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CHARCOAL PRODUCTION AS AN ENTREPRENEURIAL LIVELIHOOD STRATEGY IN THE IKOLE LOCAL GOVERNMENT AREA OF EKITI STATE, NIGERIA

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Abstract
This study empirically examined the assessment of charcoal production as an entrepreneurial livelihood strategy in Ekiti, Nigeria. A multistage sampling procedure was employed to select the 66 respondents for this study. A structured questionnaire was used to obtain data, summarize, and present them using tables, frequency counts, percentages, and means, while budgeting analysis and linear multiple regression models were used to analyze the relationships between variables. The results revealed that there were slightly more male (56.1%) respondents in terms of charcoal production than female (43.9%). The results revealed that most (53%) of the charcoal producers were literate. The budgeting analysis of charcoal production showed that it is a profitable venture with an average net profit of ₦340,770 and a return on investment of 1.66. Using linear multiple regression, the study identified several key factors influencing charcoal production, including age (β = -0.453, p < 0.10), level of education (β = 1.334, p < 0.01), level of production (β = 0.932, p < 0), and years of experience in charcoal production (β = 0.418, p < 0.01). The livelihood strategies employed by charcoal producers focus on efficient processing and carbonization of wood and the training and retraining of producers. It is recommended that charcoal producers use alternative raw materials instead of fresh trees to produce charcoal.

1. INTRODUCTION

Charcoal is a dark gray residue consisting of carbon and any remaining ash. It is produced by the slow process of heating wood and other substances in the absence of oxygen, called "pyrolysis" (Hagemann *et al.*, 2018). It is an impure form of carbon that contains ash (Jelonek, 2020). According to Akinbami et al. (2019) and Audu (2013),

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the cry for alternative energy sources due to the impact of global warming has given charcoal an edge in the global market. Nonetheless, it is a splendid domestic fuel and can be made from almost any organic material such as wood, coconut shells, rice husks, or bones.

Usually hardwood species like 'Oma', 'Opepe', 'Eku'. 'Mahogany', 'Ata', and 'Afara' are also promoted. Energy from biomass, essentially fire wood and charcoal, is the most essential source of energy in developing countries (Olugbire et al., 2016). Even in urban areas where modern fuels are used, especially fire wood and charcoal, remains popular among low-income earners due to the non-affordability of modern fuels, electric stoves, and gas cookers. While the use of fuel wood is common in rural areas, charcoal use is important for low-income earners in urban areas (Smith et al., 2017).

Entrepreneurship is a tool for facilitating rural economic development, which is increasingly needed to respond to the growing impact of the high cost of petrochemical fuels on rural livelihoods in less developed countries like Nigeria (Akinbami et al 2019).

Charcoal has been reported to increase soil fertility and soil biota and hence soil biological dynamics and to improve polluted soils, especially those containing very high levels of heavy metals (Ndegwa et al., 2016). Nonetheless, the production of charcoal has several negative environmental effects. It was associated with deforestation in Nigeria and other parts of the tropics, soil deterioration, and organic matter decline (Chidumayo and Gumbo, 2013). The process of charcoal production also enhances soil properties, especially at kiln sites where dried felled trees accumulate and are burned. In West Africa, energy use is seriously dependent on biomass energy (Jamala et al., 2013).

The availability and reliability of supply and cheaper prices render charcoal preferable than alternative energy sources (Audu, 2013). In Nigeria, firewood and charcoal are important sources of cooking fuel for poor and middle-income households (Audu, 2013). When compared with gas fuels such as ketone and other liquefied petroleum gases (LPG), charcoal is more affordable, has relatively stable prices, is convenient to manufacture, accessible to all, and can be produced without external support. Similarly, the non-accessibility and high rate of electricity instability have also led to increased charcoal usage rates in developing countries (Olugbire et al., 2016).

However, charcoal producers in Ekiti State (Ikole LGA inclusive) produce a small quantity of charcoal. This is due to a lack of knowledge about model charcoal production programs, innovations and improved charcoal technologies, all of which have the potential to increase production, livelihoods, profits and the standard of living of producers. Producers in Ekiti State are using old technologies and processes to produce charcoal, indicating that they lack technical expertise on how to adopt upgraded technology and use new methods to achieve high production levels that will boost their entrepreneurial livelihoods.

