

Gross Value Added of Wood Fuel Production in Ethiopia

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Abstract

Ethiopia is among the developing countries dependent on solid biomass energy source. Wood-fuel is among the dominant solid biomass energy source used by all households in the country. Charcoal and firewood are the source of income for the poor rural households and primary fuel in most rural and urban areas of Ethiopia. The gross value added from value chain across all levels of wood fuel production in Ethiopia was about USD 5,858 million, accounting about 4.5% of the GDP in 2014. It increased to USD 6,419 million in 2015. It is difficult to present the cost-benefit distribution along the chain of charcoal production and marketing because it passes through informal channels. Large number of people are employed in the various phases of the charcoal value chain, including: tree harvesting; sizing of wood; preparation of charcoal kilns; loading the wood into kilns and unloading charcoal after conversion; unloading, bundling, packaging and transportation, and marketing. However, that distribution of income and profit in charcoal production-supply channel in Ethiopia is highly skewed toward the producers, that is, 75% of the total revenue/bag. Even though, wood-fuel production generates significant income to rural poor, the production and consumption of both charcoal and firewood is inefficient and unsustainable causing environmental problems. Therefore, there is a need for institutional interventions that promote and regulate more environmentally friendly means of production. Promotion of improved cook stoves (ICS) can increase energy efficiency and sustainability. We recommend using alternative renewable energy sources like biogas and electricity (hydroelectric power, electricity from wind power and thermal energy) to reduce the environmental impact wood-fuel production and consumption.

Keywords: Wood fuel, gross value added, value chain, gross domestic product, Ethiopia

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1. Introduction

Ethiopia is among the developing countries depending on solid biomass energy mainly from wood fuel. Wood-fuel production consists of firewood collected from the forest and wood converted to charcoal. Wood product demand and consumption is growing fast in Ethiopia due to continuous increase in population and economic growth. Wood-fuel (firewood and charcoal) is the largest source of wood-based production and consumption in Ethiopia (UNEP, 2016). Wood-fuel is produced mainly from natural forests including natural high forests, woodlands, area enclosures and plantation forests (UNDP Ethiopia, 2017).

The past 15 years have seen a massive increase in the consumption of charcoal in all regions from 48,581 tons/year in 2000 to 4,132,873 tons/year in 2013. However, its production and marketing in Ethiopia is organized informally (Geissler et al., 2013; Bekele and Girmay, 2013). The majority of informal charcoal producers are low to middle income or poor pastoral/agro-pastoral and mixed farming households living in the dry lowlands of Ethiopia. These households produce charcoal regularly as their main or additional source of income to support their families (MEFCC, 2016a). With the exception of some women engaged in the retailing activity, in the majority of cases the charcoal business appears to be dominated by younger men, particularly the landless youth. However, the production, transportation and marketing for charcoal and firewood are illegal. Charcoal is transported to urban centers using trucks, automobiles, camels and donkeys (MEFCC, 2016b).

The informal nature of production and marketing of charcoal and firewood resulted in difficulty to know the main supply chain and value chain channels. The price at the production site for both fuel wood and charcoal is incomparable to the retail price in the cities. In addition, the price of charcoal is much higher when purchased in small retails than in sacks. Distribution of income and profit sharing in the illegal charcoal production-supply channel in Ethiopia is highly skewed toward the producers who are earning about 75% of the total revenue/bag ((Bekele and Girmay, 2013); MEFCC, 2016a; Gemechu et al., 2019). This is also due to its informal and illegal nature of production and marketing. Therefore, knowing the value chain of the wood fuel production in the country is very essential in assessing the gross value added, which can contribute to the country's gross domestic product. The gross value added could be expressed both per unit of solid biomass (charcoal and firewood) produced and as a percentage of gross domestic product. In this study national data on major solid biomass production collected by Ethiopian environment, forest and climate change was used. Various national reports from national and regional project documents were also used in the analysis.

