



Capacity Building in Energy Planning and Management

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# BIOMASS VALUE CHAIN ANALYSIS – MAPUTO/MATOLA 2012

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Draft



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## 1. INTRODUCTION

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Biomass energy constitutes as the main source of energy for the majority of people in developing countries mainly for cooking, lighting and space heating. In Mozambique, this form of energy accounts for approximately 83% of the total energy consumed throughout [1]. Rural areas, which represent more than 80% of the total population of the country, and also the peri-urban areas are the major consumers of biomass mainly in the form of woodfuel, charcoal and crop residues. Approximately 80% of the urban population living in peri-urban areas use wood and charcoal for cooking purposes.

Mozambique's energy resources can be classified into the following categories: (i) commercial energies, consisting of large hydropower plants, natural gas and coal; (ii) traditional energies, a group comprising woodfuel, charcoal and animal dung, and (iii) renewable energy resources, from which biomass, small hydro, wind and solar energies may have a special relevance [2].

The aim of this study is to tackle, in relatively detailed analysis, all actors involved in the charcoal energy market, from loggers to end-retailers. A livelihoods approach is used to describe the economic significance at each level of the charcoal chain of supply, with the view to contribute in the formulation of a national biomass strategy towards promoting sustainable development while meeting the energy needs of those people who depend on traditional biomass for their subsistence.

## 2. LITERATURE REVIEW

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The development of policies on energy planning requires information from the source of production to end-use. Biomass is a poorly documented energy resource in most developing countries such as in the case of Mozambique. The informal nature of the charcoal business is one of the constraining reasons for the collection of up to date and timely data. This is due to lack of official information (eg. Tax records, formal employment contracts and census related data).

Furthermore, since large amounts of charcoal are gathered by individuals, and in many cases operating without official exploration licenses, and therefore out of the authority's control, adequate statistics are generally inexistent. Although it is clear that consumption rates of charcoal are increasing, there still a lot of associated factors to be understood, such the patterns of income generating for rural and urban households – there is little record of profit margins and expenditures.

The large-scale consumption of woodfuels is associated with the serious environmental problems of deforestation due to unsustainable woodfuel harvesting. Around major cities and towns, along the main development corridors in Mozambique, and around highly populated areas, the woodfuel scarcity is clearly evident and affects heavily the living standards of the population. Although it is recognized that the pressure on natural woodlands arises from a number of sources, other than biomass harvesting, namely, urbanization, commercial exploitation of timber and extensive land clearance for commercial agriculture, charcoal production is known to play a significant role in this picture.

Human health is another important factor associated to the use of biomass energy in most developing countries due to exposure of indoor air pollution. It is estimated that approximately 2500 million people in the world are exposed daily to emissions from domestic biomass cooking. Available studies indicate that exposure to indoor

air pollution from traditional biomass combustion causes respiratory and cardiovascular diseases, and contribute to increased mortality [3]. Women and infants are particularly the most vulnerable people.

The third associated adverse impact recently recognized is global warming linked with an increase in greenhouse gases emissions. According to recent studies, the combustion from traditional biomass is one of the important sources of greenhouse gases in many developing countries [4, 5]. Recent studies reveal that the low combustion efficiency of biomass in typical stoves and cookers leads to the formation of higher products of incomplete combustion.

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### 3. METHODOLOGY

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In the scope of this study, seven categories are identified, according to the role played in the charcoal chain; in sequential order of the process, these are (i) wood loggers, (ii) charcoal producers, (iii) packers or bag sorters, (iv) transporters, (v) wholesalers, (vi) hand-carriers and (vii) retailers. More details of this categorization are discussed in section 4.

Qualitative interviews were conducted with the various intermediates of the aforementioned categories in the chain to collect information used in this study. Qualitative interviews are extensively used to assess information on socio-economic profile and activities for biomass energy studies.

The interviews were carried out in Maputo city and the surrounding peri-urban area basically where the incidence charcoal activity is significant. A total of seven markets were selected as a sample to interview informants. The markets are as

follows: in the city, two markets were chosen, Malanga and Museu, while the rest of the five markets were Xipamanine, Vulcano, Xiquelene, Mucorreano and Delina. These are located in the peri-urban area of Maputo. The targeted categories in markets include transporters, wholesalers, retailers, carriers and hand trolley drivers (**Table 1**).

**Table 1:** Visited sites for interviews

#	Sites	Date (December)
<b>I.</b>	<b>Train Station</b>	
	Gare de Mercadorias	2, 8, 13, 16
<b>II.</b>	<b>Markets</b>	
<b>1</b>	Malanga/Nwacacana (OUA)	12
<b>2</b>	Xipamanine	12
<b>3</b>	Vulcano	12
<b>4</b>	Xiquelene	13
<b>5</b>	Mucorreano	13
<b>6</b>	Delina (Aeroportos)	13, 15
<b>7</b>	Museu	15
<b>III.</b>	<b>Residential Areas (Interview with Domestic Retailers)</b>	
<b>1</b>	Biarro da Polana Caniço	13
<b>2</b>	Bairro de Maxaquene	13
<b>3</b>	Bairro das Mahotas	14
<b>4</b>	Bairro Ferroviário	14

Since there are two subcategories of retailers: those operating in market places and also retailers who sell charcoal in their homes (*domestic retailers*), Interviews were also administered in four residential neighborhood (*Bairros*) namely Polana Caniço, Maxaquene, Mahotas and Ferroviário, all located in the peri-urban Maputo.

