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Determinants of Alternative Sources of Cooking Energy among Households in Ekiti State, Nigeria

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Abstract:
The study examined determinants of alternative sources of cooking energy among households in Ekiti State of Nigeria. The study utilized descriptive research design. The study employed primary data through the use of structured questionnaires. Multiple regression was adopted for data analysis. The alternative sources of cooking energy examined were wood fuel, charcoal, kerosene, electricity, solar and liquefied petroleum gas. The findings revealed that price, economic status, household size, and preference have significant effect on sources of cooking energy. However, social background revealed a negative and insignificant effect on sources of cooking energy. The study concluded that the most used alternative source for cooking is liquefied petroleum gas in Ekiti State, Nigeria. It further displayed that the most used alternative source of cooking in rural areas is Kerosene and in the urban areas, the most used alternative sources of cooking is liquefied petroleum gas. It is suggested that the government should ensure prompt availability of alternative sources of cooking energy such as liquefied petroleum gas, kerosene, and electricity for the populace of Ekiti State and Government should discourage deforestation in Ekiti State so as to make woods available as source for cooking energy in the state

Keywords: Alternative sources of cooking energy, price, household size, economic status, social background, preference

1. Introduction

Energy consumption patterns in the world today shows that Nigeria and indeed African countries have the lowest rates of consumption. Nevertheless, Nigeria suffers from an inadequate supply of usable energy due to the rapidly increasing demand which is typical of a developing economy. Energy constitutes one of the most important aspects of human life whereby it is a commodity that is vital for the existence of modern life (Eakins, 2013). The patterns of energy usage in Nigeria's economy can be divided into industrial, transport, commercial, agricultural, and household sectors. Despite the fact that the importance of different end uses for energy varies significantly from country to country because of the differences in climatic conditions, policies, level of economic development and other factors, it is generally agreed that the household sector is one of the most important energy consumption sectors (Bhattacharyya, 2011).

The household sector accounts for the largest share of energy usage in the country at about 65%. The major energy consuming activities in Nigeria's households are cooking, lighting, and use of electrical appliances (Oyedepo, 2012). The role of energy in household cooking cannot be underestimated because it accounts for a major part of the total energy consumed in Nigeria. In many developing countries, the high costs of modern cooking energy and electricity is a major constraint and this has made some households to retain the old form of using cooking wood fuel. Fuel wood which is also known as wood fuel is considered as the oldest form of fuel used among households especially in African countries. For many years, fuel wood has remained cheap when compared with kerosene which is the next cheapest energy source among households. Its supply is more reliable and due to the nature of African extended families, fuel wood is more suited for cooking especially for large families and during festivals.

In Nigeria, the percentage of households using solid fuel is high (70 %), including 86 percent of households in rural areas and 42 percent of households in urban areas. Among the households that reported use of solid fuel for cooking, the majority (94 percent) were using an open fire/stove without a chimney or hood. The use of some solid fuels has been associated with indoor pollution and unsafe levels of toxic emission. Biomass Fuel usage is associated with high levels of indoor air pollution and an increase morbidity which led to high mortality both in adults and children. Indoor air pollution accounted for 1.5 to 2 million deaths per year worldwide, half of them occurring in children younger than five years due to acute respiratory infections (ARI), also in women due to chronic obstructive pulmonary disease (COPD) and lung cancer.
In most Africa countries, the use of modern source of cooking is not paramount especially in rural areas. Desalu, Ojo, Ariyibi, Kolawole and Ogunleye (2012) discovered that the use of solid fuel like wood, agricultural waste, dung and charcoal was higher in poor families of rural areas while in the urban areas, the use of solid fuel was also higher in poor families but the use of gas and electricity were higher in rich families in Ekiti state using Ado-Ekiti as the urban area and

Ido-Osi as the rural area. Jekayinfa (2007) observed that the use of woodfuel as a source of energy among households as a result of scarcity, high cost and also epileptic nature of electricity supply from the National grid with shortage in the supply of petroleum products. The author pointed that the use of woodfuel has led to maximum environmental temperature, land degradation, deforestation among other environmental hazards.

