millions of urban and peri-urban residents, but also a critical livelihood support for many rural households. The World Bank (2009) as cited by Kifukwe (2013), suggested that the charcoal sector, being poorly governed, contributed over USD 650 million annually to the Tanzanian economy and is a major source of employment and income in both urban and rural areas.

Despite the fact that charcoal business is perceived negatively due to its history of unsustainable production, current new regulations allow and support charcoal production as long as it is carried out in a sustainable manner (Pike, 2012). Tanzania is one of the top ten producers of charcoal in the world, producing approximately 3% of the world's total (FAO, 2010).If charcoal production and its use are to contribute to sustainable development and poverty alleviation, the entire charcoal value chain needs to be addressed in a holistic manner (KFS, 2013). That it should include full and formal recognition of wood-based fuels as a future-oriented source of energy and it should be taken as a prerequisite for deliberate change from informal energy supply towards modern, locally-based energy industries. Therefore, better information about the charcoal value chain will facilitate in identifying opportunities for more efficient organisation of charcoal markets, producer cooperatives, and other institutions that enhance returns to the value chain participants (Shively *et al*., 2010).

Despite the significance of charcoal in urban households in Tanzania, it is surprising to see that not much research has been carried out to assess the charcoal value chain in Tanzania especially in the study area. Most of the studies done so far on charcoal provide generalized information related to the value chain, and which might not be quite informative. Some of the studies include Van Beukering*et al.* (2007) which aimed to provide a comprehensive analytical overview of all three components of the charcoal

sector: production, trade and consumption. Other studies including that of World Bank (2009) and Kifukwe (2013) in which the later argues that charcoal is a potential driver of economic growth where Tanzania can empower its citizens to develop and modernize the sector so that charcoal becomes a valuable, renewable and sustainable energy source.

In addition, there is meagre knowledge on how the chain is organised, coordinated and function between the key players. Similarly, there is scanty information on the roles of actors and it is unclear whether revenues and profit shares are either evenly distributed among stakeholders or skewed in favour of vendors making others engage in charcoal business just to earn their living. Therefore, this study intended to uncover systematic analysis of the charcoal value chain by taking all parts of the chain into account.

The scientific information from this study generated baseline data for future assessments ofcharcoal value chain in Western Tanzania and possibly elsewhere in the tropics. It also provides information that can serve as a basis for budget allocation to the forestry management and better use of government resources.

1.3 Objective of the Study

1.3.1 Overall objective

The overall objective of the study was to analyse charcoal value chain (CVC) in Uyui District and Tabora Municipality in order to understand the economics of the industry, its functions in totality and suggest strategies to improve value addition along the chain.

1.3.2 Specific objectives

In order to achieve the overall objective, the study intended to:

(i) Identify the actors and assess their roles in the chain;

(ii) Determine profits and marketing margins of various actors along the value chain; and

(iii) Determine the factors influencing charcoal profitability among the actors.

1.4 Research Questions

Based on the above specific objectives, the following questions guided the research work:

(i) Who are the key actors along the chain and how are they coordinated, organised and function?

(ii) What is the pricing structure and margins at different nodes of the charcoal value chain?

(iii) What are the factors affecting charcoal profitability among actors in the chain?

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Theoretical Framework

2.1.1 Definition of terms

2.1.1.1 The value chain concept

The value chain concept was used by Michael Porter in the 1980s. He defined the value chain as the various activities which were performed in particular links in the chain. Value chain is a whole series of activities that create and build value at every step. The total value delivered by the company is the sum total of the value built up all throughout the company (Porter, 1980). Focusing on the value-creating activities could give the company many advantages. For example, the ability to charge higher prices, lower cost of manufacture, better brand image, faster response to threats or opportunities.

Porter defines the value chain as made of primary activities and support activities. Primary activities involves inbound logistics (getting the material in for adding value by processing it), operations (which are all the processes within the manufacturing), outbound (which involves distribution to the points of sale), marketing and sales (which go sell it, brand it and promote it) and services (which maintains the functionality of the product, post sales). The support functions which feed into all the primary functions are the firm infrastructure, like Management Information System which allows managers to monitor the environment well, human resources, which develops the skills needed to steer the company well, procurement to buy/source good at the right price, which increasingly takes importance because of difficult economic conditions and technology, which could give the firm speed, accuracy and quality. Both allow the firm to charge a margin, which partly comes from the value addition of the primary and support functions.

The concept has since been expanded to cater for larger units such as industry sub-sectors. According to Kaplinsky and Morris (2000), the value chain expresses the "full range of activities which are required to transfer a product or service from conception, through the different phases of production, delivery to final consumers, and final disposal after use". In value chain, the actors that are involved play some roles including marketing functions involving production, storage, transportation, and value addition.

Another definition is given by Sturgeon (2001) who defines "value chain" as a chain of productive activities, the vertical sequence of events leading to a delivery, consumption and maintenance of goods and services". Sturgeon (2001) argues further that various value chains often share common economic actors and vary according to the organisational scale, Sturgeon (2001) redefines "value chain" as the sequence of productive (such as value added) activities leading to and supporting end use". According to Sturgeon (2001), value chains have three dimensions, which are; organisational, spatial and the type of actors involved (production actors).

From the organisational viewpoint, value chains are either complex and dynamic or simple depending on their sustained supply of a variety of critical inputs (such as human resource requirements, capital equipment and service) (Sturgeon, 2001).

The second dimension (spatial) springs from an understanding that some value chains have wide coverage, some may operate at international levels. These latter chains are sometimes referred to as global commodity chains (Gerreffi, 1999).

The third dimension of the value chain involves the production actors or firms that participate in the chain. According to Sturgeon (2001), these actors can be producers (in case of agricultural production value chain), suppliers, retailers/wholesalers, or lead firms.

2.1.1.2The value chain analysis

FAO (2013) defined value chain analysis as the assessment of a portion of an economic system where upstream agents in production and distribution processes are linked to downstream partners by technical, economic, territorial, institutional and social relationships. Value chain refers both to a set of interdependent economic activities and to a group of vertically linked economic agents, depending on the scope of the study the focus of the analysis can be on the activities or on the agents (FAO, 2013). A value chain starts with the production of a primary commodity, ends with the consumption of the final product and it includes all the economic activities undertaken between these phases such as; processing, delivery, wholesaling and retailing. Goletti (2006) reported that value chain analysis ideally requires dealing with all participants along the value chain.

Well-functioning value chains are said to be more efficient in bringing products to consumers and therefore all actors, including small-scale producers and poor consumers, should benefit from value chain development (RIU, 2008). Value chain analysis can play a key role in identifying the distribution of benefits of actors in the chain through the analysis of margins and profits within the chain, it is possible to determine who benefits from participation in the chain and which actors could benefit from increased support or organisation. An efficient marketing system cannot be successful if one of the segments along the value chain is inefficient. Inefficient segments along the value chain affects producers, traders and consumers. Therefore, a study of value chain analysis is vital in order to identify the segment which is inefficient. This would allow interventions geared towards improving the charcoal flow from producers to consumers.

2.1.1.3 Value chain governance

Governance refers to the organization of a value chain and coordination between actors making it possible to bring a product from primary production to end-use(UNIDO, 2011). This can include the power and ability with which certain actors in the value chain exert coordination and control along the chain. According to USAID (2007) value chain governance is the dynamic distribution of power and control among actors in a value chain. While the term can have many meanings, in this instance, we use it to describe the sharing of information and systematic standards promoted by the "governing" entity in a value. Governance can be characterized along a continuum of four types of relationships (USAID, 2007):

Market relationship: Arms-length transactions in which there are many buyers and many suppliers (spot market); commodity is undifferentiated; repeat transactions are possible but not necessary; little information is exchanged between firms; interactions between firms are limited; and technical assistance is not provided.

Balanced relationship: Both buyers and suppliers have similar alternatives - if supplier has few buyers, then buyer has few suppliers; extensive information flow in both directions, with buyer often defining the product (design and technical specification); both sides have capabilities that are hard to substitute; both sides are committed to solving problems through negotiation rather than threat or exit.

Directed relationship: Main buyer takes at least 50% of supplier's output; buyer defines the product (design and technical specification) and monitors the supplier's performance; buyer provides technical assistance; buyer knows more about supplier's costs and

capabilities than supplier knows about buyer's; supplier's exit options are more restricted than buyer's.

Hierarchical relationship: Vertical integration of value-added functions within a single firm; supplier is owned by buyer or vice versa; limited autonomy to make decisions at the local level.

Governance ensures that interactions between firms along a value chain exhibit some level of organisation rather than simply being random. The various types of governance may be appropriate for a chain at different times. Each type has benefits and limitations. Understanding governance is important for identifying where in a chain to intervene.

2.1.2 Marketing Theories

2.1.2.1 Market chain analysis

According to FAO (2005), market chain is defined as a process of following a product from production to consumer by looking at all points of the chain, prices in and out of each point, functions performed by each point, market demand and supply (trends), market constraints and analysing the market opportunities for the particular product. Market chain analysis as a way of gaining insight into the (a) operations of specific market channels while focusing on their growth potential, (b) activities and efficiency of actors along the chain, (c) business support services involved, and (d) policy and regulatory frameworks. Using the information from the analysis, opportunities and constraints can be identified within specific market chains, and ways can be seen to improve a defined client's capacity to compete more effectively.

2.1.2.2 Marketing channels

According to Kotler (2005) marketing is defined as an activity, set of institutions and processes of creating, communicating, delivering and exchanging goods and services that have value for customers, clients, partners, and society at large. It generates the strategy that underlies sales techniques, business communication, and business developments. Therefore, it is an integrated process through which companies build strong customer relationships and create value for their customers and for themselves.

Kotler (2003) defined marketing channels as a set of interdependent organisations involved in the process of making a product or service available for use or consumption. Most producers do not sell their goods directly to the final users. Between them, stands a set of intermediaries performing a variety of functions. These intermediaries constitute a marketing channel also called a trader channel or distribution channel. A good marketing system has to reconcile with all these points. Few producers sell their goods directly to the final users. However, most producers use intermediaries to bring their products to the market. Intermediaries reduce the amount of work that must be done by both producers and consumers. In effect, consumers need the highest produce value at the lowest possible price; farmers want the highest possible returns from users.

2.2 Empirical Studies

2.2.1 A review of stakeholders in charcoal value chain

The first component of the charcoal value chain is forest management to supply wood raw materials for charcoal production based on demand. Currently, the largest share of charcoal comes from natural forests while plantations, woodlots or trees outside the forest play only a small role on charcoal production (Kaale 2005). Value chain analysis

examines the sequence of productive (i.e. value adding) activities leading to end-use. Blodgett (2011) reported that, within the charcoal value chain, there are many different stakeholders who participate in the various activities which include wood production, carbonization, transportation, wholesaling, retailing and consumption. According to the World Bank (2009) the structure of the charcoal chain is complex, comprising of many different stakeholders with different objectives and economic potential (Fig. 1).

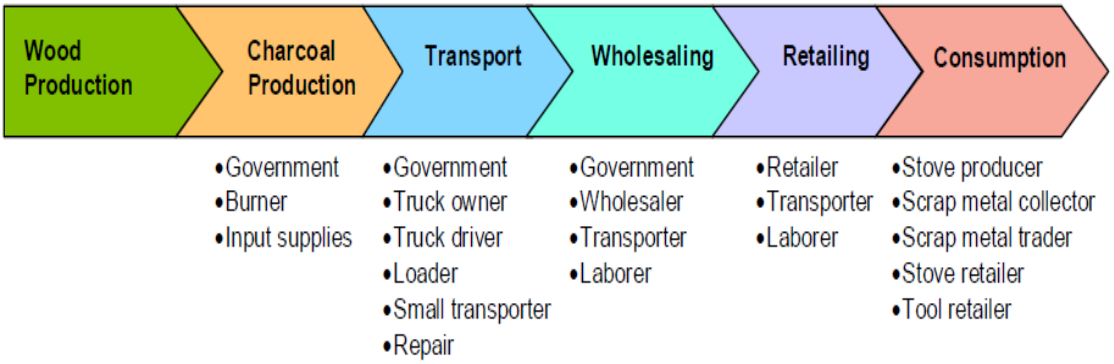

Figure 1: Beneficiaries in the charcoal value chain in Tanzania

Source: World Bank (2009)

According to the author, charcoal producers can either be contracted by wholesalers or transporters or work on their own, selling their products individually. They either consider charcoal production as their main economic activity or engage only occasionally in it for ad-hoc cash generation, especially in case of unexpected expenses. These producers sell their product to their patrons or individually to large- or small-scale transporters. Some of the large-scale transporters are also wholesalers. These wholesalers then pass the charcoal on to smaller-scale retailers and consumers

Depending upon the route followed by charcoal from producer to consumer, various actors are involved, including transporters, wholesalers and retailers. A study of charcoal consumption, trade and production in Malawi (Kambewa*et al.,* 2007) revealed three channels; the first channel was from producer to consumer, the second route was from

producer to buyer to consumer and the third channel was from producer to primary buyer to secondary buyer to consumer in which there is both wholesale and retail markets. According to the authors, the last scenario was most common where there were well-established wholesale markets, especially in high-density, shanty and unplanned areas.

Charcoal production plays a significant role in the economy of most sub-Saharan African countries, including Tanzania. The value chain provides numerous jobs at each step of the chain. Although jobs are provided throughout the value chain, currently a significant amount of the revenue goes to connectors - middlemen, transporters and wholesalers - with very little going to charcoal producers.According to World Bank (2009) the revenues along the charcoal value chainin Tanzania are distributed unevenly. The charcoal producer can earn as little as 20% of the final retail price of charcoal paid by the urban consumer, whereas traders generally earn a considerable higher percentage. This may be due to several reasons: a) the supply of unskilled labour is large; b) independent producers are not organised and, thus, cannot exercise any negotiation power; c) transport and large-scale wholesaling is organised by cartel or monopolistic-type market structures; d) retailers are again not organised and lack market influence. The reason for producers and retailers not to be organised in interest groups or cooperatives is likely due to the fact that many operate illegally.

Within the Rwandese value chain, wood production sector was valued at US$ 8.7 million, carbonization at US$ 17.5 million, transport sector at US$ 19.7 million and the retail and distribution at US$ 6.5 million (Blodgett, 2011).

2.2.2 Charcoal production worldwide

The global production of wood charcoal was estimated at 47 million metric tons in 2009, and increased by 9% since 2004 (FAO, 2010). This increase is strongly influenced by Africa, which produces about 63% of the global charcoal production (FAO, 2010). Charcoal production boosted in the continent by almost 30% since 2004, thus extended Africa's global lead (FAO, 2010). Consequently, the escalating rate of wood charcoal production, particularly in developing countries, will continue to pose severe threats on the remnant woodland resources.

Among the top ten wood charcoal producing countries in the world, Brazil, with the largest forest resources in the world, stood first; while Nigeria and Ethiopia are second and third respectively (Fig. 2) (FAO, 2010). The remaining seven countries are: Democratic Republic of Congo, Mozambique, India, China, Tanzania, Ghana and Egypt.

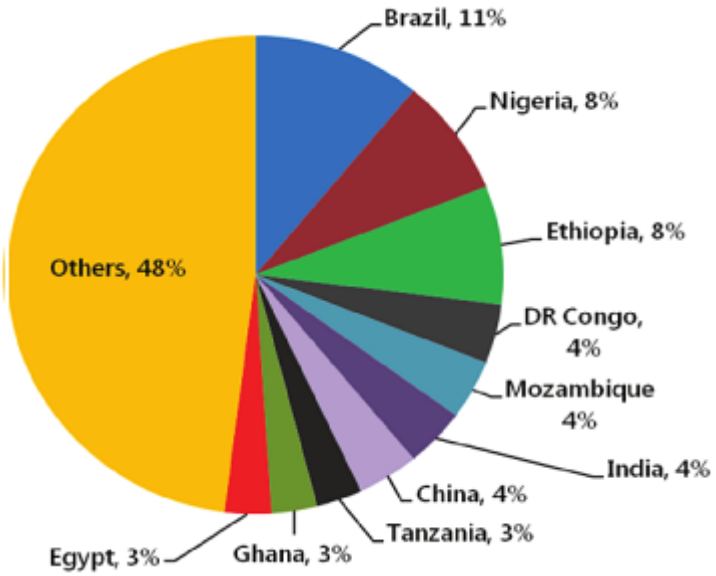

Figure 2: Top ten wood charcoal producing countries in the world

Source: FAO (2010)

2.2.2.1Charcoal production in Tanzania

Almost all charcoal in Tanzania is produced in the rural areas, with the largest shares of raw materials extracted from open miombo woodlands; reserved forests; bushland forests (publicly owned); mangrove forests, and farm lands (Van Beukering *et al.*, 2007). At least 17 million tons of wood are consumed each year in Tanzania to produce charcoal by thousands of traditional charcoal producers, and is even set to increase at faster rates in the near future (Camco, 2014). Charcoal production sites are usually located close to access roads to simplify transportation and sale. Normally, charcoal kilns are located within 5 to 15 km (Malimbwi *et. al.,* 2007). However, as woodlands deplete on favourable distances or when preferred species are exhausted, charcoal producers move even further and take the burden of carrying charcoal loads to the roadside.

Charcoal can be produced by a range of methods, from simple earth kilns to brick or metal kilns and retorts that capture condensable volatile compounds or combust them as gases using the heat generated to drive the charcoal making process (Hofstad, 1995). In most parts of Tanzania, charcoal is produced in earth mound kilns made by covering the pile of logs with earth, igniting the kiln and allowing carbonization under limited air supply (Monella *et. al.,* 1993; CHAPOSA, 2002; Malimbwi *et. al*., 2005).

