

EFFECT OF CHARCOAL PRODUCTION ON RURAL DWELLERS LIVELIHOOD IN IBADAN/IBARAPA AGRICULTURAL ZONE OF OYO STATE, NIGERIA

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Abstract

The absence of a detailed exploration into the diverse determinants affecting charcoal production hampers efforts to devise targeted strategies for sustainable development. This study therefore determined the effects of charcoal production on rural dwellers livelihood in Ibadan/Ibarapa agricultural zone of Oyo state, Nigeria. A multistage sampling technique was employed to select 175 respondents for the study area, and data were collected through structured questionnaires. Descriptive statistics and Pearson Product Moment Correlation (PPMC) were used for analysis.

*The results showed that the mean age of the respondents was 44 years, 59.4% of the respondents were males while 40.6% of them were females, The result obtained revealed that 49.7% of the respondents indicated that they were traders, 42.3% claimed to be marketer of agricultural produce, 30.9% of the respondents engaged in farming activities. The findings revealed that, more income generation factor attached with charcoal production was the main motivation which influences the rural populace in venturing into the enterprise. The PPMC results revealed that selected socio-economic variables such as; Age ($r = -0.511^{**}$, $p \leq 0.001$) has a negative and significant relationship with the effects of charcoal production on rural dwellers' livelihoods. PPMC result also revealed that no appropriate tools to use as a constraint which affects charcoal production ($r = 0.375^{**}$, $p \leq 0.000$) has a positive and significant relationship with the effects of charcoal production on rural dwellers' livelihood.*

The study concluded that charcoal is a cheap energy source for rural households. It was observed that the respondents are still productive in terms of their age and can actively participate in charcoal production. The study therefore recommended that, a programme should be established to empower and targeted at making financial provision in terms of grants and modern charcoal production tools available to charcoal producers which by taking advantage of it would improve their overall livelihoods.

Keywords: Charcoal Production, Rural Dwellers, Livelihood

INTRODUCTION

The evolution of human society has rested on the sustained interaction between man and his natural environment. Hence, natural resources are materials and substances occurring in nature which can be exploited for economic gain. They are resources that exist without any action of humankind (gifts of nature) which are either renewable or non-renewable, such as mineral, water, forest and atmospheric resources. The abundance of natural resources continues to be a key component of the world economy, especially in developing countries that depend on them for a considerable part of their Gross Domestic Product (GDP) (Hailu and Kipgen, 2017). Natural resources, especially forests represent important sources of livelihoods for many humans (especially rural farmers) in developing countries through the provision of timber and non-timber products such as charcoal. Charcoal is a primary cooking fuel for urban households in most developing countries including Nigeria, and it is also used in small-scale businesses such as restaurants, bakeries and street food stands (Deutsche Gesellschaft fur Internationale Zusammenarbeit, (GIZ), 2014).

Livelihoods which are referred to as means of making a living through various economic activities and resources that allow people to live. Different people including the rural farmers have different lifestyles and ways of meeting their needs. Similarly, households perform various activities to enhance their livelihoods. The nature of these livelihood activities depends on the availability of assets, resources, labour, skills, education, social capital, seasonality, agro-climate/agro-ecology, and gender (Akinwale, 2010).

The intricacies surrounding the production of charcoal among the rural dwellers in rural areas are complex and multifaceted, yet a comprehensive understanding of the factors that influence this practice remains elusive (Omoogun and Odok, 2018). The absence of a detailed exploration into the diverse determinants affecting charcoal production hampers efforts to devise targeted strategies for sustainable development. Factors such as economic considerations, environmental policies, technological advancements, and socio-cultural dynamics all play crucial roles in shaping the landscape of charcoal production (Obiriet *al.*, 2014). Hence, the problems underscore the intricate challenges and knowledge gaps surrounding charcoal production in rural areas. The lack of detailed insights into the methods employed in charcoal production, the multifaceted effects on rural households' livelihoods, and the influencing factors shaping this practice collectively highlight the need for a comprehensive and nuanced understanding.

Based on the background, the study provides answers to the following research questions.