The train station (*Gare de Mercadorias*) is an important entrance point of charcoal, woodfuel and other products to Maputo. The station is located in neighborhood of Mavalane, to the north of Maputo. The interviews by the station were conducted with wholesalers, transporters, carriers and hand-trolley drivers. Additional interviews were undertaken with the railway company and agriculture authorities to collect information on the train schedule, route, and other relevant information related to the study.

The selection of interviewees followed a random sampling technique; however, where it was possible an attempt was made to involve people of stratified age, taking into account gender and years of experience in the charcoal business. The interviews were conducted by a team of two researchers, the study manager and an assistant, under supervision of the project manager, from the 2<sup>nd</sup> to the 16<sup>th</sup> of December 2011.

The survey involved a total of 63 interviews subdivided into the categories and number interviews as shown in **Table 2**. Additional data and information were collected by means of informal conversation with various people during the survey and these are discussed in section 5. The fewer number of interviews with wood loggers, charcoal producers and packers or bag sorters is owing to the fact that the visit to charcoal production site, initially planned, did not take place due to non-permitting weather conditions. December is the beginning of the rainy season, making production sites within the forests largely unattainable by conventional transportation.

The questionnaire structure was developed in a fashion that enables to capture as much relevant information as possible of a category, namely, the socio-economic profile, the activity of each of the interviewees in the charcoal chain, the cost structure within the activity and, whenever it was found relevant, the health and

environmental perception of the interviewee in relation to his/her activity. The complete set of questionnaires is attached in **Annex 1**.

A pilot-test was conducted to fine tune specific aspects of the questionnaire. In general, at the end of each interview, the interviewee is given an opportunity to comment on any aspect not dealt with during the interview that, to his/her view, may be relevant for the study.

For analysis purposes, the collected information and data is entered into Excel in table format for each category surveyed. Thereafter, the collected answers are grouped with view to assess similarities or common answers, differences and any other personal views obtained from the interviewees.

The following section presents results obtained from the survey and analyzed according to the methods above described.

**Table 2:** Number of interviews per category

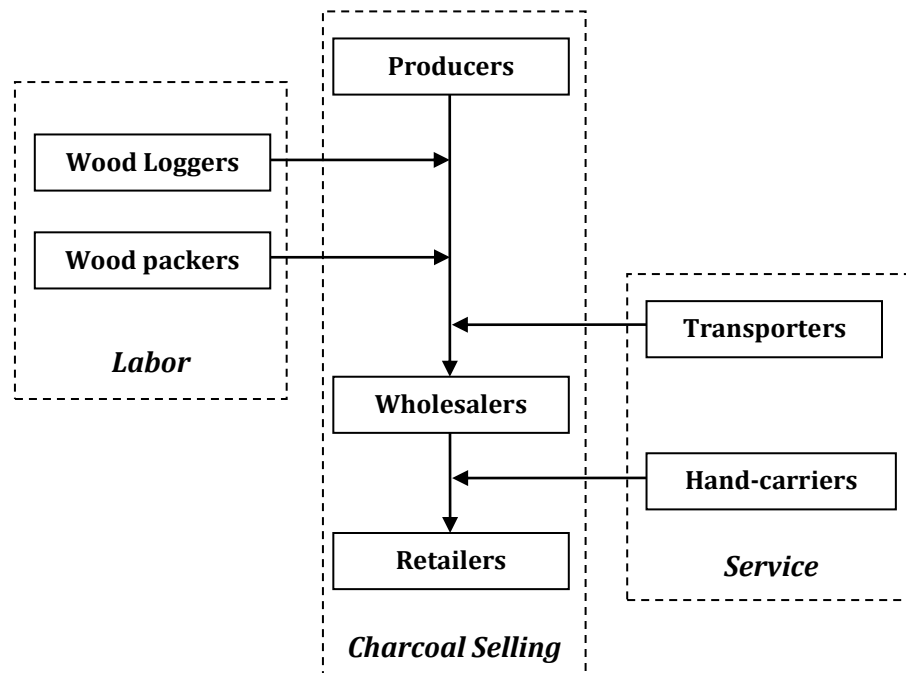
	<b>Category</b>	<b>Nr. of Interviews</b>
<b>1</b>	Wood loggers	2
<b>2</b>	Charcoal producers	2
<b>3</b>	Packers or bag sorters	1
<b>4</b>	Transporters	13
<b>5</b>	Wholesalers	17
<b>6</b>	Hand-carriers	8
<b>7</b>	Retailers	20
<b>Total Number of Interviews</b>		<b>63</b>



## 4. RESULTS – DESCRIPTION

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This section describes results obtained during the field survey relating to the socioeconomic profile and activities of the interviewees, in the charcoal chain. The figure below groups the different intermediaries within the charcoal value chain by dividing them into: labor category, commercial (selling) category, and service category. The following intermediaries were assessed in the study: Wood loggers, charcoal packers, producers, wholesalers, retailers, transporters, and hand-carriers.