2. Wood-fuel (charcoal and firewood) production in Ethiopia

Wood fuel is the most important forest product consumed in Ethiopia, with a total volume of consumption of

about 116 million m³ in 2013 (MEFCC, 2016a; MEFCC, 2017). It is produced from natural forests (natural high forests, woodlands and area exclosures) and plantations (industrial and woodlots). There is also a small volume of wood fuel sourced from wood waste and import. The imported wood fuel is mostly for industrial uses. The largest portion of wood fuel is sourced from natural forests and woodlands. Studies note that the majority (93%) of this wood fuel is sourced from natural forests and that 35% of the harvest from natural forests is unsustainable. The remaining 7% of wood fuel is harvested from public and private plantations and woodlots (UNEP, 2016b). Ethiopia is among the few remaining countries with a high percentage (over 90%) of its population reliant on solid biomass (IEA, 2013). In different towns and cities of Ethiopia over three million tons of charcoal consumed each year (NBPE, 2015). A national study on biomass energy in Ethiopia reported that by 2000 charcoal had only been consumed in significant quantities in Tigray and Somali regions and hardly in all other regions (Geissler, 2013). However, the past 15 years have seen a massive increase in the consumption of charcoal in all regions from 48,581 tons/year in 2000 to 4,132,873 tons/year in 2013. The same report stated that charcoal production and marketing in Ethiopia has always been almost entirely informally organized. The majority of informal charcoal producers are low to middle income or pure pastoral/agro-pastoral and mixed farming households living in the dry lowlands of Ethiopia (Geissler, 2013). Most charcoal coming to towns and cities is produced, transported and retailed illegally. It is transported to urban centers using trucks, automobiles, camels and donkeys. A charcoal inflow survey into Addis Ababa alone showed on an average, over 42,000 sacks of charcoal coming to the city each day (MEFCC, 2016b).

The main actors directly involved along the charcoal marketing chains include producers, distributors/transporters, wholesalers, retailers and consumers. The transporters who come with light trucks buy up to hundreds of sacks of charcoal and sell to both the retailers and directly to the consumers. Their main sales are to retailers in major urban areas. Price of charcoal is much higher when purchased in small retails than in sacks. In some cases, Consumers can buy directly from producers or distributors; depot owners are also engaged in retailing charcoal (Bekele and Girmay, 2013). According to the same report, distribution of income and profit sharing in the illegal charcoal production-supply channel in Ethiopia is highly skewed toward the producers who are earning about 75% of the total revenue/bag (MEFCC, 2016a; Gemechu et al., 2019).