Various efforts have been made in the past by government, NGO and international organizations to encourage the use of modern fuel also known as clean fuel. In Nigeria, Rural Electrification Agency (REA) in 2006 with the aim to achieve 75% electricity access by 2020, launched Nigerian Alliance for Clean Cook Stoves in 2012 which was aimed at introducing 10 million clean cook stoves to the Nigerian market 2020. Yet, the use of modern alternative source of cooking is not rampant in Nigeria.

It is observed that there is little empirical evidence on the determinants of alternative sources of cooking energy among households in Nigeria economy and appropriate statistical tools such as regression analysis as well as analysis of variance (ANOVA) were not used to analysis data. Thus, it is important to ascertain what determines alternative sources of energy in Nigeria focusing on Ekiti State as one of the developing states in Southwest Nigeria. The study observed that price, economic status, household size, social background and preferences are wholly captured by earlier studies. Also, this research further added to existing literature on the determinants of alternative sources of cooking energy among households in Ekiti State which serves as a basis for the upcoming researchers who may want to delve in to the subject and make possible suggestions for further study; thus, the essence of the study.

The objective of the paper is to evaluate the predominant determinants (price, economic status, household size, social background and preferences) of sources of cooking energy in Ekiti State.

The remainder of this paper is structured as follows. The introductory section is followed by review of literature in section two. Section three discusses the methodology, while section four presents the empirical results. Section five concludes and makes recommendations.

2. The Literature

2.1. Empirical Review

Gbadegesin and Olorunfemi (2011) used descriptive statistics to investigate the socio-economic aspects of fuel wood business in the forest and savanna zones of Nigeria and found that fuelwood remains the main source of energy for heating and cooking whereby increase in Petroleum price has increased the demand for fuel and concluded that fuelwood might go into extinction due to failure to replace harvested wood. Bojnec and Papler (2011) examined the efficient energy use and renewable sources of energy in Slovenia and indicated that their relationship between energy use and renewable source of energy.

Mwaura, Okoboi and Ahaibwe (2014) studied the determinants of household's choice of cooking energy in Uganda. Used multinomial probit model (MNP) to estimate coefficient of determinants of energy choices whereby they found out that the determinants of household energy choices were observed as consumption expenditure welfare, residing in urban or rural areas, household size and achievement of education levels beyond primary level and regional location of a household. Onoja and Idoko (2012) examined the econometric analysis of factors influencing fuel wood demand in rural and peri-urban farm households of Kogi State and posited that the most significant determinants of fuel wood demand in the study area are the price of fuel wood, price of kerosene, household size and personal incomes of the household heads.

Massawe, Bengesi and Kweka (2015) evaluated the patterns of household cooking energy and associated factors: experience from kilimanjaro region, Tanzania. It was seen that biomass was becoming a scarce commodity but still a major source of cooking energy combined with the traditional cooking stove. Also, some households make use of transition fuels or cleaner fuels combined with firewood.

Adeyemi and Adereleye (2016) studied the determinants of household choice of cooking energy in Ondo State, Nigeria. The results of the descriptive statistics and multinomial logit showed the household income, level of education, household size, occupation of the respondent, nature of the dwelling house and ownership of the dwelling house are the significant factors influencing fuel choice. Naibbi (2013) examined the fuelwood and vegetation change in Northern Nigeria. The results showed that fossil fuel supply is precarious in the country. The majority of the northern states are deprived of sufficient fossil fuel supply and this is closely correlated with their dependence on traditional fuels (fuelwood), leading to considerable pressure on the region's scarce vegetation resources.

Akintan (2014) studied the socio-cultural perceptions of indoor air pollution among rural migrant households in Ado Ekiti, Nigeria. The research used holistic approaches to understand energy issues in the study area and used methods such as questionnaires, interviews, and field observation during data collection. Wood fuel continues to be households' main domestic energy source irrespective of their socio-economic status.