**Figure 1:** Structure of charcoal value chain

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#### 4.1. WOOD LOGGERS

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Wood loggers appear in the first step of the chain since they are the ones who source wood for charcoal production. They are generally male with the age between 20 – 40 years. Usually they are employed by charcoal producers. They normally cut trees and/or tree branches manually with machetes and axes to feed the kilns. There are also loggers who use chainsaws to harvest wood. One of the interviewed wood logger has estimated that with 5 liters of gasoline it is possible to harvest wood enough to produce 35 – 50 charcoal bags of 60 – 70 kg.

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*"An electric chainsaw with 5 litre gasoline produces between 35-50 sacks of charcoal. Sacks vary around 60-70 kg. This quantity can be reached by only one person"*  
**-Wood logger**

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#### 4.2 CHARCOAL PRODUCERS

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The charcoal producer category refers to individuals who manage production sites where wood is sourced, in the forests. This category is mostly composed by males over 30 years of age. However there are also some females practicing charcoal production, generally over 30 years of age too. Charcoal producers are, in general literate people, some having attained secondary school.

Charcoal producers generally have approximately 10 – 30 or even more employees under their responsibility, these are basically wood loggers and bag sorters, therefore their main activity consists of managing human resources, the production process and sales. Some producers have their own trucks so, in these cases, they

load their trucks and deliver charcoal to wholesalers in Maputo markets themselves. They may sell charcoal anywhere during the trip if someone ask them to.

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*"I produce charcoal in Mabalane and sell it in Maputo. I am not personally involved in the production process, for this I have staff which I pay"*

**Guidion Tomas – Charcoal Producer**

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Producers travel regularly to production sites to supply their employees with staple products such as food and other basic hygiene products. They also buy spares and fuel for chainsaws and empty bags for packing charcoal.

One producer has estimated that with his 20 employees, he usually produces approximately 500 charcoal bags in a month. He has emphasized that the number of bags produced from a kiln depends very much on the ability of the workers; however, on average, a kiln produces about 50 bags. His truck carries about 170 bags of charcoal per trip to Maputo and he normally travels twice a week.

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*"The charcoal production process takes more or less two weeks to complete. I produce about 500 sacks a month. On average each kiln can produce around 50 sacks"*

**Guidion Tomas – Charcoal producer**

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Usually, in order to obtain a license for charcoal production purposes, a producer has to go through the following steps: first of all, he needs to contact local community people and ask for a parcel of land in the forest; generally all land is owned by the local community whom normally ask for a certain amount of money and wine in exchange for land. Once their request is satisfied, some kind of written agreement, which is basically the minutes of the meeting, is prepared and signed by witnesses – this serves as an approval of the community to concede the land to the

producer. Secondly, the producer applies for a license to the Department of Agriculture in Xai-Xai, the capital of Gaza province, by filling an official form and handing it jointly with the signed minutes. After the application, the process takes about a month to get the license.

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*"I work with a license to explore the forest area, and this license is frequently asked for by the fiscal authorities. There are however people which work without licenses or with expired licenses. Each license has duration of one year"*

**Jaime Justino – Charcoal producer**

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*"I use traditional methods to produce charcoal, however with gained experience we are producing each time more efficiently. I would be however interested in learning about modern production methods which are more efficient. Maybe this way the business will grow"*

**Jaime Justino – Charcoal producer**

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#### 4.3 CHARCOAL PACKERS OR BAG SORTERS

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As with charcoal loggers, bag sorters are usually employed by charcoal producers. They are generally male but there are also females packing charcoal. These workers are based at production site, and pack charcoal pieces into the 50 liter bags (usually reused maize or rice bags). They either receive payment per bag packed, or a daily wage for the work done.

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*"I work at the charcoal production location for a monthly wage of 500 Meticais. Ideally I would like to be studying; however I am in this business because I was unable to enrol at school this year"*

**Helton – Charcoal packer**

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#### 4.4 TRANSPORTERS

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In this study, the transporters category refers to both truck-drivers and hand-trolley men. All (truck) transporters met in the survey are male within the age between 40 to 60 years. The hand-trolley drivers are much younger, generally under 30 years of age. Most of the former interviewed have attended the basic (primary) school; some did not want to share their education level.

Some truck drivers are hired to transport charcoal from the production sites, in Gaza Province, to the markets of Maputo; others transport charcoal from the train station also to the markets or, from a wholesale yard to another market or to a certain charcoal end-use enterprise such as a restaurant, etc. Hand-trolley drivers typically transport small amounts of bags, usually 1 to 5 bags at the time, and for short distances. Most hand-trolley men also fall in the category of hand-carriers since they carry charcoal bags from trucks or wholesaler yards to the trolleys.

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*“My business is to transport the charcoal sacks from the train station to the markets around Maputo. I do this with my truck”*

**Jorge Macie – Transporter**

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Both truck drivers and hand-trolley men also carry other type of products other than charcoal in their daily activity. These goods include bricks, sand for construction, food products, etc. The majority of truck drivers are self-employed; while there are those who hire trucks to practice their activity. Some drivers get paid by trip or per day by owners of wholesaler yards. Trolley drivers are generally self-employed using their own trolleys; only few are employed, usually by owners of charcoal wholesale yards.

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*“I now push a trolley with charcoal from the truck to the wholesaler yard.  
One day I want to drive the charcoal trucks to the markets”*

**Mutcheca – Push Trolley operator**

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The truck-drivers interviewed at the train station work in the charcoal business only when the train arrives at the *Gare de Mercadorias* (Mondays and Fridays). Trolley-men work every day, operating from markets to different destinations. In general they work all year round and all week except for Sundays.