1. What are the socio-economic characteristics of the respondents in the study area?
2. What are the method and frequency of use for charcoal production in the study area?
3. What are the factors influencing charcoal production in the area?
4. What are the effects of charcoal production on rural households' livelihood?

METHODOLOGY

The study was carried out in Oyo State of Nigeria. Oyo State falls appropriately between $2^{\circ}38'$ and $4^{\circ}35'$ East of Greenwich Meridian. The state is bounded on west by Osun and the Republic of Benin and in the North and South by Kwara and Ogun respectively. The average rainfall in the area lies between 114mm and 1275mm with most of the annual rainfall (about 92 percent) occurring in the months between March and October, with a slight calm in the month of August, and the months of (November and February) mostly dry. The mean annual

temperature is about 27°C with very little monthly variation. The vegetation of the zone is both rainforest in the central and derived savannah at the Northern part of the state. The climatic and soil conditions of the study area favours the extensive production of arable crops like cassava, yam, maize, vegetables, and horticultural crops and tree crops like cashew, mango are also cultivated. However other income generating activities includes: trading, carpentry, blacksmithing, weaving and hair-dressing.

The study population comprises of charcoal producers in the study area.

Multistage sampling technique was employed for this study. The first stage involved the purposive selection of Ibadan/Ibarapa Agricultural Development (ADP) zone, out of the four (4) agricultural zones in Oyo State. The second stage involved purposive selection of two (2) blocks out of the fourteen (14) blocks in Ibadan/Ibarapa ADP zones, due to the predominance of charcoal production in the block. The LGAs are Ibarapa North and Ibarapa Central respectively. The third stage involved random selection of 30% of the total number of rural communities in each of the selected local government to give 15 villages in total. The last stage involved random selection of 50% of registered charcoal producers (RCP) from each of the villages sampled to give the total of 175 respondents (registered charcoal producers) as sample size. Data for the study was collected through the use of a well-structured interview-schedule as instrument for data collection in line with the stated objectives of the study. Descriptive statistical tools (frequency counts, percentages, mean, Weighted Mean Scores (WMS), rankings and standard deviation) were used to describe the socio-economic characteristics of the respondents, identify the other livelihood activities of the respondents, determine the factors influencing charcoal production determine the effects of charcoal production on rural dwellers livelihood and investigate the severity of constraints affecting charcoal production. Inferential statistical tool Pearson Product Moment Correlation (PPMC) was used to test the study hypotheses.

The variables measured in this study comprised both independent and dependent variables. The independent variable that was measured in this study includes, Socio-economic characteristics of the respondents: variables that were captured includes: Age, Sex, Years spent in school, Primary occupation, Secondary occupation, Years of residency in the study area, Marital status, Years of experience in charcoal production, Religion, Member of community organizations, Dwellers size, Monthly income from charcoal production, etc.

The dependent variable is the effects of charcoal production on rural dwellers' livelihood in the study area. This was measured by the question asked the respondents to answer; The respondents were asked to indicate the effect of charcoal production on the livelihood. The effects was measured on a 5-point Likert type scale of measurement of very high effect, high effect, moderate effect, low effect, and No effect and was given a score of 5, 4, 3, 2, and 1 respectively.

To ensure validity and reliability, the research instrument underwent a thorough review by experts in agricultural extension to confirm its content and face validity. Reliability was established through a test-retest method, and data were analyzed using SPSS to confirm the instrument's consistency in measuring the intended variables.

Data were analyzed using both descriptive and inferential statistics. Descriptive tools such as frequency distributions, percentages, means, and weighted mean scores were used to summarize data. Inferential statistics, specifically Pearson Product Moment Correlation (PPMC), was employed to determine relationships between dependent and independent variables.