Charcoal producers in Ekiti State are in need of research, skills, technical expertise, methodologies, and technologies for charcoal production and processing that will increase their incomes, profits, standard of living, and entrepreneurial livelihood.

Therefore, it is necessary to develop charcoal production as an entrepreneurial livelihood strategy in the Ikole Local Government Area of Ekiti State, Nigeria. This study is expected to provide answers to the following objectives:

i. Describing the socio-economic characteristics of charcoal producers in the study area;
ii. Examine the cost and returns to charcoal production in the study area;
iii. Examine the factors affecting charcoal production in the study area; and
iv. Identify sustainable charcoal livelihood strategies in the study area.

Hypothesis of the study

The hypothesis for this research was written in null form;

Ho_1: There was no significant relationship between the selected socioeconomic characteristics and factors affecting charcoal production in the study area.

2. METHODOLOGY

The study area is the

The study was conducted in the Ikole Local Government Area of Ekiti State, Nigeria. The Local Government is located between longitude 45º East of Greenwich and latitude 7º' 8º' 15º' North of the Equator (Oluwaleye, 2015). Its neighbors are Kwara State to the North, Kogi State to the North east, Ekiti East to the East, Gbonyin Local Government in the south, and Oye Local government in the West. The headquarters of the local government, Ikole Ekiti, is about 22.5 km from Ado Ekiti, the Ekiti State capital (Oluwaleye, 2015). The local government is mainly in the upland zone, rising to about 250 meters above the sea level. The Local Government Area (LGA) occupies an area of about 374,940 ms of land, and according to the 2006 National Population Census figure, the total population of the LGA was 168,436. The LGA comprises twenty-four towns and villages. The people are predominantly smallholder farmers who cultivate both cash and food crops as well as engage in livestock such as poultry for family consumption and commercial purposes (Oluwasusi *et al.*, 2020).

Data collection and sampling techniques

Primary data were obtained through a well-structured questionnaire. A multistage sampling procedure was used to select respondents for the study. The first stage involved the selection of Ikole-Ekiti. LGA was purposively selected due to the dominance of charcoal producers in the local government. The second stage involved the purposive selection of six (6) communities from Ikole Local Government Area: Ikole, tapaj, Oke-Ayedun, Odo-Oro, Ipao and Odo-Ayedun, based on the prominence of charcoal production in the areas. The third stage involved random selection of eleven (11) charcoal producers from each of the six (6) communities, giving a total of sixty six (66) respondents for the study.

Method of data analysis

Data collected were subjected to descriptive statistics, budgeting analysis, and linear multiple regression analysis. Descriptive statistics such as frequency distribution, means, charts, and percentages were used to analyze the socioeconomic characteristics of the respondents and other variables. A budgeting analysis was used to evaluate costs and returns on charcoal production. A multiple regression model was used to analyze the factors affecting charcoal production in the respondents. The Likert scale was also used to rank the livelihood strategies employed by the charcoal producers in the study area.

3. RESULTS AND DISCUSSION

Socioeconomic characteristics of charcoal producers

The results in Table 1 reveal that more males (56.1%) participated in charcoal production than their female (43.9%) counterparts. The results further showed that 51.6% of the respondents were between the ages of 30 and 60 years, with a mean age of 47.6 years. This indicates that the producers in the study area are middle-aged and can effectively participate in charcoal production. The results also indicated that the majority (63.6%) of the charcoal producers were married, which encouraged better decision-making in charcoal business operations. The mean household size of 4 persons obtained from the results implies that the majority of charcoal producers in the area could have access to more family labor to use for their production activities, which could potentially lead to increased productivity levels as well as higher profit levels. The results also showed that 15.1% of the respondents had tertiary education, while 37.9% and 47% had secondary and non-formal education respectively. Findings also revealed that the majority (87.9%) of the respondents had over 5 years of charcoal production experience in the area, which is in line with the work of Mensah et al. (2022). This implies that most charcoal production entrepreneurs have the required experience to adopt new innovations and improve their businesses. The results also revealed that a reasonable number of respondents (39.4%) were traders and (39.4%) were farmers. This implies that charcoal production is carried out by people in different areas of primary engagement who choose to diversify into charcoal-entrepreneurial areas. The results of the mean value of 220 bags of charcoal production

output per cycle further indicated that the majority of the charcoal entrepreneurs were just a little above the small-scale producers level, which corroborates the findings of Zulu *et al*. (2013) and Bennett *et al.* (2018).