Audu (2013) carried out a research on fuel wood consumption and desertification in Nigeria. The result shows that fuel wood is there about the only means of domestic fire in the desert prone states leading to desertification as other sources of domestic fire are almost not in use. Elegbede and Guerrero (2016) carried out a research on Algae biofuel in the Nigerian energy context. It was analyzed with the use of comparative cum qualitative review of analysis. The results indicated that there was no significant difference in the contribution of algae and other sources of biofuels as a necessity for bioenergy in Nigeria.

Danlami, Islam and Dew (2015) made an analysis on the determinants of households' energy choice: a search for conceptual framework. Electric water heater, electric clothes dryer, dish washer, number in house, family income, nature of employment, municipality of residence, expenditure per capita, private water connection, age of household head, were

found to be positively significant related to household energy choice and consumption. Sa'ad and Bugaje (2016) studied biomass consumption in Nigeria: trends and policy Issues. The study showed a highly positive relationship between biomass consumption and poverty levels as well as highly negative correlations between incomes and biomass consumption in all the six geopolitical regions in Nigeria.

Momodu (2013) carried out a research on domestic energy needs and natural resources conservation. It was revealed that fuelwood provides energy for more than 60 per cent Nigerians and also responsible for meeting 80 per cent of domestic energy needs. Adepoju, Oyekale and Aromolaran (2012) studied the factors influencing domestic energy choice of rural households in Ogun State, Nigeria. The results through logit regression showed that there was gender influence in fuel wood choice. Also, illiterate household heads had higher likelihood of choosing charcoal. Choices of kerosene oil and electricity were influenced by proximity.

Oteh, Agwu, Nwaogu and Nto (2015) investigated on mitigating climate change and determinants of access to liquefied petroleum gas (LPG) among urban households in Abia State, Nigeria. Probit regression results showed that education, income, price of LPG, availability and distance from house to place of purchase have relationship with access to LPG. Finally, it was observed kerosene is the most preferred cooking energy in urban areas.

Ebe (2014) carried out a research on socio-economic factors influencing the use of fuelwood in urban areas of Enugu State, Nigeria. The result revealed that majority of the fuelwood consumers had low level of education, low income and were married with large sizes of household. The result further indicated that large sizes of household use large quantities of fuel wood and kerosene as substitutes. The constraints of fuelwood consumption were high prices of fuel wood, health problems, lack of storage space and attraction of harmful insects such as scorpion.

2.2. Gap in Literature

Based on the above reviewed literature, it shows that there are limited researches done in Ekiti State on alternative sources of cooking energy which prompted this study to examine the determinants of alternative sources of cooking energy in Ekiti State focusing on households in rural and urban areas of the three senatorial districts in the state.

3. Methodology

3.1. Theoretical Framework

3.1.1. The 'Fuel Stacking' Theory

The theoretical framework used or adopted is The 'Fuel Stacking' Theory due to lapses or weaknesses of the energy ladder theory which narrowed what determines the choice of cooking fuel by households to income alone.
Masera, Saatkamp, and Kammen (2000) criticized the energy ladder theory on the grounds that it cannot adequately describe the dynamics of households' fuel use. Instead, they note that fuel stacking is common in both urban and rural areas of developing countries. Fuel stacking corresponds to multiple fuel use patterns where households choose a combination of fuels from both lower and upper levels of the ladder. Indeed, modern fuels may serve only as partial, rather than perfect substitutes for traditional fuels (Van der Kroon, Brouwer and Van Beukering, 2013). Multiple fuel use arises from several reasons, such as, occasional shortages of modern fuels (Hosier and Kipondya 1993; Kowsari and Zerriffi, 2011), high cost of appliances associated with using exclusively modern fuels (Davis, 1998), fluctuations of commercial fuel prices (Leach, 1992) and preferences inducing households not to fully adopt modern fuels (Masera et al. 2000). The complexity of the fuel switching process thus suggests that there is a multiplicity of factors, besides income, that may affect fuel use. This led some authors to delve into more sophisticated modelling approaches. This theory can also be called the 'Multiple Fuel' theory.
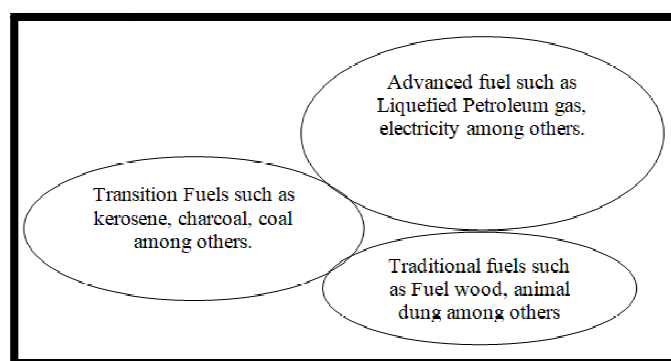

