



Assessment of Returns to Forest Charcoal Production and Trade in Oyo State, Nigeria

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Abstract

This study assessed the returns of charcoal production and trade in Oyo North zone of Oyo State, Nigeria, a major charcoal-producing area in the State, in order to recommend possible interventions for charcoal production that promotes forest conservation. Four Local Government Areas (LGAs) were purposefully selected based on the concentration of charcoal activities. In each LGA, two communities were chosen at random. Then, five charcoal producers and five marketers were randomly selected from each community, making a total of eighty charcoal producers and marketers. Six forest officials were also randomly selected. The data were analyzed using descriptive statistics and simple profit calculation. According to the findings, 82.5% and 42.5% of charcoal producers were male and had no formal education, respectively, while 57.5% and 77.5% of charcoal marketers were male and had formal education respectively. Ninety percent of charcoal producers used the traditional earth mound method. The annual cost of producing charcoal is estimated to be ₦241,595.13k (US\$ 661.90), with a revenue of ₦723,495.00k (US\$ 1,982.18), and a profit of ₦481,899.87k (US\$ 1,320.27). In terms of charcoal marketing, estimated annual expenditure is ₦19,429,344.00k (US\$ 53,231.08), revenue generated is ₦24,962,580.00k (US\$ 68,390.63), and profit is ₦5,533,236.00k (US\$ 15,159.55). According to forest officials, a licence fee of ₦16,612.90k (US\$ 45.51) is paid per year per charcoal producer, and a haulage tariff fee ranging from ₦500 to ₦1500 (US\$ 1.37 to 4.11) is collected from charcoal transporters. Returns on charcoal production that go to forestry management are so low, and the same is true for charcoal producers compared to marketers. There is a need to improve charcoal producers' earnings and to reconsider forest fees associated with charcoal production. Technology that produces more charcoal while using less wood should be encouraged, and charcoal producers should contribute to forestry development by participating in reforestation programs.

Keywords: Charcoal Production, Wood, Trade, Returns, Expenditure

Introduction

Charcoal made from wood has been used as an energy source since ancient times and is still a modern source of energy used for cooking and heating by millions of people with limited options of alternatives, particularly those who live in the urban and peri-urban areas in sub-Saharan Africa (FAO, 2020). Chiteculo *et al.* (2018) affirmed that charcoal and firewood account for more than 80% of the primary energy supply in sub-Saharan Africa and many people generate their household income from the production. Thus, the demand for woodfuel is increasing, particularly in urban areas where there is rapid human population growth (Mwampamba, 2007; Mwampamba *et al.*, 2013; Chiteculo *et al.*, 2018). Given that there are few forests in urban areas and people cannot easily gather firewood for cooking and heating, charcoal is very popular and frequently readily available in urban local markets. The raw material (wood) used in charcoal production is

sourced from natural forests, plantations, and private farms, and it is converted to charcoal most often in rural areas. Households in the rural areas rarely utilize charcoal because firewood is readily available, nonetheless, charcoal production and trade is a source of livelihood for them. As a result, the production of charcoal for urban use has had serious effects on both the social and economic well-being of rural people as well as on natural forests. Chiteculo *et al.* (2018) affirmed that forest degradation and deforestation are significantly influenced by the clearing of forests for industrialization and agriculture. This shows that urbanization and economic development are bringing about changes in charcoal consumption patterns (Falcão, 2008 and FAO, 2020).

In Nigeria, charcoal production has been associated with the clearing of indigenous trees and land degradation, as well as affecting the health, social and

economic livelihood of the rural population. As charcoal production has impacts on the ecosystem as many trees are felled without consideration for management practices that would enhance tree regeneration and growth. During the carbonization process which is when trees are burnt, greenhouse gases are emitted and there is an increase of carbon dioxide in the atmosphere thereby causing global warming. Also, FAO (2017) stated that the most common kilns used in the carbonization process to turn wood into charcoal are earth-mount or earth-pit kilns with relatively low efficiencies, mostly in the range of 10-15%, compared to 35% or even higher with modern charcoal kilns. Consequently, incessant harvesting of wood for charcoal production put strong pressure on existing trees resources and the environment is also in jeopardy. Plate 1 shows a traditional earthen mound kiln at Okeho, Kajola local government.