The bulk of charcoal commercialized in Maputo originates from Gaza province: truck-drivers mainly bring charcoal from Mabalane (230km), Combomune (300km), Macia (120 km), Motasse, Chókwe (150 km), Massingir (300 km). Once in Maputo, charcoal is delivered to the different market places including charcoal yards.

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*“I now bring charcoal by truck from Mabalane at 345 km from Maputo. In the past however, the regions of charcoal production were closer. First I brought charcoal from Matutuine, then from Magude and now from Mabalane. The locations are changing because of deforestation. Each time the trees in a region are finished, the producers move to more distant locations”*

**Gilberto Batine – Truck driver**

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The transport price by truck depends on the distance and ranges from 15 up to 50 Mt per bag. A truck can carry up to 150 bags per trip. Trolley-men charge from 40 Mt up to 100 Mt per bag also upon distance. They can carry about 10 bags per day. Generally, both truck and trolleys transport only one type of product at the time. The truck-driver’s clients are typically wholesalers, while hand-trolleys carry smaller amounts of charcoal bags for retailers, domestic buyers and restaurants.

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*“For transportation I charge per sack of charcoal carried. The distance is also taken into account. From Mabalane to the city I normally charge 150 Meticaïs per sack. It would be more expensive if the distance was larger. Generally I transport 130 to 150 sacks at each trip.”*

**Gilberto Batine – Truck driver**

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*“The rainy season affect the charcoal business by making it difficult to reach production sites. Trucks cannot easily enter flooded paths. This increases the price of transportation”*

**Custodio Jose - Transporter**

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**Figure 2:** Push Trolley and owner at train station waiting to be hired



**Figure3:** Truck owner waiting for truck to be loaded with charcoal at train station

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#### 4.5 WHOLESALERS

Wholesalers are usually females, mostly between 30 - 50 years of age. The majority of them have attended basic (primary) school although some did not want to share their education level. Four sub-categories of wholesalers were identified: (i) those who take the train to production sites and bring back charcoal to Maputo, at the station, *Gare de Mercadorias*; (ii) the second sub-category, travel to production sites and bring their merchandise to Maputo by trucks; (iii) those who have suppliers and get charcoal from truck-drives at the market; and finally (iv) wholesalers coming to Maputo, generally from places such as Manhiça and Macia. This last sub-category was found in Volcano Market and travel exclusively to sell charcoal bags and return to their places of origin once they finish selling their load.



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*“I travel to Mabalane on Tuesdays with the train, once I know the charcoal has been produced. There I find people who can help me pack and carry the charcoal sacks for a fee. The sacks are first carried to a truck and thereafter transported to the train station. The sacks arrive in Maputo on Thursday night, and are unpacked Friday morning at the station. I sell some sacks at the train station, and the rest I sell from home”*

**Isabel Amaral – Charcoal Wholesaler**

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*“I travel by train from Maputo to Xicualacuala to buy charcoal. The trip lasts for one day. I arrive on the next day. On Monday I go to the production sites to buy the charcoal from the producers.”*

**Maria de Gloria – Charcoal Wholesaler**

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Charcoal selling is a primary activity for almost all wholesalers interviewed and constitutes self-employment. Usually they practice their activity all year round on a daily basis, in many cases, except on Sundays. Some wholesalers do subsistence farming, and also sell clothes as a secondary activity. However charcoal selling remains their main activity.

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*“I come to Maputo to only sell charcoal, once I have sold all the sacks, I return to my home town in Gaza province”*

**Charcoal Wholesaler**

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Most of those interviewed have affirmed that they are unsure about what other activity they are capable to practice; some responded they would be selling other products such as clothes from South Africa while others would like to grow and sell chickens. In some cases they involve their daughters in the business, when they are away, especially those who normally travel to production sites.

*In-town* wholesalers usually acquire between 20 - 50 charcoal bags while those going to production sites can bring up to 150 bags of charcoal. Some wholesales recently engaged in the business have said they acquired charcoal from the same place/region.

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*One of the costs which I have to be prepared for is related to bribing officials at the road checkpoints. If my charcoal sacks are more full than it is accepted or if I am transporting more sacks than my license permits, than I often have to pay to pass. This is usually 300-400 Meticaís*  
**Charcoal Wholesalers**

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*“Years ago I use to buy charcoal from Muamba in Maputo province, now there are no trees in that region for charcoal production, so I go to Mabalane in Gaza province”*  
**Rosa – Charcoal Wholesaler**

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**Figure 4:** Wholesaler yard at Mucurreano market

## 4.6 HAND-CARRIERS

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All hand-carriers found during the survey are young males under 30 years of age. Most of them have attended primary school and some did not go to school at all. Their role, at the train station, consists of carrying charcoal bags from train carriages to the trucks or to hand-trolleys for the wholesalers. At the markets, they carry charcoal bags from trucks for wholesalers and, in some cases, for retailers operating in markets, or else, to hand-trolleys for those wholesalers operating out of the markets.