RESULTS AND DISCUSSION

Socio-Economic Characteristics of Respondents

The result in table 1 indicated that above average (54.9%) of the respondents were in the age range of 41-50 years, 30.3% were between the ages of 31-40 years while 12.6% and 5.3% of the respondents has the age of above 60 and ≤ 30 respectively. The mean age of the respondents was 44 years. This indicates that majority of the respondents in the study area are in their middle age, still productive and can still actively engage in various procedures charcoal production requires. This finding corroborates the findings of Obisesan (2014) who reported that middle aged people are agile, active and more innovative than the older ones and possesses more energy to dissipate on productive efforts. Sexually, the term sex describes the state of being either male or female. The distribution of the respondents in the study area as presented in table 1 reveals that above average (59.4%) of the respondents were males while 40.6% of them were females. This is an indication that the two genders engages in charcoal production in the study area although males are observed to be more involved than their female counterpart due to the energy requirements. This conforms to the findings of Akoteyon (2016) who reported that, most rural household head are often males in developing world, giving that the male counterpart have the required strength to carry out the economic activities for household livelihood.

Marital status revealed that 32.0% of the respondents indicated that they were widowed, 29.7% of them declared they were married and also separated, 28.6% indicated they are single while only 9.7% of the respondent were divorced. This implies that majority of the respondents had marital experience. This is expected to influence their economic affairs as it relates with household size and labour used especially family labour. This agrees with Adebayo and Adewumi (2023) who opined that, most rural households are married as this could be the sole effect of cultural values they hold at high esteem. Educationally, the study shows that all the respondents were formally educated but has low level of educational background. The table below implies primarily that respondents in the study area were engaged with various occupation which they sourced their livelihood from with hired labouring and crop farming being one of the main occupation in the study area. While a very few (1.1%) of the respondents were engaged in hired labouring as their secondary source of income. Hence, the result implied that the sampled rural households were into livelihood diversification. The mean years of experience of the respondents was 8 years in charcoal production. This implies that, all the respondents in the study area were experienced charcoal producers but varies from one person to the other. This conforms with the findings of Eniola *et al* (2012) who opined that, the respondents has a reasonable number of years of experience in charcoal production.

Table 1: Socio-economic characteristics of the respondents			n=175
Socio-economic characteristics	Frequency	Percentage	Mean
Age(years)			
≤30	4	2.3	44
31 – 40	53	30.3	
41 – 50	96	54.9	
> 60	22	12.6	
Sex			
Male	104	59.4	
Female	71	40.6	
Marital status			
Married	52	29.7	
Single	50	28.6	
Divorced	17	9.7	
Widowed	56	32.0	
Separated	52	29.7	
Number of years spent in school			
No formal education	----	----	6.9
1-6	81	46.3	
7-12	90	51.4	
Above 12	4	2.3	
Primary source of income			
Crop farming	54	30.9	
Livestock farming	10	5.7	
Fishing	13	7.4	
Charcoal production	31	17.7	
Hunting	4	2.3	
Laborer	63	36.0	
Secondary source of income			
Crop farming	7	4.0	
Livestock farming	10	5.7	
Fishing	5	2.9	
Charcoal production	145	82.9	
Hunting	3	1.7	
Laborer	2	1.1	
Others	3	1.7	
Household size			
≤5	20	11.4	7
Above 5	155	88.6	
Association registered			
Charcoal producer’s association	146	83.4	
Farmers association	14	8.0	
Hunters association	11	6.3	
Poultry association	4	2.2	
Average annual income from charcoal production			
≤N250000	21	12.0	N982485.7
N250001-500000	81	46.3	
N500001-750000	6	3.4	
N750001-1000000	32	18.3	
Above N1000000	35	20.0	

Average annual income from other livelihoods				
≤N50000	18	10.3	N343194.3	
N50001-100000	96	54.9		
N100001-150000	5	2.9		
Above N150000	56	32.0		
Source of labor for production				
Family labour	78	44.6		
Hired labour	94	53.7		
Both family and hired labour	3	1.7		
Ethnic group				
Yoruba	166	94.9	8	
Hausa	9	5.1		
Years of experience				
≤ 5	34	19.4		
5-10	120	68.6		
Above 10	21	12.0		

Source: Field survey, 2024.

Methods used for Charcoal Production in the Study Area

The findings of the study presented in table 2 indicated that all (100.0%) the respondents used the traditional Pit method of charcoal production while only a few proportion (10.0%) of them used the Earth mound method. Also, none of the respondents utilizes both Metal kiln method and Mud kiln method for charcoal production in the study area. The implication of this is that, charcoal production in the study area is majorly carried out using traditional way of production.