Table 1: Socioeconomic characteristics of charcoal producers (n = 66)

Variables	Frequency	Percentage	Mean
Sex			
Female	29	43.9	
Male	37	56.1	
Age			
≤ 30	16	24.2	
30–60	34	51.6	47.6
> 60	16	24.2	
Marital status			
Single	24	36.4	
Married	42	63.6	
Household size (No.)			
1–5	57	86.3	4.1
6–10	7	10.7	
> 10	2	3.0	
Educational level			
Tertiary education	10	15.1	
Secondary education	25	37.9	
Non-formal education	31	47	
Experience in years			
1–5 years	8	12.1	
6–10 years	30	45.5	9
>10 years	28	45.4	
Primary occupation			
Trading	26	39.4	
Artisan	14	21.2	
Farming	26	39.4	
Production output level			
Small scale (≤ 200 bag output)	27	40.9	
Medium scale (201 bags - 400 bag output)	29	43.9	220
Large sale (>400 bag output)	10	15.2	

Source: Field survey, 2024

Costs and returns to charcoal production

The results of cost and returns to charcoal production in Table 2 reveal a sum of ₦517, 230.00 as the total cost invested in the charcoal production business during a production cycle and a corresponding sum of ₦858,000.00 as the total revenue obtained by a charcoal producer during a production cycle. The results of ₦340,770.00 and 1.66 values of net income and return on investment (ROI) indicated that the charcoal production business is profitable and that a charcoal production entrepreneur could make a return of ₦1.66k on every ₦1 invested in the business. This is supported by the works of Nabukalu and Gieré (2019) and Ablo et al. (2022), who found the charcoal business to be lucrative.

Table 2: Costs and returns on Charcoal Production per Production Cycle (n = 66)

Items/Operation	Average cost (₦)
Fixed cost	
Depreciation of shop/store rent	15,256.00
Depreciation of Charcoal Making Machine	24,744.00
Depreciation of Cutlass and hoe	2,308.00
Total fixed cost	42,308.00
Variable cost	
Purchase of wood	45,692.00
Sawdust	23,077.00
Rice husk	26,154.00
Bamboo	24,615.00
Coconut shell	31,538.00
Bags for packaging	27,538.00
Transportation	34,615.00
Cost of labor for tree and wood felling and heating	81,538.00
Cost of bagging	55,385.00
Cost of labor for sun drying	56,923.00
Cost of labor loading and offloading	29,231.00
Equipment operators	66,154.00
Total variable cost	474,922.00
Total revenue (TR)	858,000.00
Total cost (TC) = fixed cost + variable cost	517,230.00
Net Profit = TR TC	340,770.00
Return on investment = TR/TC	1.66

*Note: ₦ 1,450 = 1US$

Source: Field survey, 2024

Factors Affecting Charcoal Production

The results in Table 3 reveal that age has a negative significant relationship (β = -0.453, $p < 0.10$) within charcoal production, indicating that an additional increase in the age of respondents may likely lead to a decrease in charcoal production. The level of education was statistically significant (β = 1.334, $p < 0.01$) with charcoal production. Education promotes charcoal production. This implies that educated charcoal producers will adopt improved technologies than non-educated ones regarding charcoal production to increase their livelihood strategies. Therefore, an increase in the education level of charcoal producers may lead to an increase in charcoal production. Furthermore, the results revealed that the level of charcoal production was also statistically significant (β = 0.932, $p < 0.01$) with charcoal production. This indicates that a unit increase in production could lead to an increase in charcoal output. Thus, years of experience in charcoal production had a positive statistically significant (β = 0.418, $p < 0.01$) impact on charcoal production. This implies that a year of additional experience in charcoal production could lead to an increase in charcoal output. R^2 value of 0.534 indicates that the selected socioeconomic characteristics considered as regression inputs in the study can only explain 53.4% of the variation found in factors affecting charcoal production.