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*“Once the train arrives full of charcoal, I am paid to carry the charcoal sack from the train to the truck which will distribute charcoal to the markets. At the charcoal production sites I do the same, however I carry the sack from the location of production to the trucks.”*

**Alfredo – Charcoal sack carrier**

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Carrying charcoal bags is the main activity for most of the interviewed carriers at the markets, except some who are also involved in other secondary activities. Almost all of the carriers carry other types of merchandise in markets and they work all year round and every day. In general, charcoal carriers are employed by wholesalers; while only few are self-employed. Some carriers also push hand-trolleys (See section on Transporters).

The highest wage of employed carriers is 2500 Mt a month, these are generally carriers working in charcoal yards located in market places. Self-employed carriers charge their service per bag of charcoal carried and the price varies according to the distance and demand. At the train station, they charge 5Mt per bag to carry a bag from the train carriage to the trucks or to hand-trolleys; at the markets they charge

between 10 – 50 Mt, depending on the distance. On average, they carry 30 sacks per day, earning them from 150-300 Meticaïs per day.



**Figure 5:** Hand carrier at train station

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#### 4.7 RETAILERS

Retailers are females, mostly in the age between 30 - 60 years, except few who were between 20 - 30 years old. Most of them have attended basic school and some did not want to reveal their school level. There are basically two subcategories of retailers: the ones selling charcoal by the markets, and those selling at their homes -

the *domestic retailers*. Both get charcoal from wholesale yards. Most retailers have a common feature: they borrow one or two bags of charcoal from wholesalers, and only after selling these they refund the corresponding amount of charcoal bags, keeping their profit.

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*“I buy charcoal sacks at the wholesaler yards and sell them in retail quantities. I sell in the form of cans, mounts and plastic bags. I share this task with my mother”*

**Cristina – Charcoal retailer**

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*“I receive the charcoal sacks on credit from the wholesalers, sell the charcoal in small quantities and repay the wholesaler once revenue has been made. I sell in retail from my house”*

**Margarida – Charcoal retailer**

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Retailers are self-employed people. For those at the markets, selling charcoal constitutes their main activity, while domestic retailers generally have other activities such selling groceries, bread, etc. For those retailers who are married, generally their husbands practice other activities; however a significant number of retailers sustain their families by charcoal selling. Activities by other family members include, working as a security guards, municipal workers, nurses, school teachers, etc. In some cases, especially for domestic retailers, their daughters are also involved in the charcoal business.

Retailers usually acquire charcoal bags in the same place but not necessarily from the same person; typically domestic retailers get 1 -2 bags per week or for approximately 10 days, while those at market places sell 1 bag per day, on average. Market retailers normally hire carriers to carry charcoal bags from yards to their selling posts. Domestic retailers hire hand-trolleys services.



**Figure 6:** Charcoal retailer at Museu market



**Figure 7:** Charcoal retailer at Xipamanini market

#### 4.8. CHARCOAL PRICES AND REVENUE THROUGHOUT THE CHAIN

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The price of charcoal depends on a number of factors, such as the, quality of charcoal, distance from production site to the place of sale, cost of transport, competition and weather conditions. At the productions sites a bag costs 250 Mt, in average. Some wholesalers have said it is possible to buy a sack of charcoal per 200 Mt in some production sites of Chicacuacala, 550 km from Maputo.

The transport price depends on the distance and ranges from 100 up to 180 Mt per bag from production sites to Maputo, by truck. Wholesalers who use train to bring charcoal to Maputo, pay about 70 Mt per sack; on top of this wholesalers spend approximately 10Mt and 50 Mt per sack with hand-carriers and truck drivers, respectively, to transport their charcoal from the train station to the selling destinations. Some wholesalers use hand trolley-cars for relatively short distances instead of trucks, and these charge from 40 Mt up to 100 Mt per bag, also upon distance. The total transport costs are in the range between 130 (via train, including those costs within Maputo) – 180 (by truck, from production sites).

Wholesalers whom use the train sell a sack of charcoal for 500 – 550 Mt at the train station, generally to other Wholesalers or retailers. At the markets, the price increases to 650 – 750 Mt, which is, in fact, the average price of charcoal per sack in many markets of Maputo.

Considering the above figures, the total cost of one charcoal bag, for the wholesalers, can be estimated at 400 – 450 Mt, from the production site to the selling posts. On an average selling price of 650 – 750 Mt per bag, the margin of revenue per sack is around 250 – 300 Mt. Of course there are others factors that need to be taken into account here, such as expenses with possible employees and market place taxes (5mt per day).

The prices of charcoal and quantities sold by retailers are shown in **Table 3**; they vary slightly from one market to another. The different quantities adopted for charcoal are aimed at accommodating a wide diversity of clients according to their purchasing power.