Figure 1: Fuel Stacking or Multiple Fuel
Source: Sclag and Zuzarte (2008)

3.2. Research Design/ Population of the Study

The study adopted descriptive survey research design method. The total population of Ekiti State as at the last population census in 2006 was 2,384,212 million Google (wikipedia). Due the large population and difficulty to go to every household to get information makes this study to make use of one town or relatively urban area and rural area in each of

the local government selected in the three senatorial districts due to the fact that these are the places where conventional and traditional sources of cooking energy are perceived by the researcher to be used respectively.

Towns	Population
Ikole-Ekiti	170,414
Ora-Ekiti	74,121
Ikere-Ekiti	148,558
Orun-Ekiti	113,754
Ado-Ekiti	313,690
Iworoko-Ekiti	153,350
Total	973,887

Table 1: Population of the Study
Source: National Population Commission of Nigeria (2006)

Thus, the population for the study is 973,887.

Simple random and purposive sampling techniques are adopted. Random sampling was used in ensuring that there is fair representation and selection of sufficient number of samples from each sample population and purposive sampling techniques is adopted to ensure that the study is conducted where it will be relevant.

The study used Yamane Taro model (1967) sample size. The formula is given and the sample size was calculated as follows:

$$n = \frac{N}{1 + N(e)2}$$

n =973,887/1+973,887 (0.05)^2
= 973,887/2345.72
= 415.17. This gives 415 after approximation.
Where, n = the sample size of the study
N= total population of the study
e= acceptable margin error term (0.05)

Towns	Population Sample
Ikole-Ekiti	73
Ora-Ekiti	32
Ikere-Ekiti	63
Orun-Ekiti	48
Ado-Ekiti	134
Iworoko-Ekiti	65
Total	*415*

Table 2: Sample Size for the Study
Source: Authors' Computation (2017)

The choice of choosing the three senatorial districts was borne out of the fact that the study requires a robust, qualitative and quantitative analysis.

Primary data was used for this study; the primary source of data collection was through administration of well-structured questionnaire which is administered to the respondents. The questionnaire which is made of two sections- section A and section B. The section A focuses on the demographic details of the respondents while the section B comprises the questions for each variable employed to achieve the objectives of the study. The questionnaire is structured in line with the research questions of the study. The research question 1 has its own question, research question 2 has its questions and each variable employed in research question 2 has its questions as well as question 3. In all, there are 40 questions and they are answered by the respondents of the study.

3.3. Model Specification

To examine the determinants of alternative sources of energy consumption in Ekiti State, the study adapted a quantitative study of Bisu, Kuhe and Iortyer (2016) and the model is stated as follows:
EC = f(Pr, ES, HS, SBG, Pf) …...3.1
For the purpose of the study objectives, the model is therefore, expressed in econometric forms:
EC= β_o+ β_1Pr+ β_2ES + β_3HS + β_4BG + β_5Pf + ϵ…........................3.2
Where EC= Energy Consumption; Pr=Price; ES= Economic Status; HS= Household Size; BG= Background; Pf= Preference.
β_o=Constant Parameter; β_1, β_2,β_3, β_4, and β_5= Parameters of the Variables; ϵ: Stochastic or error term.
Descriptive statistics, multiple regression as well as analysis of variance (ANOVA) were employed as data analysis method. Multiple regression was employed to test the formulated model for the study.