Charcoal production begins with identification of suitable trees for charcoal production, cutting down trees, which are then piled up and covered with earth to make a kiln. A fire is lit at one end of the kiln and the wood is turned into charcoal, after which the kiln is dismantled and the charcoal packed into bags (Kambewa *et al.,* 2007). Generally, charcoal is produced throughout the year. However, during the wet season most of the charcoal makers devote most of their time in agriculture while others continue to make charcoal with easy availability of kiln construction materials. This is because during the wet

season,earth blocks aremore coherent and hence easy to handle and grass materials become plenty and available. In the dry season it is difficult to construct earth mound kilns because the soil is too loose to produce the needed earth blocks for covering the kilns. During the dry season there is also scarcity of grass materials (Malimbwi *et al.,* 2007).

2.2.2.2 Tree species preferred for charcoal

Even though all species of wood can be carbonized to charcoal, the quality of charcoal varies from specie to specie and is dependent on the method of carbonization (KFS, 2013). Large tree species (>20cm diameter) with high caloric values are the most preferred, due to the large quantity of dense and hard charcoal they produce (Monela *et al.,* 1993). *Bachystegia boehmii, B. bussei, Comretum sp, Bauhhinia sp, Acacia nilotica, Fluegea virosa, Swartizia madagacariencis* and *Julbernadia sp*. are some of the species that have been reported to produce high quality charcoal (Msemwa, 2007). Most of these are Miombo woodland species. Tree species preference is based on the species property to produce charcoal with high recovery percentage, high calorific value that attracts customers and hence more income to charcoal dealers since lighter charcoal with low calorific value has a problem of crumbling easily into small pieces or fines during transportation and consequently lowering market value (Zahabu, 2001). In Kenya most species preferred for charcoal production include*Casuarina equisetifolia*, *Acacia mearnsii*, *Acacia polyacantha,* and *Acacia xanthophloea,* and other acacia and combretum species (Mugo and Ong 2006).

2.2.2.3 Charcoal production process

Charcoal is usually produced by slow pyrolysis, the heating of wood in the absence of oxygen. During the process, water is driven out first from the wood (drying) and then the pyrolysis starts when the temperature in the kiln is high enough. When the pyrolysis is

complete the kiln gradually cools down after which the charcoal can be removed from the kiln (Hofstad, 1995).

Charcoal is produced by various methods. The oldest and still the most widely used method for charcoal production is the traditional earth kiln (Malimbwi *et. al.,* 2007). Two varieties exist, the earth pit kiln and the earth mound kiln. The earth pit kiln is constructed by first digging a small pit in the ground. Then the wood is placed in the pit and lit from the bottom, after which the pit is first covered with green leaves or metal sheets and then with earth to prevent complete burning of the wood. The earth mound kiln is built by covering arranged piles of wood on the ground with earth. The mound is preferred over the pit where the soil is rocky, hard and shallow or the water table is close to the surface. Mound can also be built over a long period by stacking gathered wood in position and allowing it to dry before covering and burning (Malimbwi *et. al.,* 2007).

With Earth Mound Kiln (EMK), the process of charcoal making involves wood cutting, kiln constructions, carbonizations and finally unloading charcoal from the kiln. Generally, the work is labour intensive and muscularly done, usually by male members of the family with manual tools (axes, hoes, shovels). For a kiln with about 1.5 tons of charcoal it takes an average of about 13, 10 and 14 daysfor wood cutting, kiln preparation and carbonization respectively. Unloading the charcoal takes an average of 4 days (Malimbwi *et. al.,* 2005).

Despite the variations in kiln types, the steps for producing charcoal (Table 1) are essentially the same. According to Herd (2007), the main differences arising between regions are the tree species used, the kiln insulation material used and the arrangement.

Table 1: Steps involved in the production of charcoal using the traditional earth kiln

Step	Activity
1. Kiln site identification	1.1. Select site for kiln construction
2. Material Preparation	2.1. Tree felling 2.2. Cross cutting into short logs 2.3. Wood drying
3. Kiln construction	3.1. Kiln base structure 3.2. Stacking logs 3.3. Kiln insulation with grass & soil
4. Carbonization	4.1. Ignite kiln 4.2. Carbonization control 4.3. Cooling period
5. Sorting & selling	5.1. Sorting of charcoal 5.2. Packing into bags 5.3. Transport to road

Source: Adapted from Herd (2007)

The efficiency of the kiln depends on the construction (arrangement of the billets), moisture content of wood and the monitoring of the carbonization process. The efficiency is low when using the traditional earth mound kiln. A study conducted by CHAPOSA (2002) showed that the efficiency of the traditional earth mound kiln ranges from 11 – 30%, however, in other studies the efficiency of the traditional kiln was reported to range between 10 – 20%. The conversion rate ranges from 1 to 2 bags of charcoal taken from one cubic meter of fuel wood (TaTEDO, 2001).

2.2.2.4 Charcoal production technology in different kiln types

Charcoal makers hardly use any modern form of technology in charcoal production. The use of improved kiln to reduce the amount of wastage could contribute to efficient production. Efficiencies in different kiln types are summarized in Table 2.

Table 2: Common traditional and improved charcoal kilns

Kiln type	Traditional kiln	Improved kiln	Efficiency (%)	Remarks
Earth pit kiln	X		10 – 15	Lowest efficiency, unpopular and labour intensive in digging and covering the pit.
Portable steel kiln		X	20 – 25	Unpopular due to high initial investment (Tsh 3 000 000/unit).
Half orange brick kiln		X	25 – 35	Improved charcoal quality, not movable, high initial costs (Tsh 3 000 000 per unit).
Cassamance EMK		X	25 – 30	Unpopular, high initial cost, tedious.
Earth mound kiln	X		10 – 20	Most popular in Tanzania, low initial cost.
Improved earth mound kiln		X	15 – 25	Has a chimney, improved carbonization and improved charcoal quality.

Source: Adapted fromVan Beukering *et al.,* (2007)

In spite of unpopularity of earth pit kiln, it is recommended to be used country wide in the current forest regulation of the Forest Act No 14 of 2002 (URT, 2002a). Also adoption of improved kilns has failed due to lack of capital for kiln construction. The need to process the billets into specific sizes and transport them to kiln site is also an added cost which is limiting. However, there is evidence that experienced producers who use traditional kilns achieve more efficiency than less experienced ones (Malimbwi *et al.,* 2007).

2.2.3 Effects of charcoal production on forest resources and environment

The direct environmental impact of charcoal production is caused by the felling of trees to produce charcoal. Eleven to twenty per cent of deforestation in developing countries can be attributed to charcoal production (Norconsult, 2002). Since the trend has been that more and more people use charcoal, the tendency to fell more trees has been and will continue to increase in the absence of any affordable alternative. The problems associated with felling trees that are not replaced by regeneration or reforestation activities are well

known: depletion of water sources and water catchment areas; reduction of carbon sinks; erosion; and loss of habitat and biodiversity.

Several studies in charcoal producing countries have attempted to capture the impacts of charcoal on deforestation and forest degradation. In Malawi, Kambewa *et al*., (2007) analysis of the impact of the charcoal industry on forests revealed a volume equivalent to about 15 000 ha of forestland being cut per year, with close to 60% of the charcoal being produced in Forest Reserves and National Parks. The study also reveals the negative impacts of charcoal making on species composition of forests. In this situation preferred species for charcoal making are removed leaving woodlands of lower quality.

The principle cause of deforestation in Tanzania is the felling of trees for the production of charcoal (Van Beukering *et al.*, 2007).According to Kifukwe (2013), Tanzania is one of the largest charcoal producing countries in the world.This has led to charcoal becoming a major cause of deforestation ranking behind shifting land use to agriculture but ahead of forest fires. It is estimated that between 100 000 and 125 000 ha of Tanzanian forest is lost annually as a result of charcoal production. (World Bank, 2009). It has been also noted that where there is bushland most of it is regenerating from coppice, indicating that trees had been cut most probably for charcoal production. Because of regeneration in areas previously cut, and if there is nofurther disturbances, such area may revert to woodland, thus increasing the potential of the area to supply charcoal over a much longer time period (Mndeme, 2008).

2.2.4 Charcoal trading system in Tanzania

2.2.4.1 Charcoal trade arrangements

Trade in charcoal is conducted by formal as well as informal actors. One commercialization chain begins with government-issued licenses for the exploitation of the forest resources. The product is transported and traded by officially licensed transporters and traders who pay the necessary duties and taxes. A second commercialization chain begins without official authorization, which is essentially an informal or illegal activity. Charcoal travelling through this informal chain is transported and traded clandestinely in attempt to avoid authorities, taxation and eventual penalties (World Bank, 2009).

According to Van Beukering *et al.* (2007), the trade of charcoal in Tanzania is primarily informal and it is characterized by a high turnover rate. There is no significant warehousing. All stocks produced are promptly consumed. Abundant evidence of the charcoal trade is visible throughout the cities and surrounding regions. Highways are lined with charcoal bags for sale in the production areas and on the outskirts of towns. Thousands of markets throughout the country offer charcoal for sale.

Most of the wood used to burn charcoal is either obtained freely from on-farm sources, or illegally from government sources in charcoal producing areas (KFS, 2013). In urban areas, charcoal dealers sell their charcoal either to charcoal vendors or directly to consumers who buy charcoal in large quantities. Charcoal vendors who are spread all over the urban areas then sell the charcoal to final consumers usually in small quantities (Mndeme, 2008).

2.2.4.2 Transportation and distribution system of charcoal

Almost all charcoal produced in rural areas is transported to the main Tanzanian cities by either trucks or bicycles. Although bicycles account for quite a small percentage of the charcoal transported, they are in common use among rural and semi-urban households linked to the chain (Van Beukering *et al.*, 2007). Charcoal producers and business-people trading in smaller amounts primarily use bicycles. The fact that these two categories use bicycles is an indication of their unsteady economic conditions, and consequently, their inability to afford better and safer means of transport (Van Beukering *et al.*, 2007).

However, very few producers actually ferry their own charcoal to the cities. Napendaeli (2004) indicated that more than 60% of the charcoal producers do not transport their charcoal to the markets in urban areas and 36% of them use bicycles to ferry charcoal up to nearby main roads where charcoal dealers come to collect the bags. Only 4% of the producers do hire transport and ferry their charcoal up to wholesalers/retailers in Dar es Salaam city. They usually do this only when the charcoal production sites are less than 30km from potential markets and there is the opportunity to retain a higher margin of profit there.

Most of the charcoal produced is ferried to the cities by charcoal dealers. They collect charcoal at the production sites using their own, or in most cases, hired means of transport (i.e. lorries and pick-ups). More charcoal is transported during the dry season for reasons related to the larger quantity produced and the better conditions of the roads. In the case of Dar es Salaam, the highest amount of charcoal usually enters the city during morning hours (6:00 am) through the major routes: Morogoro, Pugu (59%), Kilwa (31%) and Bagamoyo (10%) (Napendaeli, 2004). Transportation of natural resources including charcoal is only allowed during day time between 6.00 am to 6.00 pm. Most of the

charcoal passes through checkpoints very early in the morning between 6.00 to 6.59 am and late in the evening between 5.00 and 6.00 pm. This is because most of the vehicles used are more than 10 years old (79%) with many traffic offenses and as such, drivers tend to avoid traffic police (Malimbwi *et al.,* 2007).In Kenya, transporters costs include the movement permit fee payable to KFS at a rate of KES 20/bag, Cess fee of KES 20-50/bag, cost of vehicle hire which varies with the size of the lorry and the distance to the market, the county council charges and the bribes paid to the police and the county council security (KFS, 2013).

2.2.4.3 Charcoal markets and prices

Charcoal is a highly commercialized commodity which can be transported economically over long distances for market. According to KFS (2013), the most common charcoal supply chain consists of three levels. First the transporters visit the production site or a designated collection point with motorised or non-motorised means of transportation and buy the charcoal in bulk. They then transport the charcoal to vendors (wholesale or retail) mostly in urban areas. In the national survey study findings in Kenya (Mutimba and Baraza, 2005), 56% of producers sold their charcoal to vendors via transporters as well as directly to households, food businesses and other customers including social institutions. Charcoal is sold in different units of various sizes. MNRT (2001) reported different units used by vendors to sell charcoal whereby the smallest unit used was empty paint tin (*kopo*) and the largest unit being a bag (*gunia*). In Dar es Salaam, most vendors sell charcoal at their house yards of which they are not paying taxes (MNRT, 2001).

Charcoal prices often vary depending on production and transportation costs, the quality of charcoal based on the weights and presence or absence of fines, soil particles and unburnt wood and twigs, the market with the towns providing the major market to the charcoal, the

season, royalty and on whether there is a ban from the government or not. For example, studies conducted in Kenya by KFS (2013) reported that charcoal prices vary depending on the season with lower prices registered during the dry season and higher prices in the rainy season owing to low supplies and high cost of transport. Charcoal pricing increases from a low of KES 250 per bag at the producer level to a high of KES 2,800 per bag at the consumer level, with the latter being realized where charcoal is sold to households in small 2kg-tins. In Tanzania, Camco (2013) reported that charcoal pricing increases from Tsh 7,000 per bag at the producer level to Tsh 40 000 per bag at the consumer level.

One vital piece of information that producers lack is market price knowledge. Charcoal producers are also lacking business skills. Business development skills would allow the producers to manage their business better and market their product (Blodgett, 2011). Producers sometimes are forced to yield to the demand for low prices by transporters and vendors to raise funds to fend their family needs like food, clothing and school fees, especially during drought. During the wet and planting seasons most producers halt production and engage in agriculture thereby leading to low supplies of charcoal hence higher prices. MNRT (2001) found that the highest price is fetched during wet season when processing and transport is difficult compared to dry season. Tanzanian charcoal market is valued at USD 650 million, nearly ten times the Malawian market due to the higher prices prevalent in Dar es Salaam (World Bank, 2009).

Charcoal vendors sell their charcoal in small measures of empty paint tins, buckets and small sacks. According to Mndeme (2008) to increase profit margins, the vendors normally manipulate packing, sizes and shapes of tins, buckets and bags they use as the result most of the tins and the buckets used are deformed. The manipulations are also done

by producers and transporters of charcoal and finally the effect is most felt by consumers. Malimbwi *et al.* (2007) reported that large scale vendors have to pay for tax, municipal permit, site construction, security and salaries while small scale vendors who sell charcoal at their premises usually have less running costs.

In accordance with the Forest Act No. 14 of 2002, the TFS agency is entitled to charge fees and royalty from charcoal, also the Local Government Act No. 9 of 1982 allows the district councils to charge cess fee of 5% of the royalty charged by TFS agency. These charges plus costs of production, packaging, transportation and marketing and other variable costs are incurred by charcoal dealers. Therefore for charcoal dealers to make profit, the price of charcoal has to be raised above these charges and their respective costs. Thus increase or decrease of these charges are likely to affect positively or negatively the price of charcoal. Blodgett (2011) reported that taxes along the Rwandesecharcoal value chain amount to about 7% of the end user price.

2.2.4.4 Charcoal consumption

Charcoal, which covers about 80% of urban households energy needs in Africa, remains one of the prime sources of energy in the continent, particularly in Sub-Saharan Africa (FAO, 2010). And, yet it will remain the main cooking fuel for most people in the region's towns and cities for the foreseeable future because it is accessible and affordable (Mugo and Ong, 2006). With population increase, urbanization, and economic growth, the demand for energy is expected to grow. As the modern energy sources are still beyond the reach of the majority of people in developing countries, dependence on biomass fuel is expected to continue. Household energy use can, generally be categorized as traditional (including agricultural residues and firewood), intermediate (charcoal and kerosene) or

modern (LPG, biogas and electricity) (Msuya *et al*., 2011). In developing countries, energy consumption is still low and limited almost exclusively to biomass fuels: firewood, charcoal and other organic wastes (Malimbwi *et al.*, 2010).

At national level 96.6% of Tanzania's total population (Table 3) relies on biomass fuels for cooking of which 71.8% relies on firewood and 24.8% on charcoal (Camco, 2014; MNRT, 2013). Of the estimated total population of 44.94 million people (2012), those relying on biomass (firewood, charcoal and farm residues) for cooking were 43.57 million (Table 3).Charcoal is consumed almost exclusively in urban and peri-urban areas. In rural areas where charcoal is produced, people normally use firewood. Charcoal is a convenient and accessible energy source for cooking at all times and at a reasonable cost. In addition, charcoal trade offers income generation opportunities for many people in the urban areas, through small scale retail businesses mostly run by women who sell charcoal in the urban roads. All these factors along with the absence of affordable and convenient modern alternative energies rendered charcoal to be consumed at higher rates among urban areas.

Table 3: Sources of energy for cooking in Tanzania

Energy source for cooking	Percent			Population (millions) 2012		
	Rural	Urban	Total	Rural	Urban	Total
Firewood	90.1	20	71.8	29.96	2.34	32.30
Charcoal	8.5	71	24.8	2.83	8.29	11.12
Crop residues	0.4	0.1	0.3	0.14	0.01	0.15
Biogas	0.1	0.4	0.2	0.02	0.05	0.07
Electricity	0.2	1	0.4	0.07	0.12	0.19
Kerosene	0.4	7	2	0.13	0.82	0.95
LPG	0.1	0.1	0.2	0.03	0.01	0.04
Others	0.2	0.4	0.3	0.07	0.05	0.12
TOTAL	**100**	**100**	**100**	**33.25**	**11.69**	**44.94**

Source: Adapted from Camco (2014); MNRT (2013)

Charcoal demand in rural areas has increased from 4% in 2000 to 8.5% in 2012 (Camco, 2014) and in Dar es Salaam from 71% in 2007 to 91% in 2012 (Camco, 2014). Charcoal

demand in other urban areas has increased from 53.9% in 2007 to 59.1% in 2012 (Camco, 2014). By end of 2012, the population consuming charcoal in Tanzania mainland was 11.12 million people mainly in urban and peri-urban areas (Table 3). Camco (2014) reported that in 2012 Tanzania consumed 2 333 743 tons of charcoal whereby rural households consumed 515 740 tons, urban households 1 513 602 tons and non-households (commercial, institutional, etc) all urban consumed 304 401 tons.

