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## **Profitability Analysis of Wood Charcoal Production and Marketing in Selected Communities of Rivers State, Nigeria**

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### **ABSTRACT**

*This study analyzed the profitability of production and marketing of wood charcoal in selected communities of Port Harcourt and Etche local government areas of Rivers State, Nigeria. The study described the socio-economic characteristics of the charcoal producers and marketers, measured their profitability and analyzed the factors influencing the profitability of wood charcoal production and marketing. Simple random and purposive sampling technique was used in selecting 30 producers and 100 marketers from Etche and Port Harcourt local government areas respectively: Survey research design was employed in the study. Descriptive statistics, gross margin and multiple regression analysis were used in analyzing the data. The result from the cost and return analysis on wood charcoal production showed that wood charcoal production is profitable with a cost benefit ratio of 1.3, which implies that for every one naira invested in its production, the producers gained 1.3 naira with a gross margin of ₦4,441,500 naira and net income of ₦1,033,050 naira. This clearly indicates that wood charcoal marketing is profitable in Port Harcourt local government area. The study concludes by recommending that government and financial institutions should increase efforts in providing aids such as loans, subsidies and grants for interested dealers who have little or no assistance.*

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**Keywords:** Production, Marketing, Profitability, Wood Charcoal

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### **1 Introduction**

The quest for an alternative source of energy has driven researchers and research institutions back to one of the oldest form of energy for both domestic, commercial and industrial use, wood fuel. Nigeria is constantly in the search to deviate from being a crude-oil dependent mono-economy (Agbugba & Solomon, 2008). Nigeria currently has 75 percent of her land suitable for agriculture but is only able to utilize 40 percent (Agbugba and Binaebi, 2018). The Nigerian hard wood is preferred in the international market to that of other African countries because of features like low moisture content and the high temperature it produces heat during combustion. (Ogwuche and Asobo, 2012).

Wood charcoal is a solid residue gotten after controlled combustion of a wide range of materials, commonly processed from wood and wood materials from parts of trees such as branches and trunks by burning and passing through fire under conditions of limited amount of oxygen (Haruna, Yacob and Adisa, 2013). The nation's total energy supply comprises of Oil (10.4%), gas (6%), hydro (0.6%) and commercial renewal energy 83% (Babatunde, 2017). A vast majority of the Nigerian population rely directly and indirectly on wood fuel for their daily activities. Charcoal is one of the most important commercial fuel derived from wood capable of producing heat greater than that of fuel wood, (Agbugba and Obi, 2013). Wood charcoal is a black carbon

and ash residue hydrocarbon produced by removing water and other volatile elements from animal and vegetation substances. It is manufactured through a process called pyrolysis (heating of wood in the absence of oxygen) from wood and wood materials such as trunk, branches and other parts of trees.

Amadi, Momodu and Chukuigwe. (2001) emphasized on the importance of credit facilities to the growth of the economy, the agricultural sector inclusive.

This research work examines the profitability of wood charcoal and factors influencing the demand and supply of wood charcoal in Nigeria using a two local governments in Rivers state as a case study.

### **Objectives of the Study**

The broad objective of the study is to analyse the profitability of wood charcoal production and marketing in Etche and Port Harcourt Local Government Areas of Rivers State, Nigeria. The specific objectives are to:

- i. describe the socio- economic characteristics of wood charcoal producers and marketers in the study area.
- ii. analyze the cost and returns of wood charcoal production and marketing
- iii. determine the factors affecting the profitability of wood charcoal production and marketing.

### **Conceptual Framework**

#### **Wood Charcoal Production and Consumption**

Studies carried out in Benin city of Nigeria show the main uses of Charcoal to be for cooking, Roasting of Suya, Barbecue, Maize, Plantain, cocoyam, yam etc., blacksmithing and Bronze casting. Commercial charcoal exists in lumps, extruded forms and briquettes. The common type is the lump which has less ash compared to briquettes. Briquettes is gotten by compressing charcoal typically made from saw dusts and other by-products of wood. The extruded charcoal is gotten by extruding raw ground or carbonized wood into logs without using binder (Ogwuche and Asobo, 2012).