Table 2a: Distribution of respondents by Methods used for Charcoal Production
Source: Field survey, 2024.

S/N	Methods Used for Charcoal Production	Frequency	Percentage
1.	Earth mound method	10	5.7
2.	Pit method	175	100.0
3.	Metal kiln method	----	----
4.	Mud kiln method	----	----

***Multiple responses.**

Frequency of methods used for Charcoal Production in the Study Area

The findings of the study likewise revealed the frequencies of methods utilized for charcoal production and it was observed that, pit mound was the most frequently used method which makes it to be ranked first as a method of charcoal production with the weighted mean score (WMS) of 2.00 followed by earth mound method ranking as the second most frequently used in charcoal production (WMS= 0.06). Also, it was noted that none of the respondents utilized both Metal kiln and Mud kiln method for charcoal production in the study area. This implies that, the respondents employ only two methods of charcoal production in the study area but the traditional pit method of charcoal production was the most used method. The findings of this study is in line with [Keerthana et al. \(2021\)](#) who

opined that, the charcoal is commonly produced using an ancient traditional technology dating from middle ages especially the likes of the earth-mound kiln even though there are modern retort technology which may be used as these retort–kilns have greater efficiency rating.

Table 2b: Frequency of methods used for Charcoal Production in the Study Area
Source: Field survey, 2024.

S/N	Methods Used for Charcoal Production.	Always F(%)	Occasionally F(%)	Not at all F(%)	WMS	Rank
1.	Earth mound method	0(0.0)	10(5.7)	165(94.3)	0.06	2 nd
2.	Pit method	175(100.0)	0(0.0)	0(0.0)	2.00	1 st
3.	Metal kiln method	0(0.0)	0(0.0)	175(100.0)	0.00	3 rd
4.	Mud kiln method	0(0.0)	0(0.0)	175(100.0)	0.00	3 rd

***Multiple responses.**

Factors Influencing Charcoal Production in the Study Area

Table 4 shows the factors influencing charcoal production in the study area. Based on the result findings, it was revealed that Charcoal production generates additional income for the rural households ranked first with the weighted mean score (WMS) of 3.97, closely followed by Availability of tree species that is suitable for charcoal production ranked second (WMS=3.79), It reduces numbers of trees on farmland and Increased GDP both ranked third with WMS of 3.50 while Materials required for charcoal production are available locally ranked fifth (WMS=3.24).

Furthermore, the findings revealed that, High demand of charcoal for cooking, serving as off-farm employment opportunity, Cost of input in production of Charcoal is cheap compared to farming, it is the cheapest source of household and industrial energy and It serves as security against crop failure ranked sixth (WMS=3.21), seven (WMS=3.10), eighth (WMS=2.84), ninth (WMS=2.74) and tenth (WMS=2.10) respectively as factors influencing charcoal production in the study area. The findings also revealed that, no special skill is required for charcoal production was ranked eleventh with a WMS of 1.85. This implies that, more income generation factor attached with charcoal production was the main motivation which influences the rural populace in venturing into the enterprise as it brings about a great reduction of economic dependency thereby fostering overall growth and development of the rural area. This study corroborates the findings of Smith et al., (2017) who opined that, having estimated the contribution of charcoal to household livelihood, the production of charcoal was perceived from share of overall income generation for the engaged household.