William and Pinto (2008) affirmed that the marketing of charcoal is a very lucrative venture in Nigeria. The country has a comparative advantage in the production and export of charcoal in Africa over its counterparts due to the large arable land available and the conducive climatic condition for the production of wood. Some known charcoal deports in Nigeria are in Oyo, Isheyin, Saki Igbo-Ora, Ogbomoso Jebba, Omu Aran, Egbe, Kabba, Minna, Jos and Kaduna. And all involved in charcoal production and marketing (producer, wholesaler and retailer) make a substantial amount of money from the business, although, the profit differs across the chain. World Bank (2009) claimed that instead of equitable revenue sharing across the entire value chain, revenue circulates in a loop between traders and consumers – a sort of short-circuit. Charcoal producers sometimes receive the lowest returns across the value chain. They produce in rural areas, have few productive assets and sometimes have limited access to information. On the other hand, charcoal wholesalers and retailers are drawn from all points of the income distribution and are primarily, though not exclusively, urban. They have sufficient information and direct access to the consumers, thus, the price negotiation power lies in their hands. Similarly, many stakeholders are profiting from charcoal production and trade in Nigeria; however, the share of the forestry sector in the business chain is pressured to be small and not well established.

The foregoing scenario of the cash flows to the charcoal producers being minimal, with almost no money going to the communities or governments whose forest areas are being depleted for proper forest makes charcoal production a possible threat to the ecosystem. From the aforementioned statements, it is important to assess the economic returns from charcoal production and returns to the forestry sector so as to advocate for possible policy interventions that guarantee sustainable forest development.

Methodology

The study area

Oyo state has five administrative zones, namely Ibadan,

Ibarapa, Oyo, Ogbomoso, and Oke-Ogun. Oke-Ogun comprises four regions: Iseyin, Irepodun, Kajola and Ifedapo (Ajadi, 2004). Oyo North zone is located in the northern part (savannah belt) of Oyo State, Nigeria. The zone provides a representative insight into the socio-economic conditions of farmers as regards the production of charcoal in Nigeria. It comprises 12 local government areas out of the 33 local government areas in Oyo State: Saki west, Saki east and Atisbo, Olorunsogo, Oriire, Ogbomoso North, Ogbomoso South, Suurulere, Orelope, Irepo, Itesiwaju, Kajola, Iwajowa, and Iseyin. The location is within the savannah belt of Nigeria and is located on Latitude 7°50'59"N and Longitude 3°55'59"E. The elevation above sea level is 292m 958ft. Major tree species in the area include *Viteloria paracloxum* (Emin), *Khaya ivorensis* (Ogano), *Triplochiton scleroxylon* (Arere), *Anogeissus leiocarpus* (Ayin), *Burkea africana* (Asapa), *Distemonanthus benthamianus* (Ayan), *Perkia bigolobosa* (Igba), *Terminalia avicennioides* (Idi), *Gmelina arborea* (Igi Isana), *Milicia excelsa* (Iroko), *Tectona grandis* (Gedu) etc. The study area experiences tropical climatic condition, which includes wet and dry seasons which occur from April to October and November to January respectively. Harmattan, which is a cool dry wind from the Sahara, occurs between November and February. The temperature ranges from 20°C to 36°C and the average relative humidity is 10% but can be up to 85% in the night and low as 59% in the afternoon. It has an annual rainfall of 102mm (Udo, 1987 and Popoola, 2009).