#### **Wood Charcoal Market and Distribution**

The charcoal market structure essentially links the charcoal supplier to the consumer with a primary responsibility of ensuring that charcoal is made available at the right price, right place and right time most especially during periods of scarcity as experienced in the rainy seasons. Charcoal market is seasonal and variations exist in the seasonality from one country to another. Hammond (2006), illustrated that individual entrepreneurs can engage in charcoal marketing, either as a retailer, a wholesaler selling in large quantity or as a supplier. A wholesaler or retailer can make between ₦450 naira to ₦650 naira and more from the sale of a bag of charcoal, which goes for about ₦1600 naira in the market (Onoja and Emodi, 2011)

## **II. Methodology**

### **Study Area**

This research was conducted in in Port Harcourt and Etche Local Government Areas of Rivers State. Port Harcourt has a total size of 109 square kilometers (42 sq. mi). The LGA lies between latitudes 4°46'38.71'' North and longitudes 7°0'48.24'' East of the Equator. The total population in the area was last recorded at 638,360 people in 2011 from 538,558 in 2006. On the other hand, Etche LGA has a landmass of 97,500 hectares, 376.5 square meters and population of 600,000 persons (NDDC, 2013), and is situated at a highly advantaged position more than other LGAs of Rivers in terms of its agricultural economy.

#### **Research Design:**

Survey research design was adopted for data collection from target population.

#### **Population of the Study**

The sample frame for the study comprised of charcoal producers and marketers in selected communities in port Harcourt and Etche local government areas of Rivers State, Nigeria.

#### **Sampling Procedure and Sample Size**

Purposive and random sampling techniques was employed for the study. Firstly, 10 communities/areas were purposively chosen from each of the Two (2) LGAs for producers and marketers based on their production and marketing sites, respectively. Secondly, simple random sampling technique was adopted in choosing 3 producers and 10 marketers (5 wholesalers & 5 retailers) each from the previously chosen 10 communities which gave 30 producers from Etche local government area and 100 marketers from Port Harcourt local government area. In all, a total of 130 respondents formed the sample size for the study.

#### **Data Collection Method and Sources**

Data was obtained from primary source with the aid of interview schedule and structured copies of questionnaire.

#### **Data Analysis Techniques**

The analytical methods used in analyzing collected data were Descriptive statistics, gross margin and Regression analysis.

### **III. RESULTS AND DISCUSSION**

#### **Socio-Economic Characteristics**

In this section, results of analysis of data generated from the field work were presented in line with the respondent's socio-economic features of the respondents.

**Table 1: Socio-Economic Characteristic of the Producers**

<b>Characteristics</b>	<b>Frequency</b>	<b>Percentage Mean</b>	<b>(%)</b>
<b>Gender (sex)</b>			
Male	30	100.0	1.0
Female	-	0.0	
<b>Total</b>	<b>30</b>	<b>100</b>	
<b>Age</b>			
20- 30	6	20.0	
31- 40	14	22.3	
41- 50	7	46.7	
51 and above	3	23.3	
<b>Total</b>	<b>30</b>	<b>100.0</b>	
<b>Marital Status</b>		<b>100</b>	

Single	6		
Married	24	20.0	1.80
Divorced	-	80.0	
Widowed	-	-	
<b>Total</b>	<b>30</b>	-	
<b>Level of Education</b>		<b>100</b>	
Non- formal	8		
Primary	15	26.7	2.07
Secondary	4	50.0	
Tertiary	3	13.3	
<b>Total</b>	<b>30</b>	<b>10.0</b>	
<b>Household size (no of persons)</b>		<b>100</b>	
1-5	8		
6-10	11	26.7	2.33
11-15	4	36.7	
16 and above	7	13.3	
<b>Total</b>	<b>30</b>	<b>23.3</b>	
<b>Average Monthly Income (naira)</b>		<b>100</b>	
50,000	11		
50,001 – 100,000	9	36.7	2.07
100,001- 150,000	7	30.0	
150,001- 200,000	3	23.3	
200,001 and above	-	2.0	
<b>Total</b>	<b>30</b>	<b>10.0</b>	
<b>Business experience (years)</b>		<b>100</b>	
1-5	8		
6-10	13	26.7	2.37
11-15	2	43.3	
16-20	4	6.7	
21- above	3	13.3	
<b>Total</b>	<b>30</b>	<b>10.0</b>	