Table 3: Linear Multiple Regression showing the relationship between the selected socio- economic characteristics and Factors Affecting Charcoal Production

Variables	(β) Coefficient	Std. Err	t-value	Significant
Marital status (X_1)	1.182	1.870	17.818	0.633
Age (X_2)	-0.453	0.250	-0.55	0.015*
Level of education (X_3)	1.334	0.261	4.81	0.002***
Primary occupation (X_4)	-0.315	0.158	-0.71	0.052
Household size (X_5)	1.224	0.118	1.41	0.308
Level of production (X_6)	0.932	0.212	17.818	0.001***
Years of experience (X_7)	0.418	0.831	0.74	0.000***
R^2	0.534			
Adjusted R^2	0.477			
Significant at 1%***, 10%*				

Source: Field survey, 2024

Livelihood Strategies for Charcoal Production

The results in Table 4 reveal the distribution of the livelihood strategies adopted by the charcoal producers in the study area. The findings show that promoting efficient processing and carbonization of wood ($\bar{x} = 1.83$) was ranked as the most viable livelihood strategy employed by charcoal producers. With this in mind, many respondents could now follow the due stage (carbonization) in the charcoal-making process, which is the most important step of all, since it has the power to influence the whole process from the growing tree to the final distribution of the product to the user. Followed by training and re-training for charcoal producers ($\bar{x} = 1.83$), with this, respondents would know much about regulated or legal charcoal resources and efficient conversion technologies. This would be a change in the perception that charcoal production is not a poor man's business and should not be considered 'dirty' and economically unattractive. Other livelihood strategies like participation in associations for government and non-government interventions, encouraging natural regeneration of trees, developing quality standards for charcoal production, and using alternative raw materials instead of fresh trees to produce charcoal were ranked as the 3rd, 4th, 5th and 6thstrategies respectively.

Table 4: Livelihood Strategies of Charcoal Producers (n = 66)

Livelihood strategies	Yes	No	Mean ($\bar{x}$)	Rank
Promoting efficient wood processing and carbonization	56(86.2)	9(13.8)	1.83	1st
Training and retraining of charcoal producers	55(84.6)	10(15.4)	1.81	2nd
Participation in government and nongovernment intervention associations	47(72.3)	18(27.7)	1.70	3rd
Encouraging the natural regeneration of trees	28(43.1)	37(56.9)	1.41	4th
Developing quality standards for charcoal production	26(40.0)	39(60.0)	1.38	5th
Alternative raw materials instead of fresh trees to produce charcoal	18(27.7)	47(72.3)	1.28	6th

Source: Field survey, 2024

4. CONCLUSION AND RECOMMENDATIONS

This study investigated socio-economic dynamics, profitability, factors influencing production, and the adoption of various livelihood strategies within the charcoal production sector. The findings reveal a vibrant but complex

landscape characterized by a predominantly male workforce, with a significant representation of married individuals, suggesting mature demographic engagement in the trade. The profitability analysis underscores charcoal production as a lucrative venture with substantial return on investment, highlighting its importance as a source of income for many households. Factors affecting charcoal production, including age, education level, primary occupation, production level and years of experience, indicate a nuanced interplay between personal, economic and social elements that shape production outcomes. Additionally, the livelihood strategies adopted by producers showed a community striving toward sustainability and efficiency, despite facing challenges that necessitate external support and intervention.

Based on the findings of this study, the following recommendations are made to support and enhance the charcoal production sector:

1. The government should develop and implement policies that support sustainable charcoal production with a focus on environmental conservation and renewable resources.
2. Relevant training programs on sustainable production techniques, efficient processing, and carbonization methods should be organized for charcoal producers to enhance productivity and environmental conservation.
3. Charcoal producers should use alternative raw materials instead of fresh trees to produce charcoal.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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