Table 3: Distribution of respondents by Factors influencing charcoal production

Factors	Strongly agree F(%)	Agree F(%)	Undecided F(%)	Disagree F(%)	Strongly disagree F(%)	WMS	Rank
Charcoal generates additional income	170(97.1)	5(2.9)	----	----	----	3.97	1 st
It serves as off-farm employment opportunity	20(11.4)	154(88.0)	----	1(0.6)	----	3.10	7 th
Availability of tree species that are good for charcoal production	151(86.3)	15(8.6)	7(4.0)	----	2(1.1)	3.79	2 nd
High demand of charcoal for cooking	77944.0)	92(52.6)	6(3.4)	----	----	3.21	6 th
Materials required for charcoal production are available locally	85(48.6)	52(29.1)	33(18.9)	5(2.9)	----	3.24	5 th
It us the cheapest source of household and industrial energy	48(27.4)	41(23.4)	81(46.3)	3(1.7)	2(1.1)	2.74	9 th
It reduces numbers of trees on farmland	90(51.4)	82(46.9)	3(1.7)	----	----	3.50	3 rd
It serves as security against crop failure	17(6.3)	6(3.4)	152(86.9)	2(1.1)	4(2.3)	2.10	10 th
No special skill is required for charcoal production	8(4.6)	50(28.6)	33(18.9)	76(43.4)	8(4.6)	1.85	11 th
Cost of purchasing input is cheap compared to farming	19(10.9)	113(64.6)	41(23.4)	----	2(1.1)	2.84	8 th
Increased GDP	107(61.1)	55(31.1)	10(5.7)	----	3(1.7)	3.50	3 rd

Source: Field survey, 2024

WMS: Weighted Mean Score.

F= frequency

%=percentage

Effects of Charcoal Production on Rural dwellers Livelihood

The result in table 4 reveals the distribution of respondents by effects of charcoal production and was revealed that, Cheap source of cooking energy was ranked first as an effect of charcoal production was the most prominent effect with the weighted mean score (WMS) of 3.88. It provides income during off season as the second (WMS=3.45), it reduces poverty level was ranked third (WMS=3.42), it leads to Scarcity of fuel wood was ranked forth (WMS=3.25), helps in establishment of local market was ranked fifth (WMS=3.10), Economic diversification was ranked sixth (WMS=2.75), Employment opportunity was ranked seventh (WMS=2.63), desertification was ranked eighth (WMS=2.47), Deforestation and loss of biodiversity was ranked ninth (WMS=2.06) while Land degradation was ranked tenth (WMS=1.59) was ranked as effects of charcoal production in the study area. Furthermore, table 4 reveals that, Health hazard associated with charcoal production was ranked eleventh with the weighted mean score of 1.24 while, charcoal production causes air pollution was ranked least at the twelfth position (WMS=1.16) as effect of charcoal production.

Table 4: Distribution of respondents by Effects of charcoal production on rural dwellers livelihood

Effects	Strongly agree F(%)	Agree F(%)	Undecided F(%)	Disagree F(%)	Strongly disagree F(%)	WMS	Rank
Provides income during off season	83(47.4)	90(51.)	----	2(1.1)	----	3.45	2 nd
Employment opportunity	46(26.3)	26(14.9)	95(54.3)	8(4.6)	----	2.63	7 th
Cheap source of cooking energy	162(92.6)	8(4.6)	2(1.1)	3(1.7)	----	3.88	1 st
Economic diversification	12(6.9)	108(61.7)	55(31.4)	----	----	2.75	6 th
Establishment of local market	91(52.0)	14(8.0)	67(38.3)	3(1.7)	----	3.10	5 th
Reduces poverty level	122(69.7)	17(9.7)	26(14.9)	7(4.0)	3(1.7)	3.42	3 rd
Deforestation and loss of biodiversity	18(10.3)	18(10.3)	104(59.4)	26(14.9)	9(5.1)	2.06	9 th
Land degradation	29(16.6)	11(6.3)	1(0.6)	128(73.1)	6(3.4)	1.59	10 th
Health hazard	32(18.3)	17(9.7)	12(6.9)	14(8.0)	100(57.1)	1.24	11 th
Air pollution	12(6.9)	19(10.9)	6(3.4)	86(49.1)	52(29.7)	1.16	12 th
Scarcity of fuel wood	74(42.3)	77(44.0)	20(11.4)	1(0.6)	3(1.7)	3.25	4 th
Desertification	15(8.6)	62(35.4)	90(51.4)	6(3.4)	2(1.1)	2.47	8 th

Source: Field survey, 2024

WMS: Weighted Mean Score.

F= frequency

%=percentage

The result of the Pearson Product Moment Correlation (PPMC) in the Table 4.7 revealed that significant relationship exists between the selected socio-economic characteristics of respondents and effects of charcoal production on rural dwellers' livelihoods.