**Source:** Field Survey, 2020

The result from table 1 shows that charcoal production is a Male dominated venture with adults within the ages of 31-40 being the predominant age group involved in the business and these are men with family, implying that charcoal production is a venture used in sustaining livelihood in families. This is in consonance with the marital status in which majority indicated they are married with family. With white collar jobs being difficult to come by especially for those with no higher degrees from tertiary institutions, unskilled labour is what they resort to and only 10% of charcoal producers have higher degree. So it is a source of income mainly for people without higher degree and who are unable to get skilled employment. The producers are not highly educated and are poor as evidenced by their large family size. Their monthly income is not much, and for their years in production, majority of them are below ten years.

**Table 2: Socio-Economic Characteristic of the Marketers**

<b>Characteristics</b>	<b>Frequency</b>	<b>Percentage (%)</b>	<b>Mean</b>
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<b>Gender (sex)</b>			
Male	43	43.0	1.57
Female	57	57.0	
<b>Total</b>	<b>100</b>	<b>100</b>	
<b>Age</b>			
20- 30	17	17.0	2.38
31- 40	44	44.0	
41- 50	23	23.0	
51 and above	16	16.0	
<b>Total</b>	<b>100</b>	<b>100</b>	
<b>Marital Status</b>			
Single	23	23.0	1.97
Married	65	65.0	
Divorced	4	4.0	
Widowed	8	8.0	
<b>Total</b>	<b>100</b>	<b>100</b>	
<b>Level of Education</b>			
Non- formal	8	8.0	2.83
Primary	24	24.0	
Secondary	45	45.0	
Tertiary	23	23.0	
<b>Total</b>	<b>100</b>	<b>100</b>	
<b>Household size (no of persons)</b>			
1-5	76	76.0	1.25
6-10	23	23.0	
11-15	1	1.0	
16 and above	-	-	
<b>Total</b>	<b>100</b>	<b>100</b>	
<b>Average Monthly Income (naira)</b>			
50,000	51	51.0	1.77
50,001 – 100,000	25	25.0	
100,001- 150,000	20	20.0	
150,001- 200,000	2	2.0	
200,001 and above	-	-	
<b>Total</b>	<b>100</b>	<b>100</b>	
<b>Business experience (years)</b>			
1-5	69	69.0	1.38
6-10	25	25.0	
11-15	5	5.0	
16 and above	1	1.0	
<b>Total</b>	<b>100</b>	<b>100</b>	

**Source:** Field Survey, 2020

Marketing activities were predominantly female with an almost even population of male, unlike production that was strictly a male affair. Age, marital status, education level, household size,

average monthly income and years of experience were relatively similar to the socioeconomic status of the producers as some marketers were equally producers.

The socio-economic features of charcoal producers and marketers are similar for both Etche and Port Harcourt local government areas as tables 1 and 2 is a representation of both areas.

### Costs and Returns of Wood Charcoal Production and Marketing

The section presents the results on the profitability evaluation of wood charcoal production and marketing. Profitability index such as gross margin, net income and cost benefit ratio were employed in the evaluation.

Table 3 presents the evaluation of the costs and returns analysis of wood charcoal production in Etche LGA.

**Table 3: Costs and Returns of Wood Charcoal Production (Etche)**

Items	Amount (₦)	Share of Total cost (%)
<b>Total Variable Costs (TVC)</b>		
Cost of wood	1,338,000	39.19
Labor Cost	1,233,000	36.11
Transportation cost	747,000	21.88
Cost of packaging	82,500	2.42
<b>Total (TVC)</b>	<b>3,400,500</b>	
<b>Total Fixed cost</b>		
Depreciated cost of tools (machetes, axe, barrow)	13,950	0.40
Land	-	
Total (TFC)	13,950	
Total Cost (TFC + TVC)	3,414,450	
<b>Total Revenue</b>	<b>7,842,000</b>	
Profit (TR – TC)	4427550	
Gross Margin (GM= TR – TVC)	4,441,500	
Net income (GM – TC)	1,033,050	
Cost Benefit Ratio	1.3	