According to Van Beukering *et al*., (2007), households represent the most relevant source of charcoal demand in urban and peri-urban areas. The second largest consumer of charcoal is the commercial sector, which consists of petty food vendors and restaurants/hotels. Charcoal is also used by small-scale industries which include small textile finishers, food processing industries (breweries, smokeries, etc), agro-processing industries (tobacco curing, tea drying and beeswax processing industries) and industries involved in the production of building materials (burnt bricks, lime, smiths, foundries, pottery and ceramics). Whereas the service sector, which consists of secondary schools, colleges, hospital/health centers and prisons, as well as other institutions, represent a marginal share of the total demand for charcoal.

Recent household budget surveys, census and other data show that, currently, a quarter of all Tanzanians consume charcoal as their primary cooking and heating fuel (Table 4). Dar es Salaam makes up one third of total consumption (Camco, 2014). Several studies have given different estimates on the percentage of Dar es Salaam households depending on charcoal as a source of energy for cooking purposes. Camco (2013) reported that over 90% of the households in Dar es Salaam, and almost all the restaurants and hotels, use charcoal as their only source of cooking energy and buy their charcoal from suppliers

where the price differential between suppliers is small. The World Bank's (2009) assessment from 2001 - 07 also showed that the number of households in Dar es Salaam cooking with charcoal grew from 47% to 71%, while the uses of LPG declined from 43% to 12%. Other estimates include TaTEDO (2001) estimated at 85%, and Ishengoma and Ngaga (2001) at 86% of the total demand.

Table 4: Tanzania population using charcoal in 2012 (by area)

Area	Total Pop.	% Pop. Using charcoal	No. using charcoal	% Total charcoal demand
Dar es Salaam	4 364 541	91.0	3 971 732	35.7
Other urban	7 316 739	59.1	4 321 976	38.9
Rural	33 246 720	8.5	2 825 971	25.4
Total	44 928 000	24.8	11 119 680	100.0

Source: Adapted from Camco (2014)

In Kenya, the annual consumption was estimated at between 1.6 - 2.4 million tons (Mutimba and Baraza, 2005), with 10 % of the charcoal heading to the capital city, Nairobi (Njenga *et al*., 2013). In Malawi, the four largest urban centres account for roughly 90% of the charcoal used in the country (Kambewa *et al*., 2007).Various energy studies have concluded that biomass fuels for the foreseeable future will remain the main energy source for the household sector (Camco, 2014).

2.3 Conceptual Framework

According to Mayeta (2004), a conceptual framework binds facts together and provides guidance towards collection of appropriate data. The conceptual framework of this study (as detailed in Figure 3) assumes that charcoal value chain connects various nodes from production to consumption. The produced charcoal is transported to different places where they can be utilized by the end consumers. In each node it is expected that various key

actors of different categories like producers, transporters, wholesalers, retailers and consumers are involved in performing different roles. It is further assumed that these roles leading to charcoal profitability may be influenced by different factors like age, education level, gender, district in which the actor carried out the business, years of experience in charcoal business, access to market information, category of respondent, the season charcoal business is done and number of charcoal bags sold at time. Also, the government influence charcoal business by providing license, law enforcement and regulation, and road and cess fees.

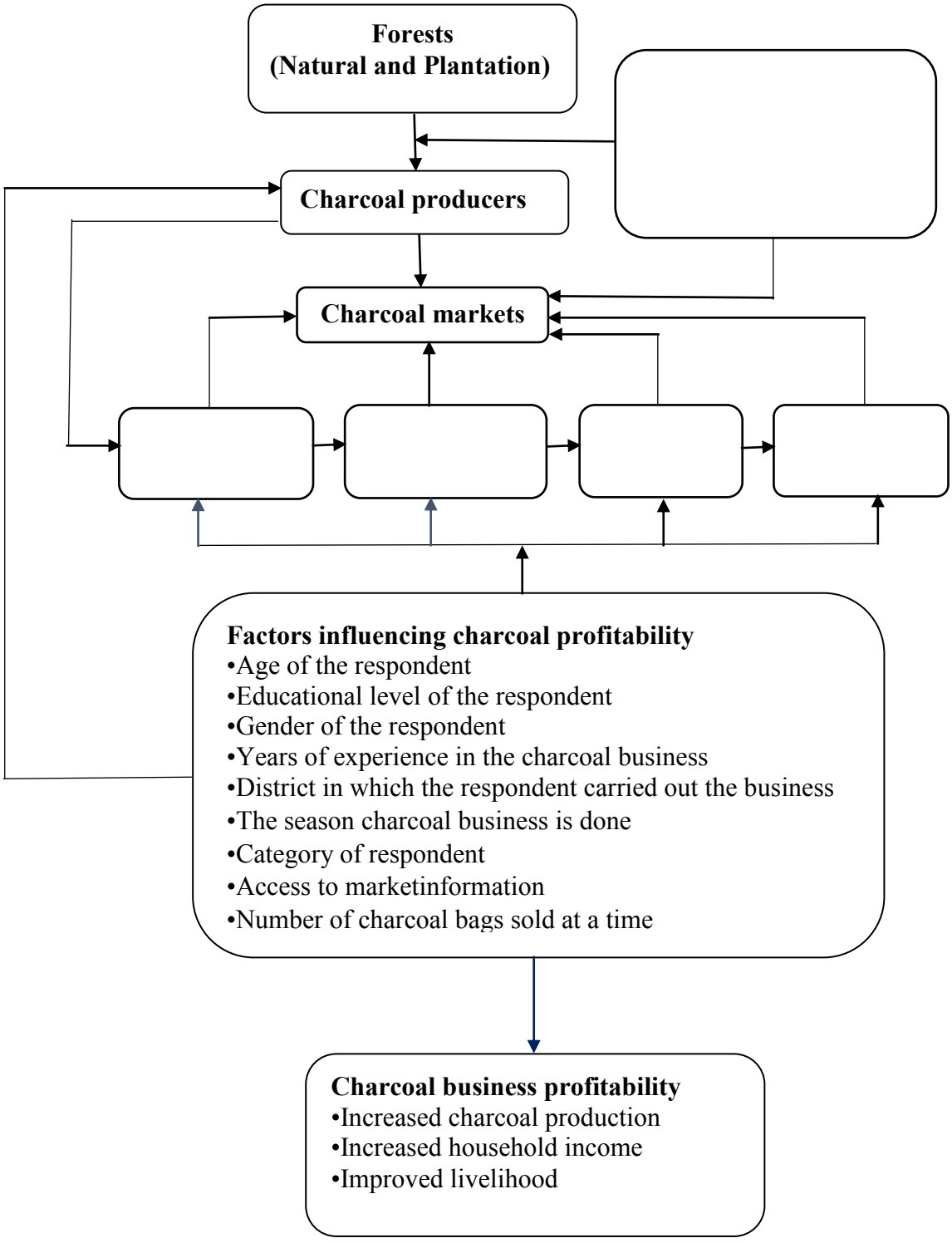

Figure 3: Conceptual framework for the study

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Selection of the Study Area

The study was conducted in UyuiDistrict and Tabora Municipality in Tabora Region, Tanzania. The District was selected because of being the main charcoal producer in Tabora Region. Tabora Municipality was deliberately selected due to presence of the major charcoal markets. Charcoal production and marketing is a major income generating activity in the study area due to the richness of the forest resources.Forests cover about 58% of Tabora's land surface (Majule*et al*., 2012). These natural forests in the districts are being cleared for the purpose of charcoal making to supply mostly Mwanza and Dar es Salaam cities and Shinyanga and Tabora Municipalities.The charcoal is mostly used for cooking in household, institutions, hoteliers and food vendors (Van Beukering *et al*., 2007).

3.2 Description of the Study Areas

3.2.1 UyuiDistrict

3.2.1.1 Geographical location

Uyui District is among the six districts in Tabora Region. Most parts of the district are located at the Central part of Tabora Region, and surround TaboraMunicipality (Fig. 4). The district lies between Latitudes $05^0$45' and $06^0$55' South of the Equator and between Longitudes $32^0$85' and $34^0$15' East of Greenwich. It is bordered to the North by Nzega and Igunga districts as well as by the Shinyanga Region. To the South it is bordered by Sikonge District; to the West by Urambo District and to the East by the Singida Region (TDC, 2014).

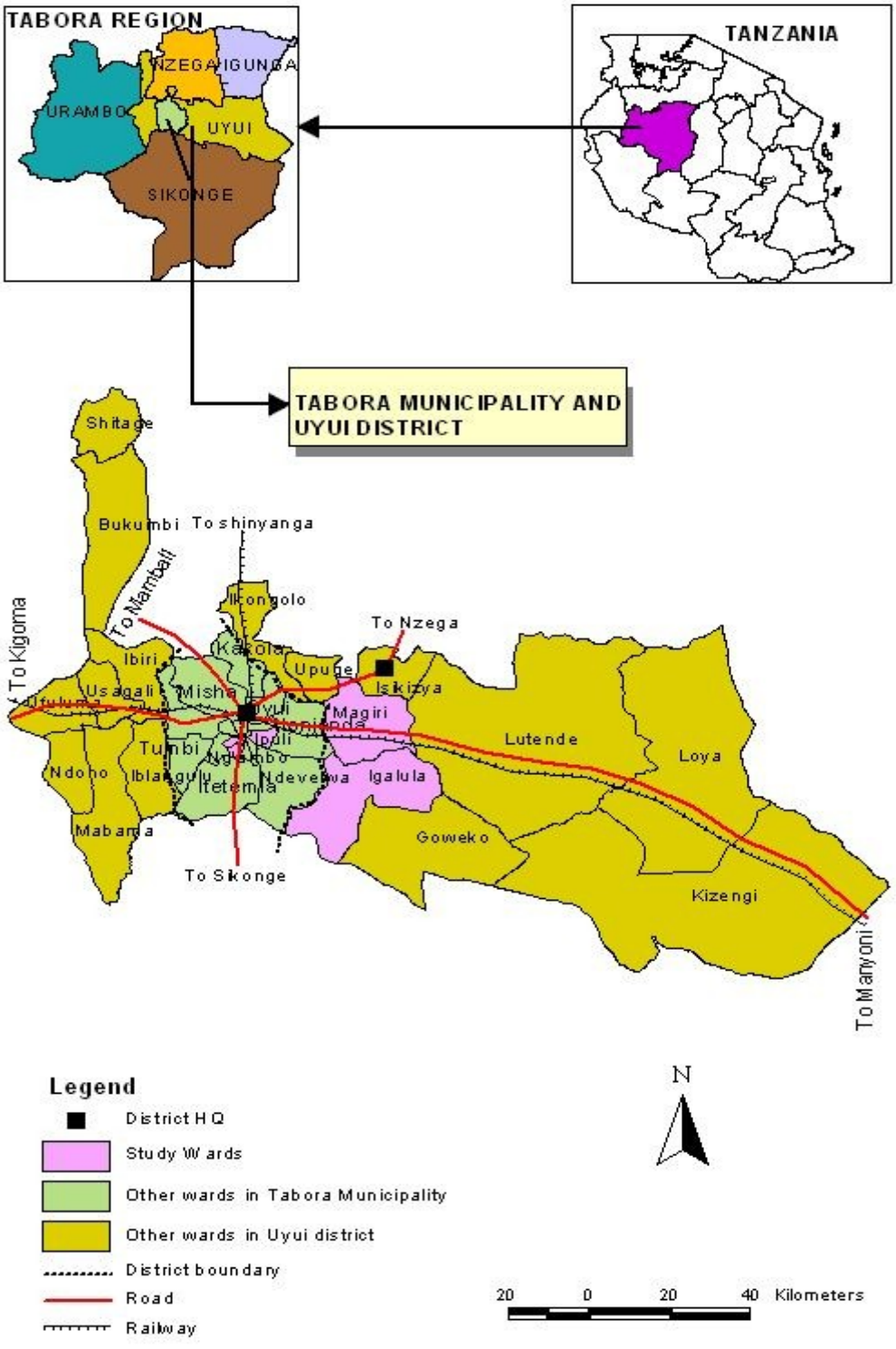

Figure 4: Map of Uyui District and Tabora Municipality showing wards involved in the study

3.2.1.2 Land area, land use pattern and administrative units

Uyui District has a total land area of 13 453 square kilometres most of which is plain land with very few small hills, valleys and escarpments (TDC, 2014). The arable land available for agricultural production is 471 square kilometres. Out of the arable land in the district, only 150 square kilometresare actually cultivated annually, living the remaining 321 square kilometres either lying idle due to some reasons such as soil leaching infestation, or being edges and river beds. Maize is the major food crop grown in the district. Other crops grown are cassava, sorghum, groundnuts, tobacco and cotton. Paddy produced in some wards of the district is dependent on rain fed floods and hence it is grown entirely in low lying lands. It is normally transplanted during January and February during long rain season (TDC, 2014).

About 220 square kilometres are forest reserves while normal forests grassland used for grazing cover are about 2600 square kilometres. Figure 5 shows land use pattern of the district.Administratively, Uyui District is divided into 3 divisions and 17 wards with a total of 92 villages distributed unevenly.

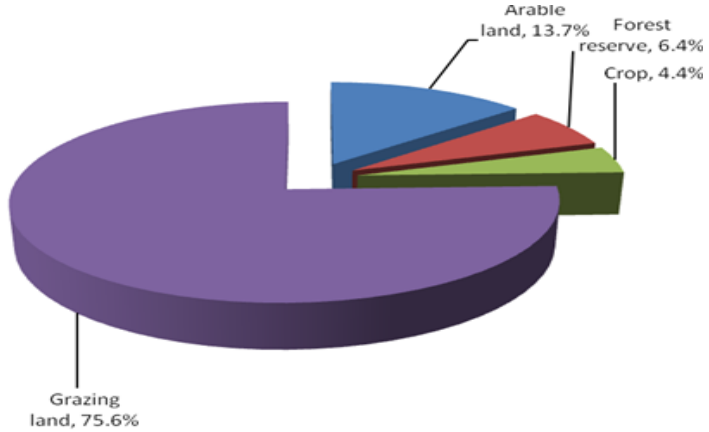

Figure 5: Land use pattern in Uyui District

Source: TDC (2014)

3.2.1.3 Climate, soil and topography

With exception of very few slopes, the district is relatively homogeneous with gently undulating plains intersected by seasonally flooded valley bottom soil. In the extreme North East, this pattern gives way to open flat land for cultivation and is covered by well or moderately drained soils with texture of sandy loams. The soils vary between red lateritic earth grey sand to silt hardpan and iron crust “mbuga”. Moreover, there are sandy clay loams and reddish coloured soils on inter flute slopes that are saturated with water within 100cm of the surface during the growing season (TDC, 2014). However, the majority of these soils have high nutrient contents and are considered suitable for a wide range of food and cash crops and have the potential for profitable cultivation and therefore Uyui District soils can best be described as best as moderately fertile. The district receives rainfall of between 750mm and 950mm annually falling between the months of October or November to February or March and a second lower peak occurs in February or March and the rains then tail off in April or sometimes in May (TDC, 2014).

3.2.1.4 Population and ethnic groups

According to the 2012 population and housing census, UyuiDistrict had a population of 396 623 people of whom 196 446(49.5%) were males and 200 177(50.5%) were females (NBS, 2012). The annual population growth rate for Uyui District was 2.6% with population density of 30 people per square kilometres and the average household size is estimated at 6.6.The District has two main ethnic groups namely: Nyamwezi and Sukuma. The majority of Sukuma occupy the North Eastern part of the district while the majority of Nyamwezi occupy most of the district. In addition to that, the district is also occupied by a small group of Ha in Western part (TDC, 2014).

3.2.1.5 Employment

Employment of the people is much diversified. It cuts across from self-employed groups, non-governmental organisations (NGOs) to government employees. Some people are employed in the local and central government while others in local and international non-government organisations (TDC, 2014). However, most people are self-employed working either in the agriculture and beekeeping sectors or running micro-enterprises such as small shops and market stalls. The business of charcoal making and marketing is another micro-enterprise conducted by individuals. It is quite common along main roads and feeder roads to see men with bicycles loaded with bags full of charcoal being transported to Taboratown for selling.

3.2.1.6 Main source of cash income

Uyui District as a rural district has vast economic opportunities. Agriculture sector ranked first with the selling of annual food crops being reported as the main source of income of the rural agricultural households in the district. This was followed by other casual cash earnings, sales of cash crops and then business income (TDC, 2014).

3.2.2 Tabora Municipality

3.2.2.1 Geographical location

Tabora Municipality is located at the centre of Tabora Region in the Western part of Tanzania and is the headquarters of the Region (Fig. 4). It lies between latitudes 4^{o} 52’ and 5^{o} 09’ South, and between longitudes 32^{o} 39’ and 33^{o} 00’ East. Also it is located about 800 kilometres West of Dar es Salaam and about 320 kilometresEast of Kigoma port on the shores of Lake Tanganyika.