3. Wages along charcoal value chain

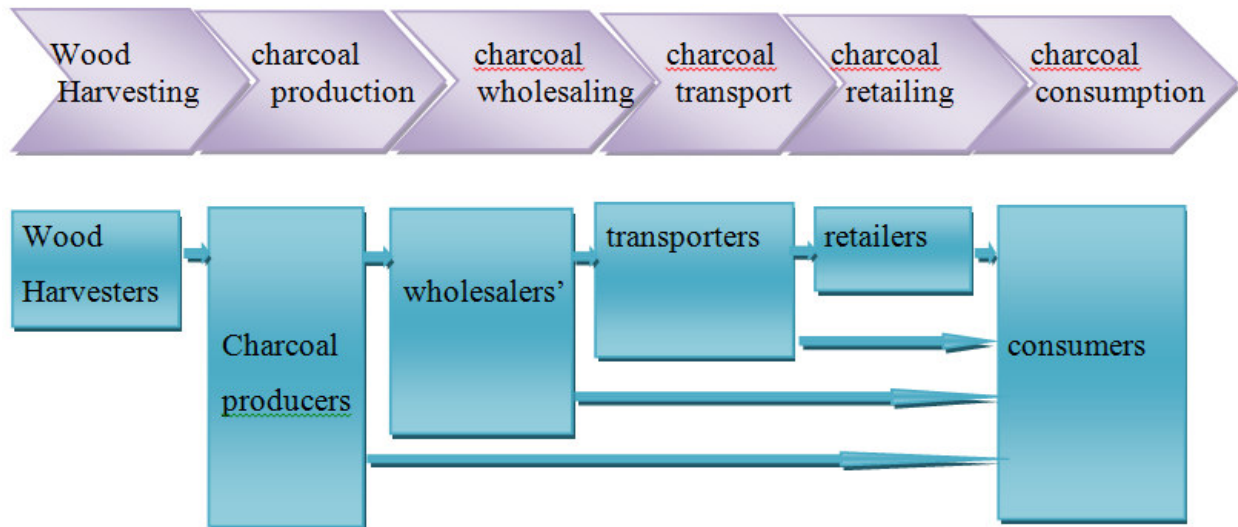
Charcoal turns out to be among the most important and reliable cash income sources compared to income from semi-subsistence crop and livestock activities, which are subject to climatic and other calamities. The main actors directly involved along the charcoal marketing chains include producers, distributors/transporters, wholesalers, retailers and consumers (Fig 1). The transporters who come with light trucks buy up to hundreds of sacks of charcoal and sell to both the retailers and directly to the consumers. Their main sales are to retailers in major urban areas. Charcoal retailers buy charcoal in a sack from charcoal depots or transporters and sell in small retails to low income consumers who are not able to pay for a sack of charcoal. Price of charcoal is much higher when purchased in small retails than in sacks. In some cases, consumers can buy directly from producers or distributors; depot owners are also engaged in retailing charcoal. Beside local market, it was argued that there are some illegal exports, mainly to Djibouti, Kuwait, Saudi Arabia, Sudan and Somaliland (Bekele and Girmay, 2013; Yitayal, 2015).

As the charcoal commodity is moved from the point of production through markets to consumers, it incurs various costs: production, transportation and other informal costs (e.g. bribes and payments to brokers, loading and unloading, and, in a few cases, payment by producers to those who claim to have ownership rights over the trees). Thus, it is problematic to present accurately the cost-benefit distribution of the business along its chain. According to the recent national charcoal value chain assessment (MEFCC, 2016a), most of the charcoal produced in Ethiopia is traded and supplied to consumers through the following channels:

- Channel 1: Illegal private producers-private vendors-urban consumers
- Channel 2: Illegal private producers-foreign smugglers-foreign market
- Channel 3: Licensed and permitted private/group producers-private vendors-urban consumers
- Channel 4: Illegal regular household level producers-local vendors-local consumers
- Channel 5: Illegal irregular producers directly to road-side buyers or local consumers

Of these, Channel 4—the illegal regular household level charcoal producer to local towns—is the most frequent charcoal production-supply channel covering much of the charcoal-producing regions in Ethiopia, mainly with pastoral/agro-pastoral and mixed farming communities in dry lowlands. Distribution of income and profit sharing in the illegal charcoal production-supply channel in Ethiopia is highly skewed toward the producers who are earning about 75% (ETB 225) of the total revenue/bag (MEFCC, 2016a).