**Source:** Computed from Field Analysis (2020)

Results from the cost and return analysis on wood charcoal production indicated that wood charcoal production is profitable with a cost benefit ratio of 1.3, this implies that for every one naira invested, the producers gained ₦1.3 with a gross margin value of ₦4,441,500 and net income value of ₦1,033,050. Cost of raw material has highest percentage of the total cost (39.19%), followed by labor cost (36.12%), transportation cost (21.88%) and cost of packaging (2.42%). Hence, the results show that wood charcoal production is profitable in the study area, an indication that the business is a viable means upon which the livelihood of the dealers can be supported

### Costs and Returns of Wood Charcoal Marketing (Wholesalers)

Table 4 presents the evaluation of the costs and returns analysis of wood charcoal marketing (wholesale) in Port Harcourt.

**Table 4: Costs and Returns of wood charcoal marketing for wholesalers**

Items	Amount (₦)	Share of Total cost (%)
<b>Total Variable Costs (TVC)</b>		
Market expenses (Transportation + tax + packaging)	254,000	38.12
Labor Cost		
<b>Total (TVC)</b>	<b>41,300</b>	<b>6.19</b>
	<b>295,300</b>	
<b>Total Fixed cost</b>		
Rent	371,000	
Total (TFC)	371,000	55.68
Total Cost (TFC + TV)	666,300	
<b>Total Revenue</b>	<b>3,080,000</b>	
Profit (TR – TC)	2,413,700	
Gross Margin (GM= TR – TVC)	2,784,700	
Net income ( NI = GM – TC)	2,118,400	
	3.6	
Cost Benefit Ratio		

Source: Computed from Field Analysis (2020)

### Costs and Returns of wood charcoal marketing (retailers)

Table 5 presents the evaluation of the costs and returns analysis of wood charcoal marketers (wholesale) in PHALGA

**Table 5: Cost and Returns of Wood Charcoal Marketing for Retailers**

Items	Amount (₦)	Share of Total cost (%)
<b>Total Variable Costs (TVC)</b>		
Market expenses (Transportation + tax + packaging)	111,900	25.04
Labor Cost	19,000	4.25
<b>Total (TVC)</b>	<b>130,900</b>	
<b>Total Fixed cost</b>		
Rent	316,000	70.71
Total (TFC)	316,000	
Total Cost (TFC + TV)	446,900	



<b>Total Revenue</b>	<b>1,309,600</b>
Profit (TR – TC)	862,700
Gross Margin (GM= TR – TVC)	1,178,700
Net income ( NI = GM – TC)	731,800
Cost Benefit Ratio	1.93

**Source:** Computed from Field Analysis (2020)

As shown in tables 4 and 5, results from the cost and return analysis carried out on wood charcoal marketing indicate that wood charcoal marketing is lucrative and highly profitable with a cost benefit ratio of ₦3.6 and ₦1.9 for wholesalers and retailers respectively, this shows that for every one naira invested, wholesalers gained ₦3.6 while retailers gained ₦1.9. Hence, both wholesalers and retailers recorded gross margins of ₦2,784,700 and ₦1,178,700 respectively. More so, their net income value indicated ₦2,118,400 and ₦731,800 for the wholesalers and retailers respectively. For the wholesalers, rent has highest percentage of the total cost (55.68%), followed by market expenses (38.12%) and labor (6.19%). For retailers, rent also had the highest percentage of total cost, (70.71%), market expenses (25.04%) and Labor (4.25%) This result shows that wood charcoal marketing is profitable in Port Harcourt local government area.

#### **Factors affecting the Profitability of Wood Charcoal Production and Marketing**

This section shows results from the analysis of factors influencing the marketing and production of wood charcoal.