3.2.2.2 Administrative boundaries

Tabora Municipal borders Uyui district in the East, North, West and South. Tabora Municipal was established as a Town Council in 1958. On the re-establishment of the Local Government Authorities in July, 1978, the boundary of Tabora Town Council was re-defined. A ministerial order declaring the boundary was published in the official Gazette as Government Notice No.97 of 30th June, 1978. In July 1988, Tabora Town Council (TTC) was raised to Municipal status. Hence, Tabora Municipal Council continued to Administer 13 wards until 8th November, 1991 when the Government Notice No.484 declared new boundaries to include 8 wards within its jurisdiction. At present, Tabora Municipal Council (TMC) consists of 25 wards, 31 villages and 116 hamlets.

3.2.2.3 Land and soils

Tabora Municipal has an area of 1 092square kilometresand is about 1.43% of the total area of Tabora Region. About 41% of the total area is arable land while 34% is occupied by natural forests, hills and ridges and 8% of the area is a planned area for human settlement (TMC, 2014).The soils in the Municipality fall under the following classes:

- Rock and very shallow soils found below 10cm deep from the surface. The local names of this group are “Lugulu”, “Masholo” and “Chamlimani”.
- Well drained soils having sand textures between 0 – 100cm from the surface, found around the uplands locally known as “Isenga”, “Luseni” and “Kichanga”.
- Soils with texture between 50 – 100cm of sandy clay loam and clay with reddish colour known as “Kikungu” soils.
- “Mbuga” soils found in areas with low ground water table of within 100cm of the surface during wet season. These soils are liable to flooding.

3.2.2.4 Population and ethnicity

According to 2012 Tanzania Population and Housing Census (URT, 2013), the population size of Tabora Municipal is 226 999, out of them males are 111 361 and 115 638 are the females. The annual population growth rate for Tabora Municipal was 2.9% with population density of 30 people per square kilometres. The main ethnic groups are Nyamwezi, Sukuma, Ha and Tutsi.

3.2.2.5 Economic activities

Main occupation provides an account with regard to what activity the labour force in the given locality is engaged in. The community ofTabora Municipality has such economic activities as farming, livestock keeping, forestry, fisheries, manufacturing activitiesand shopkeeping; while other people depend on public service employment. Crop farming had been the major economic activity in which maize and rice are the leading staple food crops and tobacco is the major cash crop (TMC, 2014).

3.2.2.6Poverty

Poverty is the major challenge towards development in the Municipality. To curb this problem, the Municipality has initiated several development schemes to economically empower the community. More than 30 Women economic development groups were initiated since 2007/08.

In the year 2011/12, the Municipality succeeded to promote Small and Medium Enterprises (SME's) where small business such as carpentry, agribusiness and livestock keeping were initiated through TASAF in collaboration with the Municipality (TMC, 2014). However, through such efforts, per capita income has increased from Tsh1019 565 in 2010 to 2 123 000 in 2012 per annum which is 48% increment (TMC, 2014).

3.2.2.7 Climate and topography

The climate of the Municipality is highly influenced by its altitude and distance from the sea in the East. It lies between 1,100m and 1,300m above sea level. The prevailing winds blow from East and Northeast. The Municipality receives an average rainfall of 800mm per annum. The heavy rains fall between November and April although the patterns are extremely variable and unpredictable. From the beginning of the rainy season normally in November, the rainfall peak in December, followed by a slight lull in January or February (TMC, 2014).

The mean temperature is between 22^{o}C and 26^{o}C. Highest temperature occurs in October just before the start of the rainy season and falls gradually in December and remains relatively constant until May. Between May and August temperatures are at their lowest levels (TMC, 2014).

Large part of the Municipality's terrain is gentle and undulating with an average slope of less than 5%. Hills surrounding the Municipality have high proportion of rock outcrops having steady slopes of more than 30% gradient.

3.2.2.8 Vegetation

Natural vegetation found in Tabora Municipality includes Miombo woodlands, acacia woodlands and grasslands (MNRT, 2013). Much of the natural vegetation has been degraded resulting to low production capacity. This is partially due to the fact that the area has been settled for many years without environmental conservation. Also, the disappearance of natural vegetation is attributed to population increase in the areas around Tabora town due to increasing demand for agricultural land, grazing, fuel wood and

building materials.Currently natural vegetation can only be seen in protected areas such as Igombe dam, Urumwa and Ntalikwa forest reserves. Also, they occur in areas abandoned by cultivators where the regeneration is taking place. In other parts of the Municipality, natural vegetation occurs as isolated natural trees or shrubs (TMC, 2014).

3.3 Research Design

A cross-sectional research design was used in this study. This approach has the advantage tothe researcher; to save time and collect data and information at a single point in time as stated by Kothari (2004). The design is also used for a descriptive study as well as for determination of relationship between variables. Moreover, the design is suitable because it is fast and can accommodate large number of study units at low cost (Casley and Kumar, 1988).In this study, questionnaire was the main toolfor data collection and supplementary information were captured by personal observations and checklist during Key Informants' (KI) interviews.

3.4 Sampling Techniques

Taking into account time allocated to conduct study and resource available; two wards from Uyui District and six wards from Tabora Municipal were purposively selected. These included Magili and Igalula wards in Uyui District and Ntalikwa, Gongoni, Ipuli, Ng'ambo, Chemchemand Kanyenye wards from Tabora Municipal. Theselection of wards was based mainly on production and marketing, and areas where charcoal value addition activities are accessible by road. The units of the study were the key actors along the chain which are charcoal producers, transporters, wholesalers, retailers and consumers. Both random and purposive sampling technique were used in selection of sampling units. A complete and numbered list of all large quantitycharcoal transporters and wholesalers in

the respective wards was collected from District Forest Manager. Wholesalers and/or large quantity transporters were not many and an attempt was made to cover all of them. The list of charcoal producers was obtained from village leaders. Charcoal producers, wholesalers and/or transporters were purposively selected while charcoal retailers andconsumers were randomly selected from the market centres and households respectively.

3.5 Sample Size

The sample of 114 respondents from different categories were drawn for interview which include: 38 producers, 37 retailers, five wholesalers/transporters and 34 consumers.This was based on different activities each of the respondents were doing.The sample size was reasonably large especially in conformity with Bailey's (1994) argument that around 30 cases seems to be the minimum for studies in which statistical data analysis is to be done.

3.6 Data Collection

3.6.1 Primary data

Primary data were collected using different set of questionnaires (Appendix 1 –5) that were designed with respect to each actor along the chain. The researcher used interview method through questionnaires administered to 114 respondents who were doing different activities along the chain. This method was useful to the researcher since it helped to obtain information even from respondents who have difficulties in reading and writting.These questionnares were supplemented by personal observation where the researcher observed various activities done by actors in the field such as charcoal producers, transporters, wholesalers, retailers and consumers. Also, one checklist (Appendix 6) for Key Informants was designed for the forest officials from TFS agency

and district councils, and some highly experienced charcoal dealers for Uyui District and Tabora Municipality.

Prior to the main survey, a pre-testing was done in order to test the validity of questionnares. A preliminary survey was used to establish sample frame, determine approximate time required in completing a questionnareand conducting situational analysis of the study area.

3.6.2 Secondary data

Secondary data were collected from different sources including books, journals, research studies, office records, published reports/papers, internet and national libraries.

3.7 Data Analysis

Qualitative data obtained from interviews, notes from researcher and observation were analyzed by using content analysis method. Ideas and issues were summarized, synthesized and reviewed against literature accessed to draw inferences on the matters in question.

Quantitative data obtained from questionnaires were entered, coded and analyzed by using Statistical Package for Social Sciences (SPSS) and presented using descriptive statistical tables, percentages, charts and graphs.

3.7.1 Analysis of profit and marketing margins of various actors along the value chain

(i) Profit margin analysis

At each node, the profit received by each value chain participant was calculated as the total revenue for each participant minus his/her total variable costs. Variable costs include

the purchase of charcoal, costs associated with production, marketing and transportation, taxes, fees, and vehicle, facility or equipment rental.

The profit margin for actor i at node j (PMij) was calculated as;

PMij = TRij – TVCij.....Eq (1)

Whereby:

TRij = revenue obtained by actor i at node j

TVCij = total cost incured by actor i at node j

(ii) Marketing margin analysis

Marketing margin is the percentage of the final weighted average selling price taken by each stage of the marketing chain. It measures the share of the final selling price that is captured by a particular agent in the marketing chain (Scott, 1995). The marketing margin was calculated by finding the price variations at different levels in a chain and then compare them with the final price paid by consumer using the following formula:

TGMM = [CP – PP]/CP*100.....Eq (2)

$GMMi = [SP_i – SP_{(i-1)}]/CP * 100$.....Eq (3)

GMM_P= 100% - TGMM.....Eq (4)

NMM = TGMM – TMC.....Eq (5)

Whereby:

TGMM = Total Gross Marketing Margin in %;

CP = Consumer Price;

PP = Producer Price;

GMMi = Gross Marketing Margin of ith agent at a given point in the chain;

SPi = Selling Price by ith agent at a given point in the value chain;

$SP_{(i-1)}$= Selling Price by a preceding agent (i-1), which is a buying price paid by ithagent at a preceding point in the chain;

GMM_P= The producer participation margin;

NMM = The Net Marketing Margin; and

TMC = The Total Marketing Charges expressed as percentage of retail price.

3.7.2 Analysis of factors influencing charcoal profitability among actors in the chain

In determining factors influencing charcoal profitability, the multiple linear regression (MLR) analysis was used. The MLR model was used because of the nature of data in which the dependent variable was measured on a continuous scale, there were more than one independent variables, and the relationship between dependent and independent variables was linear.

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_9 X_9 + \varepsilon \quad \text{.....Eq (6)}$$

Whereby:

Y = Charcoal profitability in Tsh measured as a gross profit of the actor;

α= Constant term;

β_1-β_9= Coefficients of the independent variable;

X_1 = Age;

X_2 = Education level;

X_3 = Gender;

X_4 = Experience;

X_5 = District of respondent;

X_6 = Sale of charcoal bags;

X_7 = Category of respondent;

X_8 = Involvement seasonin charcoal business;

X_9 = Marketing information; and

ε = Error term

3.8 Limitations of the Study

There were various factors that limited this study especially during the data collection:

(i) Forest officials normally conduct patrols in Uyui district and Tabora Municipality in which those charcoal dealers who are caught doing charcoal business without permission or license are taken before the court for disciplinary action. This made respondents difficult to believe that collected information was for studies or for the government. Therefore, the researcher had to spend a lot of time with respondents to explain the purpose of this particular study and clear their doubts and this improved their response.

(ii) The survey was done during the period when charcoal transporters within the region were not allowed to sale charcoal outside the region. The region issued the ban in order to minimize deforestation being caused by unsustainable charcoal production. The charcoal business was in the informal sector and data on the quantities of charcoal sold outside the region were not readily available. However, experience has shown that enforcement of the ban was weak. Charcoal transporters in Tabora Municipality indicated that they were transporting charcoal to Dar es Salaam and Mwanza at least twice per month. Some of the charcoal was purchased through legal system, but majority was through black market.Because of fear, some people were not ready to disclose information about their charcoal

transportation business which increased the cost for data collection to the researcher who extended duration for data collection while looking for the people who were willing to provide the required information.

(iii) Some respondents refused to give any information since they were tired of the students and the government people who always come to collect some information and disappear without any changes. The researcher had to replace those who refused until sufficient sample was obtained.

Regardless of the limitations, the information collected was appropriate to achieve the objectives of this study.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Overview

The purpose of this research was toanalyse charcoal value chain in Uyui District and Tabora Municipality. This chapter represents the findings obtained during the time of data collection. It is divided into four sections. The first section outlines the chapter overview. The second section describes the charcoal value chain actors, their roles and socio-economic characteristics. It is very important to study the characteristics of chain actors in order to comprehend how they influence the value chain performance. The third and fourth sections deal with charcoal profitability whereby; the third section covers the profit margin analysis at different nodes of charcoal value chainwhile the fourth section deals with factors influencing charcoal profitability among actors in the study area.

4.2 Value Chain Actors,their Roles and Socio-economic Characteristics

The charcoal value chain comprises a range of actors; this study identified five key actors in the value chain. They include charcoal producers, transporters, wholesalers, retailers and consumers. The number of actors in the value chain is possibly a function of the routes followed by charcoal from producers to consumers. The key value chain actors reported in previous studies (Kambewa *et al.*, 2007; Shively *et al*., 2010; Blodgett, 2011; KFS, 2013) included transporters, wholesalers and retailers.

4.2.1 Socio-economic characteristics of value chain actors

4.2.1.1 Characteristics of charcoal producers

The survey results indicated in Table 5show that all sampled charcoal producers were males. This is an indication that charcoal production is largely undertaken by men. The

results show further that a large number of charcoal producers (65.8%) were aged between 18 and 30 years. These men and young age group domination in charcoal production may be ascribed by gender roles and responsibility based on the local culture. Although less supported by the findings of this study, it is worth noting that charcoal making is a laborious undertaking, hence requiring physically strong and active people and may require putting them away from home over extended period of time. This may partly explain why the active age group of men are more likely to play central role in charcoal making leaving women at home to take care of the family. It should be noted that men's strength is considered to be greater than women's in physical work and therefore it determines the tasks carried out in day-to-day activities and directly affecting the specific activities of the charcoal value chain. Although it was not established in this study, it can be hypothesized that women are generally excluded from the cutting and burning stages of charcoal as they are likely to be perceived as lacking the strength required to cut trees and burn them for charcoal, and most of these activities being conducted in remote locations.These findings are almost similar to that of Herd (2007) who reported that charcoal production in the Chicale Regulado,Mozambique is dominated by males (77%) with 22-35 age bracket, and the high number of women in the population was not expected due to the physical nature of the activity.

Education wise, it was found that 63.2% of charcoal producers were illiterate and 36.8% had attained primary education. The larger number of people with no formal education and others having just attained primary education suggests that charcoal production has been considered as self-employment by the majorities who have not been employed and have failed to advance themselves in education. The study findings on education concur with Shively *et al*. (2010) who argued that charcoal producers in Uganda have the lowest level

of education.Regarding respondents' marital status, results show that half (50%) were married. This suggests that considering the age group and marital status, charcoal production is largely done by mature people and most are likely to depend on charcoal production as one of the sources of income to the family.

Table 5: Socio-economic characteristics of charcoal value chain actors

Item	Producer (n=38)		Transporter/Wholesaler (n=5)		Retailer (n=37)		Consumer (n=34)	
	Count	%	Count	%	Count	%	Count	%
Gender								
Male	38	100.0	4	80.0	15	40.5	14	41.2
Female	0	0.0	1	20.0	22	59.5	20	58.8
Marital status								
Married	19	50.0	3	60.0	27	73.0	34	100.0
Unmarried	19	50.0	1	20.0	5	13.5	0	0.0
Separated	0	0.0	1	20.0	0	0.0	0	0.0
Widowed	0	0.0	0	0.0	5	13.5	0	0.0
Age								
18-30	25	65.8	0	0.0	13	35.1	20	58.8
31-45	0	0.0	3	60.0	16	43.2	3	8.8
46-60	4	10.6	2	40.0	8	21.6	8	23.5
Above 60	9	23.6	0	0.0	0	0.0	3	8.8
Educational level								
Illiterate	24	63.2	1	20.0	12	32.4	0	0.0
Primary school	14	36.8	3	60.0	20	54.1	31	91.2
Secondary school	0	0.0	1	20.0	3	8.1	3	8.8
College	0	0.0	0	0.0	2	5.4	0	0.0

4.2.1.2 Characteristics of charcoal wholesalers/transporters

The results of this study revealed that there was a vivid male dominance in wholesalers/transporter's gender composition (Table 5). The proportion of female charcoal wholesalers/transporters in the study area was only 20% while the rest (80%) were males. This situation could be attributed by the difficult nature of the business, which involves travelling to remote production sites to collect charcoal and returning back to the selling points. Furthermore, men are likely to often have more access to capital to purchase large

amounts of charcoal for resale to retailers. Findings from this study thus concur with those of KFS (2013) which reported that 90% of the charcoal transporters/wholesalers interviewed in Kenya were males.

Education wise, the majority of the sampled wholesalers/transporters had attained primary education. As far as age composition is concerned, it was revealed that almost two-third (60%) of sampled wholesalers/transporters were aged between 31 and 45 years and the rest (40%) were aged between 46 and 60 years. Again, like the charcoal producers whom mostly comprised of married people, 60% of the charcoal wholesalers/transporters were married. This implies that, due to their social and economic commitments (include ensuring food availability for family members, better housing, education cost for children, clothing and acquisition of better health services), married couples are more likely to engage into charcoal wholesaling/transportation as one of the income generating activities. These observations are likely to translate into inequitable monetary gain in charcoal value chain based on gender, level of education and marital status in the study area.

4.2.1.3 Characteristics of charcoal retailers

Results show that 59.5% of retailers were females and 40.5% were males (Table 5) suggesting that females are more likely to be involved in the charcoal retailing business and therefore leaving men to perform the laborious tasks of producing and transporting charcoal. Charcoal retailing is rather likely a light duty compared to charcoal production and wholesale. The fact that most of charcoal retail businesses are conducted around homesteads might influence women to concurrently selling charcoal while at the same time performing other primary activities like taking care of children and cooking. Charcoal production and wholesale were likely to be done by men probably because were hard task duties that are carried away from home and needs travelling and camping. These findings

are supported by CHAPOSA (2002) study which reported that most ofsmall scale charcoal retailers found within very close proximity to households.