**Table 3:** Charcoal prices and the quantities used in surveyed markets

<b>Charcoal Prices (Mt)</b>							
#	Sites	20 l (12 - 14) kg	10 l (6- 7) kg	5 l (2.5 -3) kg	2 l (1 - 1.5) kg	Bundle (0.5 - 0.7) kg	Sack (70 - 110) kg
<b>II. Markets</b>							
1	Malanga/Nwacacana	130	70	-	-	10	650
2	Xipamanine	130	70	25	13	10	600
3	Vulcano	140	70	25	-	5	600
4	Xiquelene	180	100	-	13	10	650
5	Mucorreano	180	100	-	-	-	650 - 700
6	Delina (Aeroportos)	180	-	-	-	10	650 - 700
7	Museu	200	-	-	20	-	800
<b>III. Residential Areas</b>							
1	Bairro da Polana Canço	-	-	-	-	10	-
2	Bairro de Maxaquene	-	-	-	-	10	-
3	Bairro das Mahotas	-	-	-	-	10	-
4	Bairro Ferroviário	-	-	-	-	10	-
<b>Average Price</b>		163	82	25	15	9	

Retailers are the final selling intermediates in the chain. An approach to estimate their margin of revenue per sack sold can be drawn from Table 3. For example, considering charcoal selling in bundles; if we assume that a bag of charcoal weighs approximately 70 kg, in average, and a bundle is of 0.7 kg, ideally, the retailers profit would be 300 Mt per sack, since he/she can portion 100 bundles per sack. However, it should be noted that this estimate is subject to the specific weight and the quality of charcoal in the bag. Many retailers have reported complaints regarding the fact that, frequently, about one fifth of the content in a sack was not solid blocks of charcoal, but rather charcoal residues and dust. This could represent losses of at least 100 Mt per sack for retailers.



Charcoal prices have increased significantly in recent years. Reports by the interviewees during this survey, for instance, indicated that the cost of a charcoal bag at the site of production was 8 Mt in 1995; 35 Mt in the year 2000 and; currently it is approximately 250 Mt. This increase in the price of charcoal at the production sites has increased as a result of the scarcity of accessible forest areas and the growing demand of charcoal in urban Maputo.

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## 5. DISCUSSION

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The intermediates of the charcoal value chain are both male and female between 20 to 60 years old. The highest literate category in the chain is that of producers, with frequency of secondary school education. Most of the categories are gender oriented, except for producers, an activity practiced by both sex. Normally the tasks, such as hand-carrying and transportation are practiced by men.

In some cases, one individual can participate in various interrelated categories. For instance, some producers may also be transporters and wholesalers; some even own wholesale yards in markets, these are generally large-scale producers and sellers in the business. In the same line, there are hand-trolley drivers who are also carriers.

The choice of participating in various categories is justified by the margin profit and experience in the business and, generally, these individual dedicate full-time service to this activity. The work experience of the different intermediaries, vary from a few months to over 30 years of experience. It appears that *top-categories*, of wholesalers and producers are the most profitable.

A significant number of interviewed intermediaries, especially retailers have responded that they sell charcoal due to lack of options. The fact that they run their business, by borrowing a couple of bags and only after selling, in small quantities to consumers, usually in tins, bundles or small plastic bags, they refund to wholesalers. This suggests that they practice their activity for their subsistence. Domestic retailers are also involved in selling other types

of groceries. Some hand-trolley drivers said they would like to become truck drivers in the future.

The survey indicates that the distance of charcoal production sites has increased in recent years, according to answers from producers and wholesalers practicing this activity for a while, generally those with almost a decade in the business. For instance, to illustrate this fact, these categories of intermediates have argued that they started the charcoal business within Maputo, mainly in Goba, Moamba and Matutuine, southwest of Maputo and within a distance of 100km. Nowadays they mainly source charcoal from forests of Gaza province. The production sites are located as far of 200km and even over 400km from Maputo, for example, Mabalane, Combomune and Chicucuala.

For some intermediated, the environmental issues raised during the survey, especially to producers, are recognised to be important in their activity, however they pointed out that charcoal constitutes their main livelihood. Furthermore, they would welcome any project towards protecting forests, provided they get enough profit out of it. The long distances travelled to run their business impacts negatively in their social lives. Nevertheless, they are sceptical in the implementation and success of such program. There are those who attribute the forest threat to other factors other than charcoal making.

It was clear during the survey that the most vulnerable categories to health impacts associated to charcoal activity are wood loggers, packers and hand carriers; however some of these intermediates are not even aware of the risk they are exposed to. Some of them, especially carriers, have argued that they take personal measures, such as drinking milk to combat adverse impacts on their health. Much charcoal dust is ingested during the work activities. This may have a long term health impact on those working. Some charcoal sack carriers report to suffering from respiratory problems such as tuberculosis. Episodes of accidents or injuries with wood loggers were reported during the manipulation of their equipment. Falling of charcoal bags occur, especially when carriers have to carry heavy bags or simply when they are exhausted. The back strain is also considerable when considering charcoal sack carriers. Some of the sacks are reported to weigh up to 100 kg's.

## 6. CONCLUSION

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This study focused on the charcoal value chain by means of describing and analysing the role of each of the intermediates involved in charcoal business, from wood loggers to charcoal retailers. The study area, where this fuel is commercialised and consumed, is Maputo, city and the peri-urban surroundings. The charcoal originates from production sites located some 120 to 500 km away from Maputo to the north, in the neighbouring province of Gaza.

It is evident that the charcoal industry provides employment and source of revenue for many of the rural and urban people in Mozambique. It is also clear from the data that the charcoal production sites are moving further in land as a direct result of the deforestation caused by this activity. Policy makers have to delicately balance between maintaining the livelihood of those involved in the charcoal value chain while at the same time addressing the environmental treat caused by the industry.