**Table 6: Regression Analysis on Profitability determinants of Wood Charcoal Production**

<b>Variables/Coefficients</b>	<b>Linear Model***</b>	<b>Semi-Log Model (or growth model) {a}</b>	<b>Double-Log Model (Lin-log model)</b>	<b>Exponential Model</b>
Intercept	b = 23919.779	751555.888	4.974	-262604.6
(t-ratios)	(0.284)NS	(0.989)NS	(5.754)***	(-0.6000)NS
Age of marketers	b = -14487.59	-116224.455	-0.148	-2584.663
(t-ratios)	(-2.751)**	(-2.167)**	(-2.421)**	(-0.0997)NS
Level of Education	b = 24248.922	248949.978	0.005	39382.97
(t-ratios)	(0.917)NS	(0.878)NS	(0.014)NS	(2.6330)**
Household size	b = -45064.659	-286498.969	-0.279	47846.34
(t-ratios)	(-3.689)***	(-2.4699)**	(-2.110)**	(2.6102)**
Average household income	b = -1372.850	-66141.492	-0.062	-12603.5
(t-ratios)	(-1.754)*	(-0.895)NS	(-0.732)NS	(-1.0266)NS
Business experience	b = 63073.300	219707.177	-0.726	33289.02
(t-ratios)	(2.934)***	(0.870)NS	(2.525)**	(1.9090)*
Quantity of charcoal produced	b = 59705.282	353501.639	0.660	13634.66

( <i>t-ratios</i> )	(5.714)***	(2.976)***	(4.884)***	(-0.5058)NS
Cost of raw material(wood)	b = -0.001	-52498.576	0.006	-26285.33
( <i>t-ratios</i> )	(-0.001) NS	(-0.678)NS	(0.073)NS	(-1.0497)NS
Price of wood charcoal	b = 7785.124	47498.716	0.180	64260.54
( <i>t-ratios</i> )	(1.019)NS	(0.434)NS	(1.448)NS	(2.7261)**
Distance to forest	b = -172.006	-243323.716	-0.130	-84788.54
( <i>t-ratios</i> )	(-0.007)NS	(-1.596)NS	(-0.748)NS	(-
Price of substitute	b= -378.145	-196686.486	0.101	5.8193)***
( <i>t-ratios</i> )	(-1.340)	(-0.748)NS	(-0.337)NS	
<b>MODEL FIT TESTS</b>				
R- squared	0.971	0.873	0.963	0.731091
Adj R-squared	0.955	0.806	0.944	
F-statistic	62.854	13.027	49.749	27.88528
Prob(F-statistic)	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)*** 24.75541

Source: Output from SPSS software based on Field Data (2020).

(NS= not significant, \* = significant at 10%, \*\* = significant at 5%, \*\*\* = significant at 1%)

**Table 7: Regression Analysis on the Profitability determinants in Wood Charcoal Marketing**

Variables/Coefficients	Linear Model	Semi-Log Model (or growth model) {a}****	Double-Log Model (Lin-log model)	Exponential Model
Intercept	b = 24834.068	-25775	4.793	-262604.6
( <i>t-ratios</i> )	(0.493)NS	(-0.095)NS	(2.222)NS	(-0.6000)NS
Age of marketers	b = 360.304	-13672.363	-0.097	-2584.663
( <i>t-ratios</i> )	(0.397)NS	(-1.642)NS	(-1.466)NS	(-0.0997)NS
Level of Education	b = 119.061	5515.589	0.010	39382.97
( <i>t-ratios</i> )	(0.125)NS	(1.131)NS	(0.247)NS	(2.6330)**
Household size	b = 1570.521	20576.127	0.059	47846.34
( <i>t-ratios</i> )	(0.717)NS	(3.879)***	(1.403)NS	(2.6102)**
Average household income	b = 5891.338	1380.654	0.063	-12603.5
( <i>t-ratios</i> )	(4.963)***	(0.260)NS	(14791)NS	(-1.0266)NS
Selling Price of wood charcoal	b = 0.273	-7759.750	-0.035	33289.02

(t-ratios)	(0.806)NS	(-0.935)NS	(-0.535)NS	(1.9090)*
Purchase price of wood charcoal	b = -17.891	-1131.438	-0.444	13634.66
(t-ratios)	(-1.204)NS	(0-0.014)NS	(-0.685)NS	(-0.5058)NS
Marketing expenses (transport, packaging, rates, taxes)	b = 2.576	9954.347	-0.014	-26285.33
(t-ratios)	(4.377)***	(2.002)**	(-0.346)NS	(-1.0497)NS
Business/ market experience	b = 14680.477	38249.756	0.306	64260.54
(t-ratios)	(6.971)***	(6.594)***	(6.612)***	(2.7261)**
Labor cost	b = -1.698	796.170	-0.045	-84788.54
(t-ratios)	(-0.830)NS	(0.236)NS	(-1.669)*	(-
Quantity of charcoal sold/month	b= 9922.836	22844.103	0.674	5.8193)***
(t-ratios)	(3.332)***	(2.71)**	(9.407)***	
<b>MODEL FIT TESTS</b>				
R- squared	0.913	0.919	0.965	0.731091
Adj R-squared	0.903	0.910	0.961	
F- stats	93.618	100.827	243.14	27.88528
Prob(F-statistic)	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)*** 24.75541