Married respondents accounted for 73% while 13.5% were single and another 13.5% were widowed (Table 5). This suggests that charcoal retailing business is an important source of income to their families. The results further revealed that (43.2%) of charcoal retailers were aged between 31 and 45 years, 35.1% were aged between 18 and 30 years and 21.6% were aged between 46 and 60 years. This implies that charcoal retail business is done by all age groups although dominated by the middle aged people. This is probably because middle aged people are more active and have more responsibilities, the young aged people are likely be engaged in other activities like schools while the elders are likely to be engaged in leadership roles. Education wise, 54.1% of sampled charcoal retailers had attained primary education, 32.4% were illiterate, 8.1% had attained secondary education and 5.4% had attained college education. This implies that as one gets to higher levels of education, he/she is less likely be engaged in charcoal retail business.

4.2.1.4 Characteristics of charcoal consumers

Study findings revealed that more than half of the sampled households (59.4%) in Tabora Municipality, used charcoal as the main source of energy while the rest (40.6) used other sources of energy like firewood, kerosene, LPG (gas) and electricity. This indicates that Tabora Municipality households rely more on charcoal as they are less likely to opt for alternative sources of cooking fuel; for instance, a Municipality residence is likely to have no sufficient time to search for and collect firewood as a source of cooking fuel compared with their counterparts in rural areas. The study findings are in line with Van Beukering *et al.* (2007) who argue that more than 85% of the total urban population in Tanzaniadepends

on charcoal for household cooking and energy for small and medium enterprises. The findings from this study are supported by Camco (2014) who claimed that charcoal demand in Dar es Salaam is about 91% and in other urban areas is 59.1%. The study's findings also concur with KFS (2013) report that charcoal demand in Kenya is high among urban households. Charcoal is preferred in urban areas because it is cheap, easy to transport, distribute and store. It is almost smokeless and has a higher caloric value (30 MJ/kg) than firewood (15MJ/kg) (Van Beukering *et al.*, 2007).

During the household survey, the characteristics of the respondents who were present by then were just representative of the family but charcoal was either consumed or not by the particular family. The survey results revealed that, 58.8% of sampled household representatives were females and all of them were married (Table 5). As far as age distribution is concerned, majority (58.8%) of sampled household representatives were aged between 18 and 30 years while 23.5% were aged between 46 and 60 years, 8.8% were aged between 31 and 45 years and another 8.8% were aged above 60 years. As regards to education, it was revealed that 91.2% of sampled family representatives had attained primary education and the remaining 8.8% had attained secondary education.

4.2.2 Roles of value chain actors

4.2.2.1 Charcoal producers

These are the main key actors within the carbonization section of the Charcoal Value Chain in which they provide labour for charcoal preparation at site. Study findings have shown that charcoal producers can either be contracted by bicycle transporters (cyclists), large-scale transporters (vehicle transporters) or wholesalers or work on their own selling their product individually. They either consider charcoal production as their main

economic activity or temporary engagement only especially when they need immediate money. Charcoal making is more or less a zero-cost activity and it is supported byVan Beukering *et al.* (2007) who argue that involvement of rural people in charcoal production is related to the labour- intensive nature of the business with a very low input of capital. Charcoal production in the study area is conducted by formal as well as informal actors. Most producers collect the wood free of charge, use their own labour and make a negligible initial investment to buy the basic tools required to set up the activity (i.e.axe, machete, hoe and spade). These are the primary tools required for charcoal production in the study area and are usually used for more than two years. It was revealed that people in the study area were encouraged to produce charcoal due to lack of alternative income generating activities and the fact that charcoal is a cash product, with a large ready market to absorb the entire production. The findings from this study are supported byVan Beukering *et al.* (2007) and KFS (2013) in which the later argued that most of the small scale charcoal producers in Kenya were directly involved in charcoal production and had no other alternative sources of income apart.

The results in figure 6show that producer's main source of trees for charcoal preparation was from private forests (40%), forest reserve (26%) and from public/open land (34%). Charcoal was also produced when new land is cleared for crop production. Trees cleared from such land are used to produce charcoal. This study revealed that charcoal is produced throughout the year, though quantities varied with seasons. Even though its demand within the urban areas peaked during the rainy season, most producers reported a disruption in charcoal production due to activity switching in favour of farming activities during this time. The average amount of charcoal per producer is approximately 30 bags per month which is consistent with Camco (2013) study which found that production quantity varies

from 5 bags to 30 bags per month.These findings are almost similar to those of Mndeme (2008) who argue that most of charcoal producers in Morogoro rural district produce an average of approximately 28 bags per month each bag weighing at an average of 56 kg.

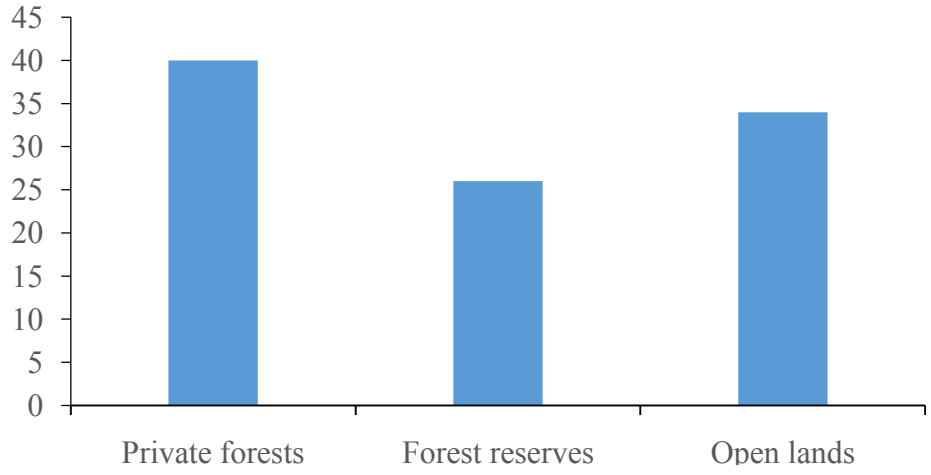

Figure 6: Percentage responses on different sources of trees for charcoal preparation

4.2.2.2 Charcoal transporters

The study observed two main means of transporting charcoal from the production site to market centres. These include vehicles ranging from 3 to 30 tons (Plate 1) and bicycles (Plate 2). Other means of transport that were rarely used included tractors, small vehicles (pickup) below 3 tons, carts and by head. Findings from this study thus concur with KFS (2013) and Mndeme (2008) who argued that the common means of transport are (motorized) lorries, tractors and pickups and (non-motorised) bicycle and carts. Most of the large-scale transporters in the study area were also the wholesalers who transported charcoal for long distances of more than 20 km. Charcoal transporters using vehicles normally secure a transit pass (TP) from Tanzania Forest Services (TFS) offices at a fee of Tsh 6,500 for a seven ton vehicle or below and Tsh 13 000 for a vehicle above seven tons.

Plate 1: Charcoal being transported by a vehicle

Plate 2: Charcoal being transported on a bicycle from farmlands to the market

The bicycles (Plate 2) were used to transport charcoal for short distances of less than 20 km and normally carried one to four charcoal bags per trip each weighing about 56 kg.The

study observed that most of the bicycles were used to transport charcoal from production sites to Tabora Municipality for sale. Most of the bicycle transporters (cyclists) had no trade license and they were not paying forest royalty. They bear a great risk of being arrested by forestry officials for avoiding to pay forest royalty of Tsh 8,960 per bag of 56 kg. If arrested they loose both the charcoal and their bicycle or pay a penalty of five times the value of the charcoal they were found with of which most cyclists are unable to pay. To reclaim their bicycle they have to pay around Tsh 20 000 to 50 000 for each bicycle. However, law enforcement by forestry officials was reported to be weak as most consumers of charcoal in Tabora Municipality were regularly supplied with charcoal without scarcity and at affordable prices.

4.2.2.3 Charcoal wholesalers

It was found that majority of the wholesalers purchased charcoal mostly from producers and rarely from middlemen or transporters, and resale to either retailers or directly to consumers. However, from the study areas it was observed that there were very few individuals operating as wholesalers compared to other actors within the charcoal chain and they normally sale charcoal outside the Tabora Region. Most of them were transporting to Dar es Salaam for wholesale. The findings on purchasing and selling of charcoal for the wholesalers are similar with KFS (2013) study which reported that wholesalers purchase charcoal either from producers or transporters or brokers and sell to retailers in bags which is also consistent with Kambewa *et al.* (2007) study that, wholesalers buy charcoal from producers and transport it to wholesale or retail markets in town.Wholesalers in the study area obtain annual business licenses or registration certificates from Tanzania Forest Services (TFS) offices at a fee of Tsh 256 000 and trade

licences from Tanzania Revenue Authority (TRA) offices at a fee calculated according to their capital.

4.2.2.4 Charcoal retailers

Retailers in the study area had a tendency to buy charcoal mostly from either producers or bicycle transporters and rarely from wholesalers, and sell directly to consumers. Retailers sell their charcoal in bags and smaller units such as bucket, used paint tins and heaps. The business of selling charcoal in small units is mostly done by women and most of them were found engaged in other businesses in addition to selling charcoal. This suggests that retailing charcoal alone is not sufficient to meet family household financial requirements. The study findings converge with KFS (2013) study which argued that most of the retailers visited during the Nairobi questionnaire charcoal survey were engaged in other businesses in addition to selling charcoal.The study's findings also concur with Kambewa *et al*. (2007) who claim that in Uganda, smaller retailers usually sell other produce (beans, rice, sugar and maize flour) as well as charcoal.

In addition, some of the charcoal from the suppliers (producers and bicycle transporters) was purchased through legal system, but majority was through black market and also, most of the retailers were operating without license. The retailers' main customers were households (92%) and food businesses (8%) (Fig. 7). The figure tells that households were likely to be characterised with low purchasing power compared to food businesses. The later were likely to be able to opt other means of fuel sources like electricity and Liquefied Petroleum Gas (LPG).

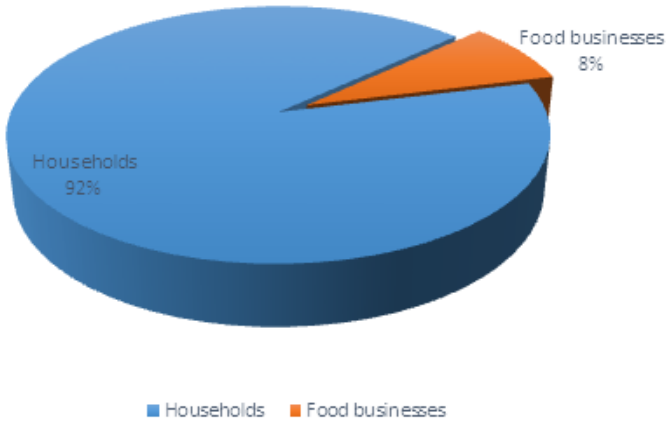

Figure 7: Percentage of retailers' main customers

The retailers' main source of charcoal was from bicycle transporters (68%) followed by producers (19%) and wholesalers (13%) (Fig. 8). This is probably because unlike producers and wholesalers, the bicycle transporters usually take the charcoal up to the selling point of the retailer in which he/she does not incur transportation cost. The study findings on retailer's main customers and source of charcoal are partly similar to that of KFS (2013) study which found that retailers' main markets were households (20%); households and commercial enterprises (67%); households, commercial enterprises and institutions (10%); and households and institutions (3%). KFS (2013) study show further that the retailers' source of charcoal was 7% from producers, 80% from transporters, 7% from wholesalers (depots) and 7% from both producer and transporter.

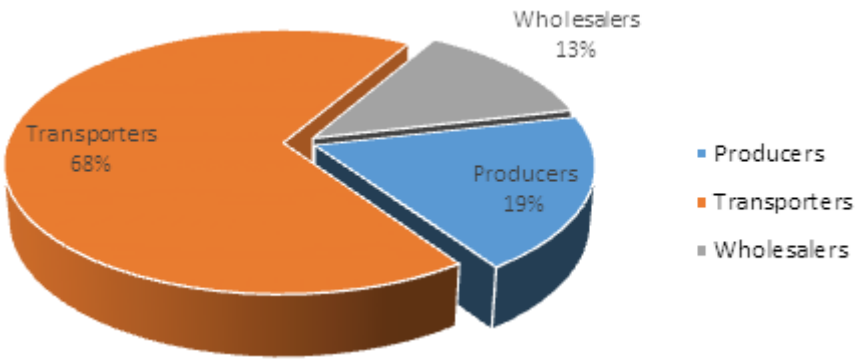

Figure 8: Percentage of retailers' sources of charcoal

4.2.2.5 Charcoal consumers

These are ultimate users of charcoal in which the majority of the consumers were households, others were commercial businesses such as hotel, restaurants, food vendors, chips and meat fryers. This is probably because, households have low purchasing power compared to commercial businesses who were able to opt for other energy sources like electricity, kerosene or gas. The study findings converge with KFS (2013) study which claimed that majority of charcoal consumers cannot afford alternatives such as LPG or electricity for cooking and heating; thus making it the main source of energy for millions of people within Sub-Saharan Africa (SSA). Thus, dependence on charcoal as the main source of energy is likely to be associated with poverty. The results indicated that charcoal is utilized mainly for cooking (73%), followed by heating/water boiling (19%), drying/preservation (5%) and for ironing (3%) (Fig. 9). These findings are supported by Kambewa *et al*. (2007) who argue that in Malawi, urban consumers of all socio-economic strata use charcoalfor cooking, heating, and other household needs, including ironing.

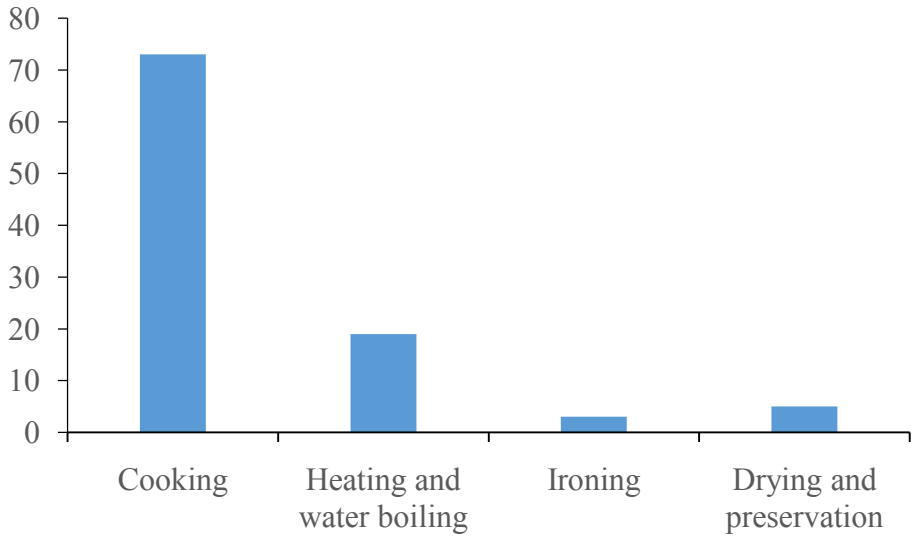

Figure 9: Percentage distribution of consumers according to pattern of utilization of charcoal

4.2.2.6 Value addition activities in the charcoal chain

In any value chain it is usually common to have value addition activities. In Charcoal Value Chain as well, there are numbers of value addition activities which are pursued by actors. The main value-adding activities in the charcoal industry include production, packaging and transport. The study revealed that producers undertake most of value addition activities before the products can reachultimate consumers. The value addition activities which were reported to be borne by producers are production, grading and packaging of charcoal into bags in the field. On the other hand, transportation of charcoal bags ready for sale was reported to be the only value addition activity undertaken by wholesalers/transporters in the chain. The study findings on value addition activities concur with Kambewa *et al*. (2007) who claim that in Malawi, the value-adding activities at the production sites are the conversion of trees and labour into charcoal, and packaging where the packaging was done either by the producers or by buyers themselves. The major value-adding activity from production site to market is transport, as there is little storage of charcoal, perhaps because of its unlicensed status.

4.2.2.7 Preferred tree species used for charcoal production

Charcoal producers have strong preference for some trees in the production of charcoal.The most common and preferred tree species for charcoal production in the study area are listed in Table 6. Respondents reported more preference on some of the species due totheir availability and high density charcoal produced from indigenous species. Out of 17 tree species listed,*Brachystegiaboehmii*ranked first (23.3%) followed by *Terminaliasericea*(19.3%)and*Brachystegiaspiciformis*(18.2%). Other species included *Combretumzeyheri*(7.3%),*Pericopsisangolensis*(6.5),*Julbernardiaglobiflora*(5.8%),*Brachy stegiamicrophylla* (4.4%), *Catunaregamspinosa*(3.6%) and

Combretumbinderianum(3.3%). The charcoal producers showed less preference to other specieslisted in Table 6 probably because of unavailability and poor quality of charcoal produced. This means that most preferred species are going to perish if the future afforestation programmes will not put more emphasis on those species.

These findings are almost similar to those of Herd (2007) who argue that*Brachystegia boehmii*, *Brachystegia spiciformis*, *Julbernardia globiflora*, *Pterocarpus rotundifolius* and *Burkea Africana*were preferred for charcoal production in the Chicale Regulado, Mozambique while*Julbenardia globiflora,Combretum molle, Brachystegia boehmii*, *Acacia robusta*, *Acacia nigrescens, Acacia nigrescens, Brachystegia microphylla* and*Sclerocarya birrea*were reported by Mndeme (2008) inMorogoro rural Districtfor the same purposes.