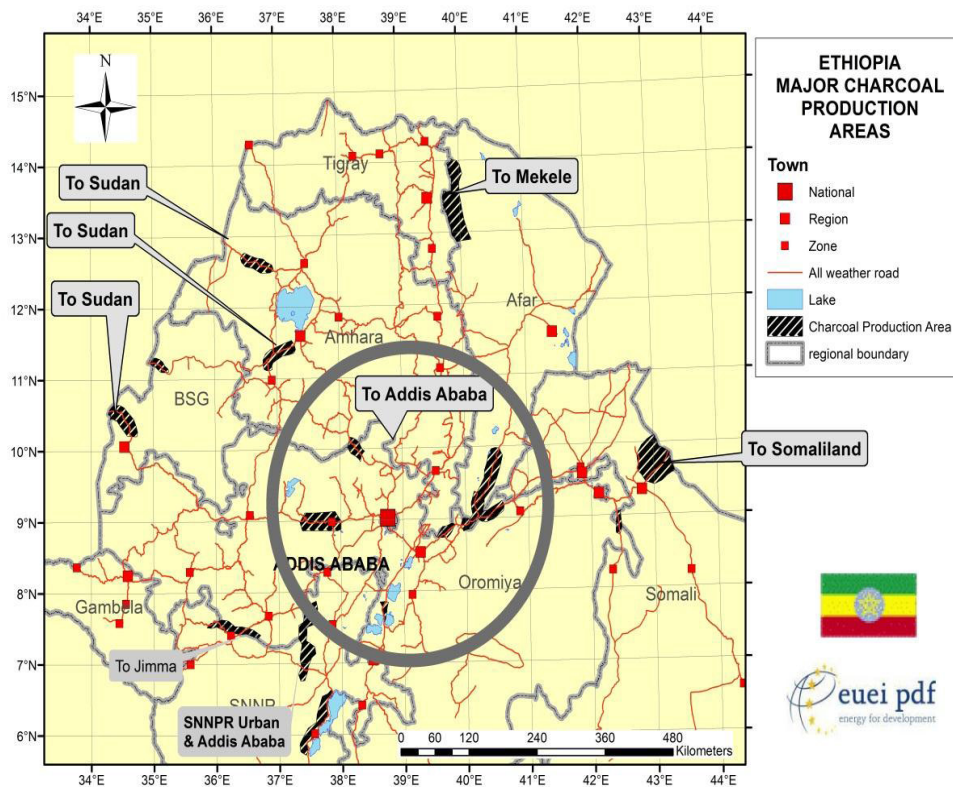
Figure 1. Map of charcoal supply chain



Source: Authors

4. Location of the activity

Most charcoal coming to towns and cities is produced, transported and retailed illegally. It is transported to urban centers using trucks, automobiles, camels and donkeys. A charcoal inflow survey conducted in August 2012 into the city of Addis Ababa alone showed an average of over 42,000 sacks of charcoal coming to the city each day (Bekele and Girmay, 2013). The acacia-dominated dry-woodland and shrub-land areas, which cover over 60% of the total landmass of Ethiopia, constitute the largest source of wood for the bulk of charcoal coming to urban centers in the country (FAO, 2017). The bulk of charcoal comes from either acacia species and/or the invasive species *Prosopis juliflora* through the eastern gate to Addis Ababa. Gewane in Afar, Bilate in SNNPRS, Langano and Borana in Oromiya, and Harshin in Somali regions are some of the major charcoal suppliers to towns and cities in each region (Fig 2).



Source: (Bekele and Girmay, 2013).

5. Percentage of Gross Domestic Product

The largest source of wood-based production and consumption in Ethiopia is wood fuel (firewood and charcoal). Studies show that more than 97.5% of the energy consumed by rural and urban households in Ethiopia during the 1990s and early 2000s is derived from biomass fuel, and 78.9% of biomass fuels are in the form of firewood and charcoal. Wood fuel is the most important forest product consumed in Ethiopia, with average wood-fuel consumption per capita of 1.35 m³/year. Based on the FSR data (MEFCC, 2017), the annual volume of wood harvested for wood fuel is approximately 120.4 million m³ round-wood equivalent (RWE) in 2015 (115.024 million m³ as firewood and 5.408 million m³ for conversion into charcoal).

Table 1: Value added of wood fuel production (UNEP, 2016)

Year	Value added		Share of GDP
	Million ETB	Million USD	Percent
2012	30,855	4,781	4.1%
2013	39,078	5,858	4.5%
2014	46,827	6,419	4.5%

The GDP contribution of wood fuel annually consumed is estimated at USD 5,858 million (MEFCC, 2016a), which is about birr 39,072.86 million per year at PPP of 2013 (UNEP, 2016), accounting about 4.5% of the GDP of the same year. The gross value added from wood fuel (Charcoal and firewood) increased to USD 6,419 million (ETB 46,827 million), accounting the same percentage share of Ethiopian gross domestic product of 2014.