**Source:** Output from SPSS software based on Field Data (2020).

*Note:* (NS= not significant, \* = significant at 10%, \*\* = significant at 5%, \*\*\* = significant at 1%)

From tables 6, The linear model is chosen as the lead equation because it is the best fit among the other models (highest number of significant variables, the highest R- square and R- adjusted value of 0.971 & 0.955 respectively, the highest F- value of 62.854, as well as conformity of the signs of the coefficient to economic theories). A significant  $P < f$  value of 0.000 show that the model is statistically significant and an R-square value of 0.971 showing that 97% of the variations in the dependent variable is explained by the independent variable

Using the lead equation (linear), results shows that factors such as age, household size, average income, market experience, business experience and quantity of wood charcoal produced per month are significant thereby influencing the production of wood charcoal in the area.

The Semi-log model is chosen as the lead equation on determining the factors influencing charcoal marketing because it is the best fit among the other models (high number of significant variables and a high R- adjusted value as well as conformity of the signs of the coefficient to economic theories). A significant  $P < f$  value of 0.000 show that the model is statistically significant and an R-square value of 0.919 showing that 91% of the variations in the dependent variable is explained by the explanatory variables.

factors such as household size, market experience, market expenses, business experience and quantity of wood charcoal sold per month are significant variables implying that they clearly influence the marketing of wood charcoal enterprise.

#### **IV Conclusion and Recommendations**

This study had found, among other things, wood charcoal production and marketing to be profitable in Rivers State of Nigeria. It can serve as an avenue for employment and income generation, reduce unemployment and poverty in Nigeria. The study recommends that more individuals and organizations be encouraged to go into the charcoal business given the profits they stand to gain, individuals going into the business should seek advice from persons who have more experience, Government and financial institutions should increase efforts in providing aids in the form of loans, subsidies, grants, etc. for interested farmers and promote tree planting and agro-forestry to make forests ever closer to urban and rural dwellers.

## References

- Agbugba, I. K. & Binaebi, E. (2018). A Comparative Study of the Agricultures Sectors Contribution to the Economic Growth of Nigeria and Malaysia. *IOSR Journal of Agriculture and Veterinary Science*, 11(3), 18-21.
- Agbugba, I. K. & Solomon, R.J. (2008). Analysis of wood charcoal market in Abia State, Nigeria. *Nigerian Journal of Home Economics (Nig.JHEC)*, 1(1), 57-62.
- Agbugba, I.K. & Obi, A. (2013). Market structure, price formation and transmission for Wood charcoal in Southern Nigeria. *Journal of Agricultural Science*, 5(15), 77-86.
- Amadi, S., Momodu, N. & Chukwuigwe, E.C. (2003). The Commercial and Merchant banks Credit to the preferred sector of Nigerian economy (1981 - 1997). *A critical appraisal. International Journal of Economics & Development*, 2 (1), 5-11.
- Babatunde, O.M. (2017). Wood fuel energy type dependence in Jos Plateau State, Nigeria. *Journal of Ecology and Environmental Sciences*, 6(1), 80-93.
- Haruna, G., Yacob, M. & Adiza. A. (2015). The household cooking sector in Nigeria: Environmental and Economic Sustainability Assessment, *Resources*, 4(1), 412-433.
- Ogwuche, A.J. & Asobe, A. (2012). Assessment of the socio-economic factors affecting Households charcoal use in Markurdi Urban Area of Benue State, Nigeria. *E-Journal of Environmental Research and Management*, 3(7), 180-188.
- Onoja, A. O. (2012). Econometric Analysis of Factors Influencing Fuelwood Demand in Rural and Peri-Urban Farm Households in Kogi State, Nigeria, *Journal of Sustainable Development*, 8(1), 115 – 127.