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### Annex 1: Questions used in interviews

## Cadeia do Carvão

### Produção – Comercialização – Consumo Final

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#### Perguntas Chave (para todos grupos da cadeia):

##### Perguntas Socio-Económicas:

1. Por favor, diga o seu nome e o seu apelido?
2. Qual é a sua idade?
3. Qual é o seu nível académico (ou escolaridade)?
4. Qual é a sua actividade (ou o seu papel) no comércio de carvão?
5. Descreva resumidamente em que consiste a sua actividade
6. Há quanto tempo se dedica a esta actividade?
7. O comércio de carvão constitui a sua actividade principal de rendimento?
8. Pratica esta actividade por conta-própria ou trabalha para alguém (para o patrão)?
9. Dedica-se a esta actividade durante todo o ano?
10. Quantos dias por semana dedica para esta actividade?
11. Diga quais são as outras actividades de rendimento que desenvolve:
  - a. Actividade secundária
  - b. Actividade terciária
12. Qual destas actividades contribui mais para a sua renda familiar?
13. Ao invés do negócio de carvão, qual é outro tipo de actividade (trabalho) que pode desenvolver?
14. Existem mais pessoas que trabalham em sua casa?
15. Que tipo de actividades estas pessoas desenvolvem?
16. Há mais pessoas na sua casa envolvidas no comércio de carvão?
17. Se sim, qual é o seu papel?

#### 1 Perguntas para os Catadores Lenha

1. De onde o Sr. tira a lenha? (Distrito, localidade)
2. Como é que abate as árvores para tirar a lenha:
  - a. Corta pelos ramos
  - b. Corta toda a árvore
  - c. Corta toda árvore incluindo as raízes

3. Que instrumentos usa para abater as árvores/ou para cortar ramos?
4. A quem pertence a terra (ou floresta) em que tira a lenha? Se a terra pertence a outrem, que tipo de acordo/arranjo existe entre o Sr. e o dono da terra para cortar a lenha?
5. Quantas árvores o Sr. corta por dia/semana/mês?
6. Houve alguma mudança do local onde tem cortado a lenha nos últimos 5 -10 anos?
7. Se sim, pode nos dizer os nomes destes locais/regiões e estimar as distâncias entre elas.
8. Porque pensa que houve mudanças em relação ao local de onde tira lenha?
9. Qual é o impacto desta mudança no seu trabalho diário? E na sua vida social/pessoal?
10. Quais são as suas sugestões para amenizar os problemas que enfrenta no seu trabalho e na sua vida social?
11. Se houvesse um projecto de plantio de árvores para produção de carvão, estaria interessado em participar?
12. Acha que um projecto dessa natureza teria sucessos se fosse implementado na sua região?
13. Que benefícios/vantagens acha que tal iniciativa/projecto traria a nível pessoal? E para o meio ambiente?
14. Quem são os compradores da sua lenha?
15. Sabe onde é que o carvão aqui produzido é vendido? (Destino final)
16. Pode, por favor, dizer qual é o seu rendimento/lucro desta actividade
17. Qual é o tamanho das árvores que costuma abater?
18. O tipo/espécie importa na escolha da árvore por abater?
19. Tem alguma preferência das espécies de árvore por abater?
20. A espécie de árvore preferida é abundante na região ou a sua disponibilidade tem estado a reduzir com o tempo?
21. Acha que o seu trabalho é seguro? Já sofreu, ou um colega seu, algum tipo de lesão/acidente durante o trabalho? Que tipo de lesão?
22. Alguém, incluindo as autoridades, tem o importunado/incomodado, durante o exercício da sua actividade?
23. Se sim, porque o têm incomodado/importunado?
24. Existe algum regulamento ou sistema de licença para o exercício da sua actividade?
25. Possui alguma licença ou já fez o pedido para o efeito? Se não, porquê?
26. A época chuvosa tem algum impacto sobre o seu negócio? Como é que afecta?
27. Qual tem sido o papel das mulheres nesta actividade?

## 2 Perguntas para os produtores de carvão

1. Quanto tempo dura o processo de produção de carvão?
2. Por favor, descreva esse processo?
3. Quantos fornos (de areia) de carvão faz por mês?
4. Quantas pessoas (empregados, parentes) são envolvidas na montagem destes fornos?

5. Qual é a quantidade de lenha que é usada normalmente num forno?
6. Qual é a quantidade de carvão produzido normalmente em cada forno? Ou quantos sacos de carvão geralmente saem em cada forno?
7. Tem conhecimento de algum impacto negativo sobre o meio ambiente associado a actividade de produção de carvão?
8. Pessoalmente já teve, ou terá acontecido aos teus colegas, problemas de saúde associados a actividade de produção de carvão? Já teve algum acidente nesta actividade?
9. Como é que ganha dinheiro a partir desta actividade?
10. Para quem vende o carvão?
11. Qual é a medida que usa para venda de carvão (kg ou em sacos)
12. Quais são os preços para cada medida?
13. Que quantidade consegue vender por dia/semana/mês?
14. Alguém, incluindo as autoridades, tem o importunado/incomodado, durante o exercício da sua actividade?
15. Se sim, porque o têm incomodado/importunado?
16. Existe algum regulamento ou sistema de licença para o exercício da sua actividade?
17. Possui alguma licença ou já fez o pedido para o efeito? Se não, porquê?
18. A época chuvosa tem algum impacto sobre o seu negócio? Como é que afecta?
19. Qual é a espécie de árvore que costuma usar na produção do carvão?
20. Tem alguma preferência das espécies de árvore para produzir carvão?
21. Qual tem sido o papel das mulheres nesta actividade?
22. Já ouviu falar em métodos modernos de produção de carvão? Se sim, quais são os métodos de que já ouviu falar?
23. Estaria interessado em adoptar estas tecnologias modernas? Porquê?