Data collection

The study was carried out in Oyo North Zone, Oyo State, Nigeria. The zone has 12 local government areas (LGAs), and four (4) LGAs (Saki East, Iwajowa, Atisbo and Kajola) were purposively selected because the LGAs are the main charcoal-producing areas in the region. Two communities were randomly selected in each LGAs. Five charcoal producers and marketers were then randomly selected in each of the major producing communities (Sepeteri, Ago-amodu, Tede, Ago-are, Ilero, Okeho, Iwere-ile and Elekoko) making a total of forty charcoal producers and forty marketers. Furthermore, six forest officials were randomly selected.

Data analysis

A structured questionnaire was used to obtain data from respondents and the data were analysed using descriptive statistics and a simple profit formula.

$$\text{Profit} = \text{Total Revenue} - \text{Total Expenses} \dots\dots 1$$

The official exchange rate of American dollars (US \$) to Nigerian currency (Naira ₦) in 2018 was 1 US\$ ≈ ₦ 365

Results and Discussion

Demographic characteristics of charcoal producers and marketers

The results in Table 1 show the distribution of the respondents based on the selected socioeconomic

variables. From the Table, 82.5% of charcoal producers and 57.5% of charcoal marketers were males. This is typical of the gender distribution of forest stakeholders which is characterized by male dominance due to the impression that forestry-related activities are strenuous. Be that as it may, 17.5% and 42.5% of charcoal producers and marketers, respectively, were females which indicates that charcoal production and marketing is not only gendered friendly but also a source of livelihood to both males and females. Thus, charcoal production and marketing is a very important contributors to the well-being of society. This is similar to the report of Fasoro *et al.* (2021) that forestry-related activities and development are gender-friendly and there shouldn't be a gendered division of labour, that is, women should not be limited to certain roles, positions and tasks when it comes to forest activities and development. According to the table, 42.5% of charcoal producers and marketers respectively fell between the age of 31 and 40 years and 72.5% and 67.5% of charcoal producers and marketers respectively were married. This is expected since age and marital status are positive correlates. That is, this is the age group where people are saddled with a lot of socio-economic responsibilities and people in this age group are usually married with attendant responsibilities of running the homes, paying school fees and meeting other exigencies in society (Fasoro *et al.*, 2021). As a result, this age group requires a significant amount of money on a regular basis to meet all of these important needs. This business is a good source of income for this group to have dominated, which means that the business is yielding enough returns to meet their financial needs; otherwise, married people in the stated age group would not have dominated. This emphasizes the importance of charcoal production in terms of livelihood and well-being. Furthermore, the level of education has a significant impact on the means and manner in which charcoal production and marketing information is sought, acquired, perceived, and managed. The higher an individual's level of education, the more empowered the individual is to acquire and apply relevant production and marketing information (Ajewole and Fasoro, 2013). In this regard, Table 1 results revealed that 42.5% of charcoal producers had no formal education. This result implies that many charcoal producers are uneducated, this may affect effective transactions among market participants and hinder them to some extent in how to seek, acquire, and use charcoal production and marketing information, particularly technology. In comparison, 81.6% of charcoal marketers had some form of formal education, while only 18.4% had no formal education. Education is known to help people understand and use improved technology and practices to increase their earnings. Oladele *et al.* (2013) and Fasoro *et al.* (2021) confirmed that educational status has a positive impact on skill acquisition and bookkeeping in businesses. According to the table, 52.5% and 90% of charcoal producers stated that charcoal production is their main occupation and that they operate on a large scale, while 70% and 75% of charcoal marketers stated that charcoal marketing is

their main occupation and that they operate on a wholesale level. The respondents' major occupation of charcoal production and marketing is an indication that the business can withstand the test of time by remaining profitable. It can also be used as an indirect measure of the authenticity and dependability of the information obtained from them, as such information is expected to have come from first-hand experience accumulated over time. It is also expected that if the business cannot take them above board in terms of earnings, they will not have had any incentive to remain in the business.