Table 6: Preferred tree species used for charcoal production

Vernacular name (Nyamwezi)	Botanical name	count	% of response
Myenze	*Brachystegiaboehmii*	64	23.3
Mzima	*Terminaliasericea*	53	19.3
Mtundu	*Brachystegiaspiciformis*	50	18.2
Msana	*Combretumzeyheri*	20	7.3
Mbanga	*Pericopsisangolensis*	18	6.5
Muba	*Julbernardiaglobiflora*	16	5.8
Mgela	*Brachystegiamicrophylla*	12	4.4
Mpogolo	*Catunaregamspinosa*	10	3.6
Mlandala	*Combretumbinderianum*	9	3.3
Mwembe	*Mangiferaindica*	7	2.5
Mgongwa	*Clerodendrumstuhlmannii*	4	1.5
Mpumbuli	*Brachystegiawangermeeana*	4	1.5
Mlama	*Combretumquainzii*	3	1.1
Mbapa	*Markhamiaobtusifolia*	2	0.7
Mkwaju	*Tamarindusindica*	1	0.4
Mperapori	*Combretumschumanii*	1	0.4
Mgembe	*Dalbergiamelanoxylon*	1	0.4
Total response		**275**	**100**

4.2.2.8 Charcoal production technology

There are a variety of kiln designs used to make charcoal in Tanzania.According to Malimbwi *et al*. (2007), charcoal is produced using two main types of kilns, namely half orange bricks kiln and earth mound kiln which is the most used in Tanzania. Furthermore, earth mound kilns are divided in three groups depending on the arrangement of wood billets in kiln construction and the name of the kiln depends on the kiln shape after construction. If it is like a rocket bomb then is called *Rocket*(Plate 3), If the shape is box like then the kiln is called *Box*(Plate 4)and if the shape is cone like it is called *Msonge* (Swahili word for roundish hut) (Plate 5). Box and rocket kilns are the two methods commonly used in the study area by small scale charcoal producers that are operating in the informal sector.

Plate 3: Charcoal production using rocket kiln

Plate 4: Charcoal production using box kiln

Source: Adapted from Malimbwi and Zahabu (2008)

Plate 5: **Charcoal production using msonge kiln**

Source: Adapted from Mndeme (2008)

Current charcoal production technologies by the producers as reported by KFS (2013) as inefficient resulting in massive wastages during wood conversion to charcoal.The traditional earth kilns, which are the most commonly used by charcoal producers in

Kenya, have very low efficiency of 10-20% in converting wood to charcoal (Mutimba and Baraza, 2005). The efficiency of charcoal burning kilns in Tanzania is also low (11-30%) which means that more wood is needed to meet the energy needs of consumers (Van Beukering *et al.*, 2007). This accelerates the rate of deforestation. The situation has been worsened by low adoption levels of new and improved technologies due to high initial investments required among other factors. Efficiency not only depends on the type of kiln used, but also on the type of wood, its moisture content, density and diameter as well as the experience of the operator and climatic conditions.The traditional conversion of wood to charcoal wastes as much as 70% of wood caloric value, which accelerates the destruction of woody vegetation (Van Beukering *et al.*, 2007).

Most of the wood used to burn charcoal is either obtained freely from on-farm sources, or illegally from government sources.From the survey, it was realized that there are three types of charcoal producers namely; full time, seasonal and occasional producers. Full time producers live within the forest areas and produce charcoal throughout the year, shifting to new areas when the sources become depleted. Seasonal producers practice agriculture as their main occupation and produce charcoal only in off-farming period of the year. Occasional producers make charcoal to meet specific cash needs during the year.

4.2.2.9 Marketing channels for charcoal in the study area

Marketing channel analysis is a useful tool in examining the series of intermediaries and their systematic linkage in performing marketing functions and information flow in the market chain to facilitate the flow of goods and service from the point of production to the end users.The study revealed that there is no integrated marketing strategy in the study area for selling charcoal that involves all stakeholders. However, four different

channelsused were identified and are summarised in Fig.10. The study findings are in line with KFS (2013) and Kambewa *et al*. (2007) which reported almost similar channels.

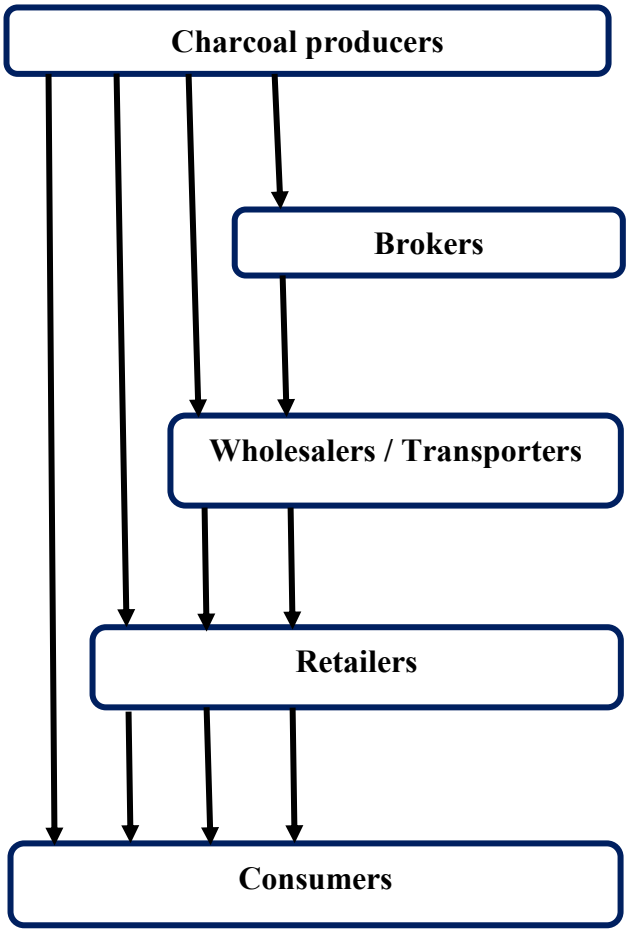

Figure 10: Marketing channels for charcoal in the study area

Channel 1: Producer to consumer: A small-scale producer takes the charcoal directly to the consumer. However,in the study area, it was noted that a few producers are able to transport charcoal to the consumers in which case the profits are higher. The producer may have established customers or sells to whoever wishes to buy.This is mostly common along the roadsides (highways) and in places where the production sites are not far from urban areas. Majority of the buyers are travellers and vehicle drivers. In terms of compliance to the charcoal rules and regulations, this channel has the highest rate of non-

compliance with most of the producers not paying forest royalty and not securing transport permits.

Channel 2: Charcoal producer to retailer to consumer: A retailer purchases the charcoal from the producer and takes it directly to consumers' homes. However, a few producers are able to transport charcoal to the retailers at the market in which case the profits are higher. Most of the people involved in this option (channel) do not have the requisite permits and documentation to trade in charcoal.

Channel 3: Charcoal producer to wholesaler/transporter to retailer to consumer: Charcoal producer sells charcoal to wholesaler or transporter. Wholesaler/transporter sells to retailer who then sells to consumers. This is the most common channel in the market with the retailers selling charcoal to consumers in smaller quantities, usually buckets, painting tins and heaps.The compliance levels are high where the transporters and wholesalers secure the transport permits and pay forest royalty and other fees accordingly.

Channel 4: Charcoal producer to broker to wholesaler/transporter to retailer to consumer: The broker in this channel connects the producer to the wholesaler/transporter. The brokerusually connects to buyers and negotiates prices with the buyers and also, facilitate faster sales.

4.3 Profit Margins Analysis along the Charcoal Value Chain

4.3.1 Profit margin analysis forcharcoal producers

Production and selling of charcoal provide employment opportunities and income generation to a large segment of the rural population in the study area. Thecosts involved

in charcoal processing using either box or rocket kiln typeinclude wood cutting, kiln construction, carbonization process, unloading charcoal from the kiln and loadingcharcoal into bags. This study revealed that a charcoal maker used 2 mandays in wood cutting, 2 mandays in kiln construction, 5 mandays in carbonization, 1 manday for unloading charcoal from the kiln and 1 manday for loading charcoal into bags that makes a total of 11 mandays (Table 7). These mandays produced an average of 20 charcoal bags.Therefore, using the current average wage rate of Tsh8,000, the labour cost for producing 20 bags of charcoal was 88 000 (Tsh 4,400 per bag)(Table 7)and the cost for buying 20 empty bags was Tsh 10 000 (Tsh 500 for each bag) that makes a sub total cost of Tsh 4,900 per bag. The study findings are in line with Mndeme (2008) studies which reported almost similar costs in rocket kiln type except that an average wage rate by then was Tsh 3,500.

Table 7: Production costs in charcoal processing

Cost item	Average number of mandays	Cost (Tsh)
Wood cutting	2	16 000
Kiln construction	2	16 000
Carbonization and cooling	5	40 000
Unloading charcoal from the kiln	1	8,000
Loading charcoal into bags	1	8,000
Total	**11**	**88 000**

Charcoal production also involves the cost of buying equipment, though some are used more than once in charcoal production. These equipment include an axe, machete, hoe and spade. Axe and machetewere used in wood cutting and average purchasing costs were Tsh 10 000 and 5,000 and normally are used for 3 and 2 years respectively. Since this study revealed that average monthly charcoal production by the small producers is about 40 bags, and therefore during the life time in use 1,440 and 960 charcoal bags are produced

using these equipment that gives the equipment unit cost of producing one charcoal bag to be Tsh 7 and 5 respectively (Table8).

However, hoe and spade are used in kiln preparation and charcoal unloading from the kiln. Purchasing cost for these equipment were Tsh 5,000 and 6,500 and normally are used for 2 and 4 years respectively. The average total number of charcoal bags produced during the life time of the equipment was 960 and 1,920 which makes the average equipment unit cost per bag to be Tsh 5 and 3 respectively (Table8). Thus, equipment in totality contributed about Tsh 20 in each charcoal bag produced.

Table 8: Costs of equipment in charcoal production

Type of equipment	Purchasing price (Tsh)	Life time in use (years)	No. of charcoal bags produced/year	Total no. of charcoal bags produced/equip.	Unit cost per bag/equip (Tsh)
Axe	10 000	3	480	1,440	7
Machete	5,000	2	480	960	5
Hoe	5,000	2	480	960	5
Spade	6,500	4	480	1,920	3
Total					**20**

Therefore, total charcoal cost of each bag includes Tsh 20 as equipment cost. This implies that an average cost of Tsh 4,920 was used to produce one charcoal bag. Charcoal producers normally sell a bag of charcoal weighing about 56 kg at the average farm price of Tsh 6,000. The charcoal producer therefore makes a nominal profit of Tsh 1,080 per bag.

4.3.2 Profit margin analysis for charcoal transporters

4.3.2.1 Charcoal transportation by vehicles

It was revealed that vehicles were used in transporting charcoal for long distancesto other regions of Tanzania mostly to Dar esSalaam.Transporters in the study area buy charcoal from the producers and resale to wholesalers or retailers. As discussed earlier in section

4.2.2, most of the large-scale transporters in the study area are also wholesalers.The total variable costs incurred by transporters which include cost of purchasing charcoal, transporting, payment of forest royalty, transit pass fee, loading and unloading, communication, purchase of empty bags, supervision andcontingencywas Tsh 494 344 (Table9). Wholesale price per ton of charcoal in Dar es Salaam is Tsh 810 000 (Tsh 45 000 per bag of 56 kg). The transporter therefore makes a nominal profit of Tsh315 656 per tonwhich is equivalent to Tsh 17 536 per bag.

Table 9: Direct costs incurred and profit accrued by transporters/wholesalers

Cost item	Units/ton	Cost/unit (Tsh)	Total costs (Tsh)
Purchase of charcoal from producers	18	6,000	108 000
Purchase of empty bags	18	500	9,000
Packaging of charcoal to bags	18	500	9,000
Rope (“kudu”)	1	5,000	5,000
Supervision	2	4,500	9,000
Loading and unloading of charcoal bags	18	1,000	18 000
Forest royalty per bag of 56 kg	18	8,960	161 280
Transit pass fee paid to TFS office	1	13 000	13000
Forest cess fee paid to District council	18	448	8,064
Village fee paid to village council	18	500	9,000
Transport to DSM using 30 tons vehicle	18	7,500	135 000
Communication (air time)	1	5,000	5,000
Contingency	1	5,000	5,000
Total direct costs per ton			**494 344**
Sales price per ton			**810 000**
Profit per ton			**315 656**

4.3.2.2 Charcoal transportation by bicycle

Observations in the study area during the field visit showed that bicycles were also a common means of transporting charcoal to the market. Most of the bicycle transporters (cyclists) in the study area normally buy charcoal from producers within the farm at an average price of Tsh 6,000 per bag of 56 kg and transport it to the urban areas for sale at

Tsh 17 000. This implies that charcoal transported by bicycle can generate a profit of Tsh11 000 per bag. Cyclists who were interviewed indicated that on average they operate for 20 days a month and each day can transport two to four bags of 56 kg. Using the assumption of selling an average of three bags per day for 20 days they could sell 60 bags of charcoal per month and therefore, the cyclist earns Tsh 660 000 per month.

4.3.3 Profit margin analysis for charcoal vendors

The charcoal vendors within the value chain include wholesalers and retailers

4.3.3.1 Wholesalers

Wholesalers usually buy and sell their charcoal in bulk. They purchase charcoal from producers and transport it to other regions of Tanzania mainly to Dar es Salaam for sale to retailers. Like charcoal transporters, the wholesalers also incur the same variable costsas presented in Table 9because both of them purchase charcoal from producers and also transport to other regions mostly Dar es Salaam. The cost of purchasing one ton of charcoal (18 bags of 56 kg) and transport it to Dar es Salaam, covering forest royalty and other variable costs is Tsh494 344 (Table 9). Wholesale price per ton of charcoal in Dar es Salaam is Tsh810 000 (Tsh 45 000 per bag of 56 kg). The wholesalers therefore makes the same nominal profit of Tsh315 656 per ton of charcoalas that of transporters which is equivalent to Tsh17 536 per bag.

4.3.3.2 Retailers

The retailers in the study area normally buy their charcoal mostly from small-scale transporters (cyclists) and rarely from wholesalers and sell to consumers in smaller units (Plate 6). The average purchasing price for a bag of charcoal around 56 kg from a bicycle transporter (cyclists) or wholesalers was Tsh 17 000. The retailers sell charcoal in smaller

units in which the common units were small buckets with an average weight of 5 kg whose average price was Tsh 2,000 and paintingtins of about 3 kg and the average selling price was Tsh 1,000. Also, charcoal was sold in heaps (about 1 kg) at an average price of Tsh300. Finally, after selling by different small units, they get an average total of Tsh19 200 for a bag of charcoal. There is no any other variable cost incurred by retailers apart from cost of purchasing charcoal. The retailer therefore makes an average gross profit of Tsh2,200 per bag.

Plate 6: Charcoal being sold in small units

4.3.4 Profit margins distributions among actors in the charcoal value chain

Table 10 presents the revenue earned per bag, cost incurred, and profit margin per bag at each stage of the chain for charcoal. These values were calculated as described in sections 3.7.1, 4.3.2 and 4.3.3.The table show that wholesalers and transporters obtained highest

profit. This could be explained by size of the business which was bigger compared to other nodes andalso, transport/wholesaling is organised by cartel or monopolistic-type market structures. Producers and retailers earn little profit probably because they are not organised and most operate illegally thus have little negotiation leverage and lack of market influence for retailers.

Table 10: Profit margins distributions for the charcoal actors along the chain

Marketing chain actors	Revenue per bag (Tsh)	Cost per bag (Tsh)	Profit per bag (Tsh)	Percent (%)
Producers	6,000	4, 920	1, 080	5
Wholesalers/transporters	45 000	27 464	17 536	84
Retailers	19 200	17 000	2,200	11

The profit accrued along the value chain is small and unevenly shared. Wholesalers and transporters take a big share of total profit (84%) followed by retailers (11%) while producers only accrue 5% of the total profit. This implies that,despite being a considerable source of income for hundreds of rural people, charcoal producers receive only a small share of the total revenues compared to the wholesalers and/or transporters. However, these findings differ from those reported by Kambewa*et al.* (2007) that,benefits are almost evenly distributed among stakeholders in thecharcoal value chain in Malawi, with values accruing to producers ranging from 20% to 33% of retail price, transporters earning 20% to 25% of final value and retailers making the greatest profits of 25% to 33% of final selling price.

On the other hand, the findings are partly similar to that of Shively *et al.* (2010) study which found that the greatest overall returns to participation in thecharcoal value chain in Uganda is among traders.Moreover, the findings on unequal distribution of actors' profit

margin are supported by KFS (2013) study which found that profits are disproportionately skewed in favour of the vendors and transporters, with the producers and the consumers getting the least margins; revenue accruals and distribution varied significantly along the value chain with the vendor (wholesalers and retailers) controlling 41% of the market share, transporters 37% and producers (wood and charcoal) only 22%.

4.3.5 Marketing margins analysis along the charcoal value chain

The results in Table 11 shows the gross marketing margins for different actors for the charcoal value chain. The large gross marketing margin for the wholesaler could be explained by the associated costs incurred such as labour, transportation, forest royalty and other contingency. On the other hand, producers had relatively lower margin probably because they incurred only on production costs. The lowest marketing margin for the retailers could be attributed to the fact that they do not incur any other costs apart from purchasing charcoal bags from suppliers.

Table 11: Gross marketing margins analysis along the charcoal value chain

Prices at various levels of the distribution channel	In Dar es Salaam		In Tabora	
	price/bag	Gross Marketing Margins	Price/bag	Gross Marketing Margins
Average farm price	6,000	-	6,000	-
Average wholesale price	45 000	-	17 000	-
Average retailing price	50 000	-	19 200	-
TGMM	-	88%	-	68.75%
GMM_W	-	78%	-	57.29%
GMM_R	-	10%	-	11.46%
GMM_P	-	12%	-	31.25%

TGMM = the percentage of the total gross marketing margin

GMM_W = the percentage of the total gross marketing margin received by the wholesaler

GMM_R = the percentage of the total gross marketing margin received by the retailer

GMM_P = the producer participation margin.