Based on UNEP (2016) estimates the gross value of rural wood fuel production in 2015 to be 34.2 billion ETB, which is very similar to the Forest Sector Review's (MEFCC, 2017) estimate of 35.5 billion ETB for 2013. The findings estimate the costs to be equal to 3.4% of gross production, giving a figure of 33.5 billion ETB for value added. The FSR's estimate of 1.35 m³ of wood fuel production *per capita* in 2013 (95% firewood and 5% charcoal) has been adopted as the basis for valuation, since it better reflects overall national conditions.

Table 3: Gross Value added from solid Biomass (Charcoal and firewood)

No.	Content	Unit	2015
1	Total wood fuel production	M ³	120.4 million
2	Total wood fuel production	kg	60.2 Billion
3	Average Energy production	MJ/kg	16.9
4	Total Energy production	MJ/year	1,017.38 Billion
5	Gross Value added	ETB	34.2 Billion
		USD	5.127 Billion
6	Gross Value Added Per Unit of Energy Produced	ETB/MJ	0.033615758
		USD /MJ	0.005039844

Source: Authors computation using data obtained from (UNEP 2016b; MEFCC, 2017)

The annual volume of wood harvested for wood fuel is approximately 120.4 million m³ round-wood equivalent (RWE) in 2015 (115.024 million m³ as firewood and 5.408 million m³ for conversion into charcoal) (MEFCC, 2017). This can be about 60.2 billion Kg of Wood fuel consumed in the same year. References indicated that one kilogram of fuel wood generates an average of about 16.9MJ energy. The wood fuel consumed in the country in 2015 generated about 1,017.38 billion MJ per year. The gross value of rural wood fuel production was (60.2 billion Kg) in 2015 to be 34.2 billion ETB. The result from table above indicated that the gross value added per unit of energy produced from solid biomass (wood fuel) in Ethiopia is ETB 0.034/MJ of biogas fuel (USD 0.005 per MJ).

6. Conclusion and Recommendation

In Ethiopia large number of people are employed in the various phases of the charcoal value chain, including: collection and sizing of wood; preparation of charcoal kilns; loading the wood into kilns and unloading charcoal after conversion; unloading, bundling, packaging and transportation; and marketing. even though, it is difficult to present accurately the cost-benefit distribution of the business along charcoal supply chain It incurs various costs like production, transportation, taxation, bribes and payments to brokers, and, in a few cases, payment for ownership rights. The distribution of income and profit sharing in the charcoal production-supply channel is highly skewed toward the producers (75% of the total revenue/bag), that is 225 ETB.

The gross value added from value chain across all levels of wood fuel (charcoal and firewood) production at national level in Ethiopia was estimated to be USD 5,858 million (birr 39,072.86 million) in 2013, accounting about 4.5% of the GDP of the year. The gross value added from wood fuel (Charcoal and firewood) increased to USD 6,419 million (ETB 46,827 million), accounting the equal share of Ethiopian gross domestic product of 2013-14. Currently, the wood fuel (charcoal and firewood) produced national level is used both by rural and urban households. It is a major income source for the poor households in the rural and the primary fuel source in

most urban areas of the country. This increases deforestation and forest degradation in the country. As a result, it is better to promote the use of improved cook stoves (ICS) that increases energy efficiency and sustainability. There is also high possibility to use alternative renewable energy sources like biogas and Electricity (hydroelectric power, electricity from wind power and thermal energy). Therefore, the energy sector should be supported by different policies that promote the use of energy saving technologies and alternative energy sources, and increase the gross value added from energy sector.

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