Motivation factors for producers and marketers' involvement in charcoal production

Table 2 reveals that a sizable proportion of charcoal producers (37.5% and 30.0%, respectively) produce charcoal for financial security and because it is a family business. The reasons for getting into the business were given by 15.0% and 10% of charcoal producers, respectively, as a community and social motivation and challenges and achievement driven. From the table, the majority of charcoal marketers (65.0%) said they do it because it provides income security and financial success. According to the findings of this study, some respondents saw charcoal production and marketing as a means of creating their own opportunities and achieving financial security, thereby improving their standard of living. In some ways, this can help to reduce poverty. For some respondents, charcoal production is a family business. Many people believe that family businesses are the only way to maintain financial and social stability. Family well-being is a powerful motivator for young people, so they were naturally introduced to the business. Some charcoal producers, as shown in the table, are motivated by a desire to give back to the community or solve an ongoing social problem. Many producers were compelled and motivated to venture into charcoal production and marketing in order to address the scarcity of energy used for cooking and heating. According to Agyeman *et al.* (2012), the charcoal industry clearly plays a significant role in the economic development of some communities.

Producers' sources of raw materials

Figure 2 shows that 47.5% of the charcoal producers source their raw material (wood) on farmlands, 37.5% source from both natural forests and on farmlands and 15% source their raw materials from the natural forests. Further investigation reveals that producers use any type of tree species for charcoal production, with little or no preference for the size of trees.

Producers' method of charcoal production and the duration of use

Table 3 shows that 90% of charcoal producers use an earthen kiln, which is the traditional method of producing charcoal while 7.5% of the producers reveal that they use the pit method. Charcoal producers (37.5%) stated that they only use the kiln once, 17.5% claim that they use the kiln twice, and 20% claim that they use the kiln three times before constructing another kiln. Also, the charcoal producers revealed that the

number of times a kiln is used is sometimes determined by the distance and accessibility of trees. That is, if a kiln is built in an area where trees are readily available, the kiln can be used more than three times; however if the trees become sparsely distributed in the area, a new kiln must be built in a new location with sufficient trees. According to the table, 60% of charcoal producers carbonize their charcoal in less than 12 days on average, while 35% produce charcoal in two to three (2-3) weeks.

Economic Analysis of charcoal production and Marketing

Data on the cost and return on investment from charcoal production and marketing are lacking due to a poor record-keeping system and a cavalier attitude among charcoal producers and marketers. Some of the respondents' information was based on assumptions and estimates. As a result, only one detailed data set could be used for this study. Tables 4 and 5 present the annual economic analysis of charcoal production and marketing, which shows various expenses of cost and revenue generated by a charcoal producer and a charcoal marketer at each stage of production. From Table 4, the total annual expenditure generated at each stage of production is ₦241,595.13k (US\$ 661.90). The annual revenue generated after selling the charcoal produced is ₦723,495.00k (US\$ 1,982.18). The annual profit made after the sale of charcoal is ₦481,899.87k (US\$ 1,320.27). Table 5 revealed that the total amount expended by charcoal marketers per month is ₦1,619,112.00k (US\$ 4,435.92). The revenue generated after selling the charcoal in a month is ₦2,080,215.00k (US\$ 5,699.22) and the profit made after the sale of charcoal per month is ₦461,103.00k (US\$ 1,263.29). Therefore, the estimated expenditure per annum is ₦19,429,344.00k (US\$ 53,231.08), revenue generated is ₦24,962,580.00k (US\$ 68,390.63) and profit made is ₦5,533,236.00k (US\$ 15,159.55). Based on the study, charcoal marketers make more money than charcoal producers in a year. This confirmed the World Bank's (2009) study that charcoal producers earn the lowest returns across the value chain. This could be attributed to literacy level as discussed earlier, as this may affect them when it comes to access to information, and sometimes engaging middlemen (intermediaries) in price negotiation and transportation reduces profits; however, the involvement of middlemen is not always negative or damaging because it enhances charcoal marketing.