4.4 Factors Influencing Charcoal Profitability among Actors in the Study Area

Charcoal business profitability was thought to be influenced by a number of factors and thus Multiple Linear Regression (MLR) model was employed to examine the contribution of each selected explanatory variable, to test their influence on net charcoal business profitability. A number of socio-economic variables were selected as predictors of actor's net profit per bag of charcoal in the study area. The nine (9) selected predictor variables include; category of the respondent (CR), District in which the respondent carried out the business (DSTR), Age of the respondent (AGE), Sex of the respondent (SEX), education level (EDU), years of experience in the business (EXP), number of charcoal bags sold at a time (S), the season charcoal business is done (ES) and access to market information (MI). The MLR equation was specified as;

$$Yi = \alpha + \beta_1 CR + \beta_2 DSTR + \beta_3 AGE + \beta_4 SEX + \beta_5 EDU + \beta_6 EXP + \beta_7 S + \beta_8 ES + \beta_9 MI \quad \text{Eq (7)}$$

Results are presented in Table 12 and estimated linear regression Equation 8.Findings indicated that the predicted model was statistically significant at $p \leq 0.05$ with an F-value 10.8. As shown in Table 12 the selected predictors were able to explain approximately 60%, (that is with a coefficient of determination $R^2 = 0.58$) of the variation observed in profitability of charcoal business and the predictors were highly correlated to charcoal business profitability by 76% (that is a coefficient of relationship R= 0.76). This implies that, the selected socio-economic factors were important in determining charcoal profitability within the study area, and the obtained coefficient of determination indicates that 40% of the variation in charcoal profitability could be explained by other factors which were not included in determining charcoal profitability. However, according to

Toole (2007) R squared value above 0.25 is considered typically meaningful in social science research. The predicted multiple regression equation is given as;

$$Yi = \alpha + (-1.173CR) + 0.512DSTR + 0.006AGE + 0.248SEX + 0.145EDU + 0.070EXP + 0.178S + 0.490\,IS + 0.183MI \quad \text{Eq (8)}$$

The multiple regression results summarized in equation 8 shows that, each factor had its own influence on the net profit generated from charcoal; however, only six factors (category of respondent, district of the respondent, sex, educational level, sale of charcoal bagsand engagement season) had been statisticallysignificantly ($p \leq 0.05$) linked to the net profit.

Table 12: Results from multiple regression model on factors influencing charcoal profitability among actors

	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	2.456	0.376		6.526	0.000
Category	-1.173	0.096	-0.822	-12.203	0.000**
District	0.512	0.114	0.268	4.495	0.000**
Age	0.006	0.043	0.007	0.135	0.893ns
Sex	0.248	0.101	0.130	2.465	0.014**
Level of education	0.145	0.060	0.116	2.42	0.016**
Experience	0.070	0.046	0.085	1.535	0.126ns
No. of bags sold	0.178	0.063	0.128	2.819	0.005**
Engagement season	0.490	0.096	0.268	5.095	0.000**
Market information	0.183	0.123	0.073	1.487	0.138ns

$R^2 = 0.58$ and Adjusted $R^2 = 0.565$; F= 10.80**
** = Statistically significant at $p \leq 0.05$, ns = Not statistically significant at $p \leq 0.05$

Results in Table 12 indicate that the positive coefficient of education level implies that an increase in education level of respondents significantly increases the net profit by a factor of 0.145. The plausible explanation on this is that; increase in education level (years of

schooling) tends to increase people's knowledge and awareness on the charcoal business. The increase in level of education also increases options to respondents to meet their livelihoods. Therefore, the respondents with high education level would be able to notice easily whether the charcoal business is profitable or not.

The sale of charcoal bags at a time had positive influence on net profit. Results showed that for every unit increase in the number of bags sold, there was 17.8% increase in the net profit generated from charcoal sales by the actor (Table 12). This implies that, number of charcoal bags sold at a time was an important factor in charcoal profitability within the study area.

The results in Table 12 indicate that,access to market information increased actor's profit generated from charcoal by 18.3 % above actors who did not have access to market information. This implies that, market information was an important factor which determined charcoal profitability in the study area. However, the effect of market information on the charcoal profitability was not statistically significant ($p>0.05$).

The results presented in Table 12further show that actor's season of engagement in charcoal business increased actor's profit generated from charcoal by 49% above actors who are just involved when in need of money. This implies that, full involvement in charcoal business was an important factor which determined charcoal profitability in the study area.

The findings as summarized in Table 12 indicate that the experience of the actor in charcoal profitability had positive influence on net profit. Results showed that for every

unit increase in the number of years in charcoal business, there was 7% increase in the net profit generated from charcoal sales by the actor. This implies that, experience was an important factor in charcoal profitability within the study area. Those with more experience in the business are more likely to succeed in making profit than novices.However, the experience had no significant influence ($p>0.05$) on charcoal profitability.

Additionally, results in Table 12showthat the district in which the actor carried out the charcoal business had positive influence on net profit. This implies that, the respondent by doing charcoal business in UyuiDistrict,could increase the net profitability by 51%.Profitability in charcoal business was related to carrying out the business in Uyui District probably due to majority of the people in Uyui depending more on charcoal as a source of energy, being carried out by more less older individuals as younger individuals could prefer to venture into other more profitable businesses. Moreover, men ripped most of the benefits as they could be able to transport more charcoal bags at a time compared to women, but also experience on business highly influenced profitability as the individuals could predict the right time to undertake the business. In addition, availability of market information and having more bags marketed at a time highly influenced charcoal profitability to the individuals who were engaged in the business.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Overview

The study analysedcharcoal value chain in the Uyui District and Tabora Municipality. The conclusion and recommendations are based on major issues that emerged from the findings of the study. The whole study is built on three specific objectives which are: identification of actors and assessing their roles in the chain, determination of profit and marketing margins of various actors along the value chainand finally determination of the factors influencing charcoal profitability among actors in the study area.

5.2 Conclusions

The charcoal value chain in the study areas involved different actors which include charcoal producers, transporters, wholesalers, retailers and consumers. Although these actors perform different activities, but the activities performed by one actor can improve the efficiency of other actors.

The profit accrued along the value chain is small and unevenly shared. Wholesalers and transporterstake a big share of total profit (84%) followed by retailers (11%) while producers only accrue 5% of the total profit.However, the wholesalers and transporters bear much of the costs. The skewness of revenues and profit shares to wholesalers and transporters could be explained by size of the business which was bigger compared to other nodes and transport/wholesaling is organised by cartel or monopolistic-type market structures. Producers and retailers earn little profit because they are not organised and most operate illegally thus have little negotiation leverage and lack of market influence for retailers.There is evident lack of business skills among the lower actors of the chain

(charcoal producers) indicated by the way charcoal is priced and how charcoal production costs are estimated. Charcoal producers for example tend to overlook labour costs especially if labour is provided by family members, also free trees they obtain without paying royalty.As a result of this the prices of charcoal at the production point tend to be lower than would otherwise be expected if all costs were taken into account. This in turn means that more charcoal has to be produced to meet the producers' income needs.

According to the findings, there was statistically significant relationship between socio-economic factors such as gender, level of education, the season charcoal business is done,number of charcoal bags sold at a time,category of respondent and district in which the actor carried out the business. However, other factors such as age, access to market information and experience in charcoal business were not statistically significant to charcoal profitability but showed a relationship with charcoal profitability. The selected predictors were able to explain approximately 60%, (that is with a coefficient of determination $R^2 = 0.58$) of the variation observed in profitability of charcoal business and the predictors were highly correlated to charcoal business profitability by 76% (that is a coefficient of relationship R= 0.76). This implies that, the selected socio-economic factors were important in determining charcoal profitability within the study area, and the obtained coefficient of determination indicates that 40% of the variation in charcoal profitability could be explained by other factors which were not included in determining charcoal profitability.

5.3 Recommendations

Based on the findings and conclusions, the study put forward the following recommendations:

i. The government should organise the charcoal industry by encouraging establishment of charcoal producers associations in order to build strength in

numbers. These associations can be formally registered and will have enhanced bargaining power when negotiating for better charcoal prices.

ii. The actors on the supply side especially the charcoal producers need training on business skills.The training should also cover issues related to improved charcoal industry so as to increase charcoal productivity and charcoal value addition.

iii. Charcoal should be charged full price based on the total cost incurred in the whole spectrum of production and marketing so that customers can choose either to use charcoal or other sources of energy which is also good for saving the environment.

iv. The government should enforce effective revenue collection system that cannot allow charcoal dealers to evade paying the required charges which has partly contributed to lower market price of charcoal.

v. Charcoal dealers should be mobilized to establish organised market networks. Such networks will enable them to access reliable markets.

vi. The government should encourage replanting trees for the sustainability of the charcoal business.

vii. Other studies should be conducted especially considering large sample to improve on the findings of this study and to bridge the gap that this study did not cover. One of the areas for further research is charcoal transportation losses. Fines increase more or less in proportion to the distance the charcoal is transported due to the vibration of the lorry.

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APPENDICES

Appendix 1: Questionnaire for charcoal producers

Questionnaire Number…….

Date of interview…….

Ward……..District…….....

Section A: Personal information of a respondent:

1. Name of the respondent …..……..
2. Mobile contacts.....……..……...
3. Age in years:1 = 18-30 [ ], 2 = 31-45 [ ], 3 = 46-60 [ ], 4 = above 60 [ ]
4. Gender: 1 = male[ ], 2 = female[ ]
5. Marital status:

   1= Married [ ], 2= Single [ ], 3= Divorced [ ], 4= Widowed [ ], 5= Separated [ ]
6. Level of education:1 = Illiterate[ ], 2 = Primary school [ ], 3 = Secondary school[ ]

   4 = College [ ], 5 =University[ ], 6 = others [ ] (specify)…
7. How many people in your household are able bodied adults?1= Less than 3 members

   [ ], 2= between 3 – 5 members [ ], 3 = more than 5 members [ ]

Section B: Information on sources of trees/wood and method for charcoal production

8. Is charcoal burning your main economic activity? 1 = Yes [ ] 2 = No [ ]
9. Experience of working with charcoal production: 1 = Not at all [ ], 2 = Less than 5 years [ ], 3 = between 5 – 10 years [ ], 4 = more than 10 years [ ]
10. Where do you get trees for charcoal preparation? Please tick

    1 = government forest [ ], 2 = private forest [ ], 3 = from own land [ ], 4 = others [ ]

    specify…
11. What are the preferred tree species for charcoal burning? Please list

12. What methods do you use for charcoal processing? 1 = Traditional earth kiln method [ ],2 = Mobile metal kiln method [ ], 3 = Pit kiln method [ ], 4 = others (specify)...

13. Which of the above in question 12 above is most preferred and why?

Section C: Information on costs incurred in production and marketing

14. Which equipment/materials did you purchase during the preparation period?

S/No	Type of equipment / material	Life time in use	Purchasing price (Tsh)
1	Axes		
2	Machete		
3	Hoe/Spade		
3	Charcoal bags		
4	Others (specify)		

15. Please indicate the costs involved in charcoal processing before selling:

S/No	Activity/item	Time (days)	Cost (Tsh)
1	Wood cutting		
2	Kiln construction		
3	Carbonization process		
4	Unloading charcoal from the kiln		
6	Loading/packing charcoal into bags		
8	Others (specify)		

16. How much do you pay the following items when marketing your produce?

Cost item	Frequency	Costs (Tsh)	Total cost(Tsh)
Transportation cost by type of transport means			
Labor (loading and unloading)			
Forest royalty and cess fees			
Communication			
Market charges			
Hidden cost (e.g. waiting time, etc.)			
Others (specify)			

Section C: Information on welfare issuesrelating to charcoal production

17. Do you think charcoal business contributes to your welfare? 1 = Yes [ ] 2 = No [ ]

18. If yes to question 17 above, in what ways does it support you? Please mention.

19. How many bags of charcoal do you usually harvest from a single production?

    1= Less than 5 bags [ ], 2 = between 5– 10 bags [ ], 3 = more than 10 bags [ ]

20. Where do you normally sell your charcoal? 1 = consumers [ ], 2 = middlemen [ ],

    3 = wholesalers [ ], 4 = retailers [ ], 5 = others [ ] (specify)…

21. How much do you sell for a bag of charcoal? 1 = Less than 7,000 Tsh [ ],

    2 = between 7,000 – 14000 Tsh [ ], 3 = more than 14000 Tsh [ ]

22. How much charcoal is produced for a given type of production kiln?

23. How much income do you usually generate per production?Tsh……

24. How often do you engage in charcoal production in a year?

    1 = Dry season [ ], 2 = When in need of money [ ], 3 = All the time [ ]

25. Have you ever received training on how to improve upon your charcoal business?

    1 = yes [ ], 0 = no [ ]

26. How do you get market information? 1 = yes [ ], 0 = no [ ]

27. If yes to question 26 above, how do you obtain such pieces of information?

    1 = friends [ ], 2 = from media [ ], 3 = direct visit to the markets [ ], 4 = others [ ] specify…

28. Who sets the price for the charcoal when selling?

    1 = buyer [ ], 2 = seller (producer) [ ], 3 = others [ ] (specify)….

29. How do you arrive to the final price per unit?

    1= negotiations [ ], 2= price fixed by a buyer [ ], 3 = price fixed by a seller [ ],

    4 = take market prices [ ], 5 = calculate cost involved [ ], 6 = others [ ] (specify)…

30. What factors are considered in setting up the price of charcoal? (Please rank)

    1 = production costs [ ], 2= packaging costs [ ], 3= transportation costs [ ],

    4 = royalty/cess[], 5 = quality [ ], 6 = seasonality [ ], 7 = others [ ] (specify)…..

31. Are you satisfied with the current charcoal prices? 1 = yes [ ], 2 = no [ ]

32. If no why?1 = price is low [ ], 2 = operational costs are very high [ ], 3 = no unit of measure the weight of charcoal [ ], 4 = buyers offer price which are in their favour [ ],5 = others [ ] (specify)….

Section D: Information on charcoal value chain

33. How do you assess the linkage between you and other actors in the value chain?

    1 = very strong [ ], 2 = strong [ ], 3 = weak [ ], 4 = very weak [ ], 5 = none [ ]

34. Who do you perceive as having greater power in the charcoal value chain? Why?

    1 = producers [ ], 2 = traders [ ], 3 = consumer [ ], 4 = none [ ]

35. How much do you trust other stakeholders in the charcoal value chain? Why?

    1 = very much [ ], 2 = much [ ], 3 = little [ ], 4 = very little [ ]

36. How do you assess the current performance of the charcoal value chain?

    1 = best [ ], 2 = good [ ], 3 = worse [ ], 4 = worst [ ]

37. How do you think the performance of the value chain can be improved?

Section E: General information

38. What are the main challenges while undertaking the charcoal production work?

39. What do you think should be done to make your work easier?

“Thank you for your time and considerations”

Appendix 2: **Questionnaire for charcoal transporters**

Questionnaire Number…….

Date of interview…….

Ward……..District……..

Section A: Personal information of a respondent:

1. Name of the respondent …..……..
2. Mobile contacts.....……..……...
3. Age in years:1 = 18-30 [ ], 2 = 31-45 [ ], 3 = 46-60 [ ], 4 = above 60 [ ]
4. Gender: 1 = male [ ],2 = female [ ]
5. Marital status:1= Married [ ], 2= Single [ ], 3= Divorced [ ], 4= Widowed [ ], 5= Separated [ ]
6. Level of education: 1 = Illiterate [ ], 2 = Primary school [ ], 3 = Secondary school [ ] 4 = College [ ], 5 = University [ ], 6 = others [ ] (specify)…

Section B: Information on transportation sources, costs and pricing

7. Is charcoal transportation your main economic activity? 1 = Yes [ ] 2 = No [ ]
8. For how long have you been doing this business? 1 = Not at all [ ], 2 = Less than 5 years [ ], 3 = between 5 – 10 years [ ], 4 = more than 10 years [ ]
9. Have you received any business or technical training?1 = yes [ ], 0 = no [ ]
10. What are the means of transport do you use? (please tick)

    1 = Lorry [ ], 2 = cart [ ], 3 = cycle [ ], 4 = others [ ] (specify)…
11. Do you prefer to transport charcoal from a particular tree species? If yes, which one?
12. Where do you get charcoal for transport?

    1 = producers[ ], 2 = other transporters[ ], 3 = wholesalers[ ], 4 = others[ ] (specify)…

13. What are the points of loading in these sources?

1 = roadside[ ], 2= production areas[ ], 3 = local assembly market[ ], 4 = others[ ] (specify)

14. Why do you prefer this loading points? 1 = cheaper labour for loading[ ],
    2 = accessible[ ], 3 = proximity to the market[ ], 3 = others [ ] (specify)
15. What is the average distance from the loading points to unloading/destination point?
16. Do you share the transport with other transporters or traders? 1 = yes[ ], 2 = no[ ]
17. If yes in question 16 above, how do you share the costs? 1 = by weight/volume[ ],
    2 = per trip[ ], 3 = equally[ ], 4 = per distance[ ], 5 = other [ ](Specify)….
18. What is the average transport cost per bag or trip of charcoal?
19. How much income do you generate per transport? Tsh……
20. How often do you engage in charcoal transportation in a year?
    1 = Dry season [ ], 2 = When in need of money [ ], 3 = All the time [ ]
21. Who set the cost for the charcoal transported?
    1 = transporter [ ], 2 = customer [ ], 3 = others [ ] (specify)….
22. How do you arrive to final cost per unit? 1 = negotiations [ ], 2 = cost fixed by transporter [ ], 3 = cost fixed by customer [ ], 4=others [ ] (specify)…
23. What factors are considered in setting up the cost of transporting charcoal? (rank)
    1 = considering existing fuel prices [ ] 2 = weight of charcoal [ ], 3 = wet or dry season [ ], 4 = accessibility [ ], 5 = costs involved [ ], 6 = others [ ] (specify)…
24. Are you satisfied with the current charcoal transportation costs paid?
    1 = yes [ ], 2 = no [ ]
25. If no, why? 1 = cost paid is low [ ], 2 = operational costs are very high [ ],
    3 = no unit of measure the weight of charcoal [ ], 4 = customers' offers price which are in their favour [ ], 5 = others [ ] (specify)…
26. What was the mode of the trade?