### **3 Perguntas para os empacotadores de carvão**

1. Como é que ganha dinheiro a partir desta actividade?
2. É pago por cada saco que empacota ou tem um salário fixo? Quanto?
3. Quantos sacos consegue empacotar por dia?
4. Pessoalmente já teve, ou terá acontecido aos teus colegas, problemas de saúde associados a sua actividade? Pode explicar?
5. Tem alguma preferência das espécies de árvore para produzir carvão?
6. Qual tem sido o papel das mulheres nesta actividade?

### **4 Perguntas para os carregadores de carvão (do local da produção para veículos de transporte - camiões)**

1. Como é que ganha dinheiro a partir desta actividade?
2. É pago por cada saco que carrega ou tem um salário fixo? Quanto?

3. Quantos sacos consegue carregar por dia?
4. Pessoalmente já teve, ou terá acontecido aos teus colegas, problemas de saúde associados a sua actividade? Pode explicar?

*Observação: Existe diferentes tipos de carregadores*

- *Carregadores manuais, do local de produção (fornos) para os veículos (camiões) de transporte*
- *Carregadores dos camiões para vendedores a grosso (grossistas)*
- *Carregadores dos grossistas aos retalhistas ou compradores domésticos*
- *O carregamento também pode ser feito por meio de carrinho de mão (vulgo chova) dependendo da quantidade transaccionada.*

## 5 Perguntas aos Transportadores

1. De onde é que o Sr. normalmente busca o carvão e lenha?
2. A que distância (em km) fica este local daqui?
3. O local de onde traz o carvão e lenha terá mudado nos últimos 5 -10 anos?
4. Se sim, onde era este local?
5. Porque acha que este local mudou?
6. Qual é o impacto desta mudança na sua vida?
7. Como é que ganha dinheiro a partir desta actividade?
8. É pago pelo saco transportado ou por viagem?
9. Se for por saco, quanto é que lhe pagam por cada saco transportado?
10. Se for por viagem, quanto é que cobra por viagem?
11. Quantos sacos de carvão normalmente transporta?
12. Durante as viagens, costuma levar outro tipo de carga/passageiros?
13. Quem são geralmente os seus clientes?
14. Sabe qual é preço do saco de carvão no local da produção?
15. Sabe qual é o preço da re-venda do saco na cidade?
16. Alguém, incluindo as autoridades, tem o importunado/incomodado, durante o exercício da sua actividade?
17. Se sim, porque o têm incomodado/importunado?
18. Existe algum regulamento ou sistema de licença para o exercício da sua actividade?
19. Possui alguma licença ou já fez o pedido para o efeito? Se não, porquê?
20. A época chuvosa tem algum impacto sobre o seu negócio? Como é que afecta?

## 6 Perguntas aos Grossistas

1. Onde é que o (Sr.) tem adquirido o carvão?
2. Adquiriu sempre no mesmo local/região?
3. Se não, qual é outro sítio onde tem adquirido e porque este local mudou?
4. Que quantidade de carvão o Sr. geralmente adquire de cada vez?
5. Como é que transporta o carvão do local da compra até o local onde faz o seu negócio?



6. A que preço compra cada unidade (saco de carvão, ou outra medida - especifica)?
7. A que preço vende cada unidade (saco de carvão, ou outra medida - especifica)?
8. Que factores determinam o preço do carvão que vende?
9. Onde é que vende o carvão? Para quem vende?
10. Quanto é que paga/gasta pelo transporte – (por saco ou por viagem)?
11. Descreva a evolução do preço do carvão nos últimos 5-10 anos
12. Com quantas pessoas (empregados por si) trabalha neste negócio? Quanto é que lhes paga?
13. A época chuvosa tem algum impacto sobre o seu negócio? Como é que afecta?

## 7 Perguntas aos Retalhistas

1. Onde é que o Sr. tem adquirido o carvão?
2. Tem adquirido sempre no mesmo sítio/ ou da mesma pessoa?
3. Que quantidade de carvão o Sr. geralmente adquire de cada vez?
4. Com que frequência adquire para o seu *stock*?
5. Como é que transporta o carvão a partir do sítio onde compra?
6. Quais são os seus custos associados a este negócio?
  - a. O preço a que compra o carvão
  - b. Despesas com os trabalhadores (empregados)
  - c. Taxa de imposto (taxa diária do mercado)
  - d. Transporte
  - e. Outras despesas? Especifique
7. Quais são as diferentes medidas que usa para vender?
  - a. (pesar com a balança)
8. Porque adoptou/escolheu estas medidas para a venda de carvão?
9. Qual é o preço para cada medida?
10. Qual é a quantidade de carvão que consegue vender por dia/semana/mês?
11. Os seus clientes/compradores são geralmente os mesmos ou nem por isso?
12. Costuma oferecer alguma facilidade aos clientes na compra do seu carvão (descontos, aceita emprestar – para pagamento posterior, pagamento por prestações, etc.)?