The results shown on Table 4.7 revealed that some selected socio-economic variables which are; Age ($r = -0.511^{**}$, $p \leq 0.001$) has a negative and significant relationship with the effects of charcoal production on rural dwellers' livelihoods. This implies that, the age of the respondents has an inverse relationship with their livelihood activities an indication that, the respondents being middle aged tend to influence the rate at which they experience the effects due to the fact that they most dominate the labour force.

Also, marital status ($r = -0.234^{**}$, $p \leq 0.002$) has a negative and significant relationship with the effects of charcoal production on livelihoods of the respondents. This implies that, the respondents' marital status has an inverse relationship with the effects of charcoal production on livelihoods of the respondents which indicates that, high rate of respondents being married contributes greatly to the availability labour for charcoal production especially family labour.

Therefore, the null hypothesis is rejected; hence the alternative hypothesis is accepted.

H_A: There is significant relationship between the socio-economic characteristics of respondents and effects of charcoal production on rural dwellers' livelihoods.

Hence, there is significant relationship between selected socio-economic characteristics of the respondents and the level of training needs of Forest officers of forest conservation. Therefore, the null hypothesis is rejected; hence the alternative hypothesis is accepted. This result is in alignment with the findings of Ayandiji and Adekunle (2014) who also reported that there is significant relationship between selected socio-economic characteristics of the respondents and the training needs of Forest officers.

H_a: There is significant relationship between some selected personal characteristics of forest officers and level of training needs on forest conservation.

Table 5: Correlation analysis results of relationship between respondents' socio-economic characteristics and effects of charcoal production on rural dwellers' livelihood

S/N	Socio-economic Variables	Correlation coefficient(r)	p-value	Remark	Decision
1.	Age	-0.511**	0.001	significant	Reject H ₀
2.	Number of years spent in school	0.007	0.928	Not significant	Accept H ₀
3.	Household size	-0.110	0.149	Not significant	Accept H ₀
4.	Marital status	-0.234**	0.002	Significant	Reject H ₀
5.	Primary source of income	0.065	0.393	Not significant	Accept H ₀
6.	Years of experience in charcoal production	-0.079	0.297	Not significant	Accept H ₀
7.	Annual average income from charcoal production	-0.078	0.306	Not significant	Accept H ₀

Source: Computed data, 2024.

**Correlation is significant at 0.01 level (2-tailed)

CONCLUSION AND RECOMMENDATIONS

Based on the findings of the study, the following conclusions were deduced from the findings made during the course of the study; It was observed that the respondents are still productive in terms of their age and can actively participate in charcoal production. It was noted that majority of the respondents were males, they all have marital experience a situation which brings about a fairly large household size which make up for source of family labour available for charcoal production in the study area. Also, all the respondents in the study area were experienced charcoal producer with an average of eight years experience in the business. Meanwhile, most of the respondents are formally educated but has quite low educational background and they all belonged to one social organization or the other. The respondents likewise engage in other multiple economic endeavors or livelihoods other than charcoal production such as farming, trading, civil service and hired labour. The respondents utilizes only two methods of charcoal production in the study area which are traditional earth mound method and pit method but the traditional earth mound method of charcoal production is the most used method. It was also revealed that, the most prominent factor influencing charcoal production in the study area was observed to be the fact that, income generation as a factor attached with charcoal production was the main motivation which influences the rural populace to venture into the enterprise as it brings

about reduction in economic dependency on the urban centers thereby fostering overall growth and development of the rural area. The effect of charcoal production in the study area was that it grants easy access to cheap energy source when compared with other energy sources.

Based on the empirical evidences deduced from the findings of the study, the following are recommended;

1. There should be joint efforts among charcoal producers with the local leaders to establish an educative initiative that aimed at equipping charcoal producers with the needed technical know-how in order to utilize modern charcoal production tools thereby optimizing their level of productivity.
2. Non-governmental organizations (NGOs) such as “The Tree Initiative” with the support of the government should the launch a programme targeted at massive afforestation in order to combat the problems of wood scarcity, bio-degradation and loss of biodiversity while also enforcing an integrated policies that create synergies among charcoal production, sustainable forest management, and livelihood enhancement.

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