Payment of fee to state government through the Department of Forestry for operation

Table 6 reveals that 82.5% of the charcoal producers pay licence fees while 17.5% of the producer do not pay the licence fee. Further investigation from the charcoal producer and forest officials confirmed that a licence fee of ₦16,612.90k is paid per annum per charcoal producer, and a haulage tariff fee ranging from ₦500 to ₦1500 (US\$ 1.37 to 4.11) is collected from charcoal transporters. Although the charcoal industry has been adopted to meet some socioeconomic benefits and energy needs of the people, the forest is the source of raw

material for charcoal, and the removal of this raw material from the forest has a significant impact on the ecosystem. As a result, licence fees serve as a means for the government to regulate the activities of charcoal producers in order to ensure sustainable forest development. Unfortunately, according to the information provided, the sector that ensures raw material availability (wood) receives the least in the business chain.

Conclusion

The study revealed that charcoal production and trade is a profitable business. However, the returns from charcoal production that goes to forestry management are so little, ditto for charcoal producers compared to marketers. There is therefore the need to improve the earnings of charcoal producers and also review forest fees associated with charcoal production. Furthermore, technology that produces more charcoal and consumes less wood must be encouraged and charcoal producers must contribute to forestry development through reforestation programmes.

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Plate 1: A traditional earthen mound kiln, Okeho, Kajola local government

Table 1: Distribution of charcoal producers and marketers by selected socioeconomic characteristics

Socioeconomic characteristics	Charcoal Producers		Charcoal Marketers	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Gender				
Male	33	82.5	23	57.5
Female	7	17.5	17	42.5
Total	40	100	40	100
Age				
20-30	6	15.0	4	10.0
31-40	17	42.5	17	42.5
41-50	11	27.5	10	25.5
>50	6	15.0	9	22.5
Total	40	100	40	100
Marital status				
Single	4	10.0	4	10.0
Married	29	72.5	27	67.5
Widowed	7	17.5	9	22.5
Total	40	100	40	100
Educational Background				
No formal education	17	42.5	7	17.5
Primary	13	32.5	13	32.5
Secondary	7	17.5	11	27.5
Tertiary	3	7.5	7	17.5
No response	0	0	2	5.0
Total	40	100	40	100
Major occupation				
Farming	13	32.5	5	12.5
Civil servant	1	2.5	3	7.5
Artisan	4	10.0	1	2.5
Charcoal producer/marketer	21	52.5	28	70.0
Retiree	0	0	3	7.5
No response	1	2.5	0	0
Total	40	100	40	100
Other occupation				
Farming	15	37.5	4	22.2
Civil servant	0	0	0	0
Artisan	0	0	0	0
Charcoal producer/marketer	19	47.5	11	61.1
Trader	0	0	3	16.7
No response	6	15.0	0	0
Total	40	100	40	100
Production/ marketing scale				
large/ wholesaler	36	90.0	30	75.0
Small/retailer	4	10.0	10	25.0
Total	40	100	40	100

Table 2: Frequency distribution of charcoal producers and marketers' motive of engaging in charcoal business

Reasons	Charcoal producers		Charcoal marketers	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Income security and Financial success	12	30.0	26	65.0
Family trade	15	37.5	5	12.5
Community and social motivation	6	15.0	2	5.0
Challenges and achievement driven	4	10.0	1	2.5
Income security and family trade	3	7.5	6	15.0
Total	40	100	40	100

Table 3: Frequency distribution showing the producers' method of production

Variable	Frequency	Percentage (%)
Method of production		
Pit method	3	7.5
Earthen kiln	36	90.0
No response	1	2.5
Total	40	100
How long the kiln is being used		
Once	15	37.5
Twice	7	17.5
Three times	8	20.0
Four times	2	5.0
A month	4	10.0
No response	4	10.0
Total	40	100
Duration of production cycle		
Less than 12 days		
2-3 weeks	24	60
No response	14	35
Total	40	100