1 = Contract [ ], 2 = first come / first served [ ], 3 = others [ ] (specify)…

27. What was the mode of payment? 1 = cash [ ], 2 = credit [ ], 3 = other [ ] (specify)…

28. Please provide details of your costs you have incurred in your business last year 2013

Cost item	**Number**	**Cost/unit**	**Total cost**
Fuels (diesel/petrol)			
Vehicle repair and maintenance			
Wages e.g. driver,			
Loading and unloading			
Communication			
Road licenses/fees			
Forest royalty and cess fees			
Transit Pass fees			
Market charges			
Others (specify)			

29. Is there any variability in the volume of charcoal you transport between seasons

1 = yes [ ], 2 = no [ ]

30. If yes to question 29 above, which months do you transport more or less charcoal?

More charcoal (months) ……

Less charcoal (months)……..

31. What do you think are the causes of these changes in charcoal supply?

Section C: Information on markets

32. Do you get information on charcoal required to be transported to the market?

1 = yes [ ], 0 = no [ ]

33. If yes to question 32 above, how do you get such information?

1 =friends [ ], 2 =through media [ ], 3 =direct visit to the markets[ ], 4 = others[ ](specify)…

34. On average how many trips or charcoal bags do you transport per month?

35. Do you have a ready market for the charcoal transported?1 = yes[ ], 2 = no[ ]

36. If yes in question 35 above, then who is your main customers (rank):

    1 = households [ ], 2 = commercial [ ], 3 = institutions [ ], 4 = industrial [ ],

    5 = other (specify)…

37. At what price and in what quantities do you sell to them?

38. Do you pay for any fees, road levies or licenses for transporting your charcoal?

    1 = yes [ ], 2 = no [ ]

39. If yes for question 38 above, how much and to whom? (please tick)

    1 = forest officers [ ], 2 = municipal council [ ], 3 = police [ ], 4 = others [ ] (specify)…

Section D: Information on charcoal value chain

40. How do you assess the linkage between you and other actors in the value chain?

    1 = very strong [ ], 2 = strong [ ], 3 = weak [ ], 4 = very weak [ ], 5 = none [ ]

41. Who do you perceive as having greater power in the charcoal value chain? Why?

    1 = producers [ ], 2 = traders [ ], 3 = consumer [ ], 4 = none [ ]

42. How much do you trust other stakeholders in the charcoal value chain? Why?

    1 = very much [ ], 2 = much [ ], 3 = little [ ], 4 = very little [ ]

43. How do you assess the current performance of the charcoal value chain?

    1 = best [ ], 2 = good [ ], 3 = worse [ ], 4 = worst [ ]

44. How do you think the performance of the value chain can be improved?

Section E: General questions

45. What are the main challenges while undertaking the charcoal transportation work?

46. What do you think should be done to make your work easier?

“Thank you for your time and considerations”

Appendix 3: Questionnaire for charcoal wholesalers

Questionnaire Number…….

Date of interview…….

Ward…….District……...

Section A: Personal information of a respondent:

1. Name of the respondent …..……..
2. Mobile contacts.....……..……...
3. Age in years:1 = 18-30 [ ], 2 = 31-45 [ ], 3 = 46-60 [ ], 4 = above 60 [ ]
4. Gender: 1 = male [ ], 2 = female [ ]
5. Marital status:1= Married [ ], 2= Single [ ], 3= Divorced [ ], 4= Widowed [ ], 5= Separated [ ]
6. Level of education: 1 = Illiterate [ ], 2 = Primary school [ ], 3 = Secondary school [ ] 4 = College [ ], 5 = University [ ], 6 = others [ ] (specify)…
7. Occupation…….

Section B: Information on sources and scale of operation

8. Type of wholesale:1 = private[ ], 2 = organisation[ ], 3 = others [ ] (specify)…
9. What was your opening capital and source?
10. For how long have you been doing this business? 1 = Not at all [ ], 2 = Less than 5 years [ ], 3 = between 5 – 10 years [ ], 4 = more than 10 years [ ]
11. Have you received any business or technical training?1 = yes [ ], 0 = no [ ]
12. Do you prefer charcoal from any particular tree species? 1= yes [ ] 2= no [ ]
13. If yes to question 12 above, which tree(s)? please list
14. Where do you get charcoal for sale? 1 = producers [ ], 2 = transporters[ ], 3 = other wholesalers[ ], 4 = others[ ](specify)…
15. What are the points of purchases in these sources?

1 =roadside[ ], 2 =production areas[ ], 3 =local assembly market[ ], 4 =others[ ](specify)…

16. Why do you prefer this source(s)? 1= cheaper buying price[ ], 2= proximity to the market[ ], 3 = homeland[ ], 4 = other reason[ ] (specify)…
17. What is the average distance from the area where you buy charcoal?
18. In what quantities do you purchase charcoal, and for how much?
19. What is the average amount of charcoal do you buy on monthly basis?
20. Is the supply from the source(s) uniform over the years?1 = yes[ ], 2 = no[ ]
21. If no to question 20 above, which month do you buy more or less quantity of charcoal?

    More charcoal quantity (months) …….

    Less charcoal quantity (months)……
22. What do you think are the causes of these changes in supply?

Section C: Information on markets

23. Do you know price in advance before taking your consignment to the market?

    1 = yes [ ], 0 = no [ ]
24. If yes to question 23 above, how do you obtain such pieces of information?

    1 = through agents[ ], 2 = through own investigation/visits[ ], 3 = other[ ](specify)……
25. To whom do you sell the produce? (rank)1 = households [ ], 2 = commercial [ ],

    3 = institutions [ ], 4 = industrial[ ], 5 = other [ ] (specify)...
26. At what price and in what quantities do you sell to them?
27. Do you charge different prices to different buyers?

    1 = yes [ ], 2 = no [ ]
28. If yes in question 27 above, please give reasons.
29. Who set price for charcoal?

    1 = producers [ ], 2 = wholesalers [ ], 3 = retailers [ ], 4 = other [ ] (specify)…

30. What factors are considered in setting the price? (Rank)1 = costs incurred [ ],

2 = supply and demand forces [ ], 3 = quality grades [ ], 4 = other[ ] (specify)…

31. What is your opinion on the existing pricing mechanism?

32. What is the average quantity of charcoal sold per day? (number of bags per day)

33. Please provide details of your costs you have incurred in your business last year 2013

Cost item	Frequency	Cost/unit	Total cost
Grading			
Packaging			
loading and unloading			
Transportation			
Communication			
Royalty and cess fees			
Market charges			
Meals			
Others (specify)			

34. Gross margin analysis

Buying price (Tsh/unit)	Selling price (Tsh/unit)

Section D: Information on charcoal value chain

35. How do you assess the linkage between you and other actors in the value chain?

1 = very strong [ ], 2 = strong [ ], 3 = weak [ ], 4 = very weak [ ], 5 = none [ ]

36. Who do you perceive as having greater power in the charcoal value chain? Why?

1 = producers [ ], 2 = traders [ ], 3 = consumer [ ], 4 = none [ ]

37. How much do you trust other stakeholders in the charcoal value chain? Why?

1 = very much [ ], 2 = much [ ], 3 = little [ ], 4 = very little [ ]

38. How do you assess the current performance of the charcoal value chain?

    1 = best [ ], 2 = good [ ], 3 = worse [ ], 4 = worst [ ]

39. How do you think the performance of the value chain can be improved?

Section E: General questions

40. As charcoal wholesalers, do you have any association in your area/district?

    1 = yes [ ], 2 = no [ ]

41. If yes, to question 40 above, what are the benefits of the association/organisation?

42. What are the main challenges while undertaking your charcoal business?

43. What do you think should be done to improve the situation above?

"Thank you for your time and considerations"

Appendix 4: Questionnaire for charcoal retailers

Questionnaire Number…….

Date of interview…….

Ward……..District……..

Section A: Personal information of a respondent:

1. Name of the respondent …..……..
2. Mobile contacts.....……..……...
3. Age in years:1 = 18-30 [ ], 2 = 31-45 [ ], 3 = 46-60 [ ], 4 = above 60 [ ]
4. Gender: 1 = male [ ], 2 = female [ ]
5. Marital status:1= Married [ ], 2= Single [ ], 3= Divorced [ ], 4= Widowed [ ], 5= Separated [ ]
6. Level of education: 1 = Illiterate [ ], 2 = Primary school [ ], 3 = Secondary school [ ] 4 = College [ ], 5 = University [ ], 6 = others [ ] (specify)…
7. Occupation…….

Section B: Information on sources and scale of operation

8. Type of retailer:1 = private[ ], 2 = group/organisation[ ], 3 = others [ ] (specify)…
9. What was your opening capital and source?
10. For how long have you been doing this business? 1 = Not at all [ ], 2 = Less than 5 years [ ], 3 = between 5 – 10 years [ ], 4 = more than 10 years [ ]
11. Have you received any business or technical training?1 = yes [ ], 0 = no [ ]
12. Do you prefer charcoal from any particular tree species? 1= yes [ ] 2= no [ ]
13. If yes to question 12 above, which tree(s)? please list
14. Where do you get charcoal for sale?
    1 = producers[ ], 2 = transporters[], 3 = wholesalers[ ], 4 = others [ ] (specify)…

15. What are the points of purchases in these sources?1 =roadside[ ], 2 =production areas[ ], 3 =local assembly market[ ], 4 = others [ ] (specify)…
16. Why do you prefer this source(s)? 1 =cheaper buying price[ ], 2 =proximity to the market[ ], 3 = homeland[ ], 4 = other reason[ ] (specify)…
17. What is the average distance from the area where you buy charcoal?
18. In what quantities do you purchase charcoal, and for how much?
19. What is the average amount of charcoal do you buy on weekly basis?
20. Is the supply from the source(s) uniform over the years?1 = yes[ ], 2 = no[ ]
21. If no to question 20 above, which month do you buy more or less quantity of charcoal?

    More charcoal quantity (months) …….

    Less charcoal quantity (months)……
22. What do you think are the causes of these changes in supply?

Section C: Information on markets

23. Do you know price in advance before selling your charcoal?

    1 = yes [ ], 0 = no [ ]
24. If yes to question 23 above, how do you obtain such pieces of information?

    1 = through agents[ ], 2 = through own investigation/visits

    [ ], 3 = other[ ] (specify)…
25. Who is your main customer (please tick)1 = households [ ], 2 = commercial [ ],

    3 = institutions [ ], 4 = industrial[ ], 5 = other [ ] (specify)...
26. At what price and in what quantities do you sell to them?
27. Do you charge different prices to different buyers?

    1 = yes [ ], 2 = no [ ]
28. If yes in question 27 above, please give reasons.

29. Who set price for charcoal?

1 = producers [ ], 2 = wholesalers [ ], 3 = retailers [ ], 4 = other [ ] (specify)…

30. What factors are considered in setting the price? (Rank)1 = costs incurred [ ],

2 = supply and demand forces [ ], 3 = quality grades [ ], 4 = other [ ] (specify)…

31. What is your opinion on the existing pricing mechanism?

32. What is the average quantity of charcoal sold per day? (number of bags per day)

33. Do you pay for any fees, or licenses for selling your charcoal?

1 = yes, 0 = no [ ]

34. If yes to question 33 above, how much and to whom?

1 = TFS agency, 2 = municipal council, 3 = others (specify)…

35. Please provide details of your costs you have incurred in your business last year 2013

Cost item	Frequency	Cost/unit	Total cost
Grading			
Packaging			
loading and unloading			
Transportation			
Communication			
Royalty and cess fees			
Market charges			
Meals			
Others (specify)			

36. Gross margin analysis

Buying price (Tsh/unit)	Selling price (Tsh/unit)

Section D: Information on charcoal value chain

37. How do you assess the linkage between you and other actors in the value chain?

1 = very strong [ ], 2 = strong [ ], 3 = weak [ ], 4 = very weak [ ], 5 = none [ ]

38. Who do you perceive as having greater power in the charcoal value chain? Why?

1 = producers [ ], 2 = traders [ ], 3 = consumer [ ],4 = none [ ]

39. How much do you trust other stakeholders in the charcoal value chain? Why?

    1 = very much [ ], 2 = much [ ], 3 = little [ ], 4 = very little [ ]

40. How do you assess the current performance of the charcoal value chain?

    1 = best [ ], 2 = good [ ], 3 = worse [ ], 4 = worst [ ]

41. How do you think the performance of the value chain can be improved?

Section E: General information

42. What are the main challenges while undertaking your charcoal business?

43. What do you think should be done to improve the situation in question 42above?

“Thank you for your time and considerations”

Appendix 5: Questionnaire for charcoal consumers

Questionnaire Number…….

Date of interview…….

Ward……..District……..

Section A: Personal information of a respondent:

1. Name of the respondent …..……..
2. Mobile contacts.....……..……...
3. Age in years:1 = 18-30 [ ], 2 = 31-45 [ ], 3 = 46-60 [ ], 4 = above 60 [ ]
4. Gender: 1 = male [ ], 2 = female [ ]
5. Marital status:1= Married [ ], 2= Single [ ], 3= Divorced [ ], 4= Widowed [ ],
   5= Separated [ ]
6. Level of education: 1 = Illiterate [ ], 2 = Primary school [ ], 3 = Secondary school [ ]
   4 = College [ ], 5 = University [ ], 6 = others [ ] (specify)…
7. What is your main occupation?
   1 = wage employment[ ], 2 = business / self-employed[ ], 3 = others [ ](specify)….

Section B: Information on the use of charcoal

8. Is charcoal your only source of cooking and heating fuel?1 = yes[ ], 2 = no[ ]
9. If no, please indicate all the other sources of fuel you use? Please tick
   1 = kerosene[ ], 2 = firewood[ ], 3 = LPG (gas)[ ], 4 = electricity[ ],
   5 = others[ ](specify)…
10. Please rank the following sources in terms of preference:
    1 = electricity[ ], 2 = kerosene[ ], 3 = charcoal[ ], 4 = firewood[ ],
    5 = LPG (gas)[ ]6 = crop residues[ ], 7 = animal dung[ ], 8 = any other [ ] (specify)…
11. What is your main reason for using charcoal (please tick only one)

1 = affordable[ ], 2 = easily available[ ], 3 = higher energy content[ ], 4 = other[ ] (specify)…

12. Where do you normally buy your charcoal for use? 1 = market[ ],

2 = production areas[ ], 3 = roadside[ ], 4 = streets[ ], 5 = others [ ](specify)...

13. Why do you purchase charcoal regularly from this particular source?

1 = high quality[ ], 2 = nearby home[ ], 3 = reasonable price[ ], 4 = others [ ](specify)…

14. From which charcoal dealer do you normally buy charcoal for use?

1 = retailers[ ], 2 = wholesalers[ ], 3= small-scale transporters (cyclists) [ ],

4 = producers[ ], 5 = others [ ](specify)…

15. What do you consider/look at when buying charcoal? (Rank)

1 = Quality[ ], 2 = Cost[ ], 3 = other[ ] (specify)…

16. What quantity of charcoal do you consume per week?

17. How much do you pay for a unit of charcoal?

Unit	Cost (Tsh)
Sack/bag	
Small sack	
Paint tin	
bucket	
Heap of charcoal	
Others (specify)	

18. What is your opinion on the price you pay per unit? 1 = price is too high [ ],

2 = reasonable price [ ], 3 = lower than expected [ ] 4 = other [ ] (specify)…

19. What is the distance to the charcoal market place where you purchase?

20. What other single most important substitute to charcoal do you consume?

1 = electricity[ ], 2 = kerosene[ ], 3 = charcoal[ ], 4 = firewood[ ], 5 = LPG (gas)[ ], 6 = crop residues[ ], 7 = animal dung[ ], 8 = any other [ ] (specify)…

21. What constraints do you face in consuming charcoal? (Rank)1 = high price[ ],

2 = long distance[ ], 3 = low quality[ ], 4 = inadequate supplies[ ],

5 = others[ ](specify)…

22. What do you think should be done to arrest the situation in question 21 above?
23. What suggestions do you have for the charcoal producers, transporters, wholesalers and retailers and other stakeholders to improve the performance of the charcoal value chain?

"Thank you for your time and considerations"

Appendix 6: Checklist for key informants

Checklist Number……

Date of interview…….

Ward…….District…….....

Section A: Respondent's characteristics:

1. Name of the key informant …..…….
2. Mobile contacts of key informant……..……
3. Title/position……..

Section B: Information on charcoal industry

4. Who are the key actors along the charcoal value chain?
5. How can you describe the structure, linkage and performance of charcoal value chain?
6. Who do you perceive as having greater power and share in the charcoal value chain? Why?
7. How many charcoal dealers have been registered in your district in year 2013/14?
8. How much do they pay as registration fees for their business?
9. How much do you charge them as royalty and cess/levy for a bag of charcoal?
10. What other charges do you collect from charcoal dealers/traders?
11. What strategies/programs/policies/incentives by government or development partners if put in place would enable growth in the charcoal business and improve chain value addition?

"Thank you for your time and considerations"