Table 4: Cost and revenue generated from charcoal production

Activities	Quantity/Rate	Cost/year (₦)	Revenue/year (₦)
Licence fee		16,612.00	
Kiln construction		2,000.00	
Cost of hoes purchased	1	1,243.58	
Cost of cutlass purchased	1	1,325.00	
Cost of shovel purchased	1	1,353.84	
Cost of axe purchased	1	1,395.23	
Cost of labour hired		84,100.00	
Cost of farmland	₦4,900/hectare	58,000.00	
Average number of bags produced in a month	145		
Average number of bags sold in a month	139		
Dues paid to the association	₦463.79/month	5,565.48	
Selling price of charcoal produced	₦433.75/bag		23,495.00
		241,595.13	723,495.00

Table 5: Cost and revenue generated from charcoal marketing

Activities	Quantity/Rate	Cost/month (₦)	Revenue/month(₦)
Cost of a bag of charcoal	₦487.50/bag	1,000,350	
Cost of transportation		168,000.00	
Cost of fuelling		55,080.00	
Cost of hiring a driver		82,125.00	
Cost of loading and offloading	₦30/bag	197,280.00	
Cost of storing charcoal		48,870.00	
Cost of shop rent		27,037.00	
Cost of tariff paid to the government	6 trip of pick-up vehicle (₦500)	6,000.00	
Dues paid to the association		4,370.00	
Selling price of a bag of charcoal	₦1,013.75/bag		
Bags of charcoal sold in a month	2,052		2,080,215.00
		1,619,112.00	2,080,215.00

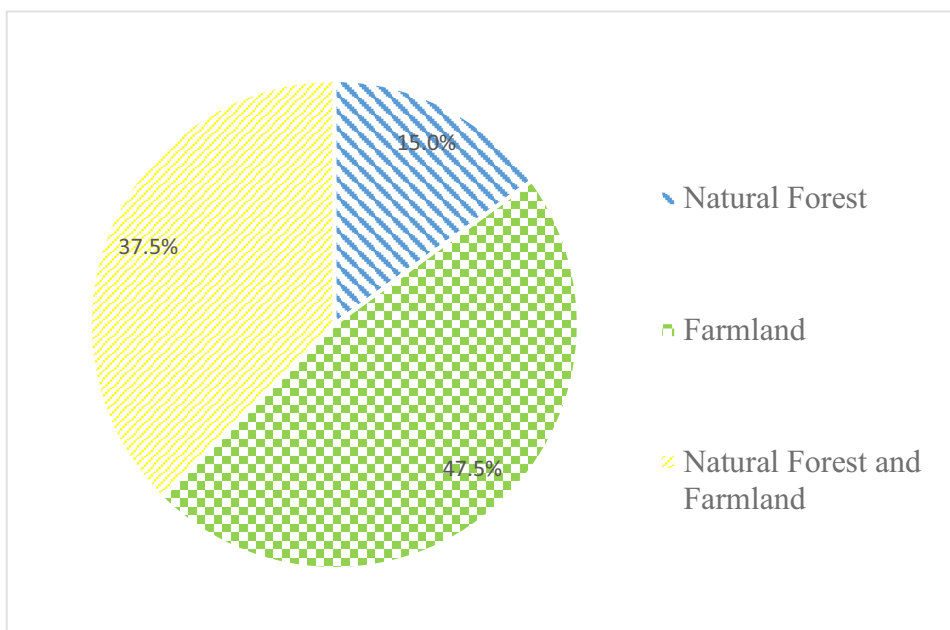


Figure 2: Distribution showing charcoal producers' sources of raw material

Table 6: Frequency distribution showing if the producers pay the licence fee for operation

Variable	Frequency	Percentage (%)
Yes	33	82.5
No	7	17.5
Total	40	100