4. Results and Discussions

4.1. Descriptive Statistics

Demographic Variable	Responses	Frequency	Percent (%)
Sex	Male	117	33.8
	Female	229	66.2
	Total	346	100
Marital Status	Single	70	20.2
	Married	190	54.9
	Widow	47	13.6
	Widower	16	4.6
	Divorcee	23	6.6
	Total	346	100
Age	21-30 years	81	23.4
	31-40 years	186	53.8
	41 and above	79	22.8
	Total	346	100
Occupation	Student	41	11.8
	Full House Wife	62	17.9
	Civil Servant	189	54.6
	Entrepreneur	46	13.3
	Retired	8	2.3
	Total	346	100
Educational Background	Primary Education	74	21.4
	Secondary Education	74	21.4
	Tertiary Education	137	39.6
	No Formal Education	53	15.3
	Others		
		8	2.3
	Total	346	100

Table 3: Demographic Details of the Respondents
Source: Researchers' Field Survey, 2019

Table 3 reveals the demographic details of the respondents which shows that 117(33.8%) of the respondents are male and 229(62.2%) of the respondents are female. The marital status of the respondents reveals that 70(20.2%) of the respondents are single, 190(54.9%) of them are married, 47(13.6%) of the respondents are widow, 16(4.6%) are widower and 23(6.6%) respondents are divorcee. The ages of the respondents revealed that 81(23.4%) of the respondents are 21-30 years of age, 186(53.8%) of the respondents are 31-40 years of age, and 41 and above of the respondents are 79(22.8%). The table further reveals that 41(11.8%) of the respondents are students, 62(17.9%) respondents are full house wife, 189(54.6%) respondents are civil servant, 46(13.3%) of the respondents are entrepreneur and just 8(2.3%) respondents are retirees. Educational qualifications of the respondents shows that 74(21.4%) of the respondents have primary education as well as secondary education. 137(39.6%) of the respondents have tertiary education, 53(15.3%) of the respondents do not have formal education while 8(2.3%) of the respondents have other forms of qualification.

4.2. Reliability Test of Study

S/N	Variables	Reliability (Cronbach Alpha)	No of Items
1	Sources of Cooking Energy	0.790	10
2	Determinants of Energy Sources of Cooking (Price, Economic Status, Household Size, Background and Preferences)	0.798	15

Table 4: Alternative Sources of Cooking Energy and its Determinants
Source: Researchers' Computation, 2019

4.2.1. Interpretation

Cronbach Alpha was used to compute the reliability test in table 4. The reliability test was conducted based on the model formulated in line with the objectives. Table 4 showed Cronbach Alpha results of the variables for the study. The results indicated that sources of cooking energy and the determinants have reliability values- 0.790 and 0.798 with 10 and 15 items respectively. The values are all greater than 0.70 which is the rule of thumb for reliability test. According to Nunnally (1967), reliability coefficient of 0.70 is acceptable.

4.3. Research Model

$SEC = \beta_o + \beta_1 Pr + \beta_2 ES + \beta_3 HS + \beta_4 SBG + \beta_5 Pf + \epsilon$

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.751[a]	.564	.558	.24992	1.807

Table 5: Model Summary[b]
Source: Researchers' Computation, 2019
a. Predictors: (Constant), Price, Economic Status, Household Size, Social Background, Preference
b. Dependent Variable: Sources of Cooking Energy

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	27.516	5	5.503	88.110	.000[b]
	Residual	21.236	340	.062		
	Total	48.752	345			

Table 6: ANOVA[a]
Source: Researchers' Computation, 2019
a. Dependent Variable: Sources of Cooking Energy
b. Predictors: (Constant), Price, Economic Status, Household Size, Social Background, Preference

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.710	.151		4.697	.000
	Price	.198	.026	.289	7.711	.000
	Economic Status	.237	.017	.536	14.170	.000
	Household Size	.225	.026	.366	8.612	.000
	Social Background	-.023	.024	-.045	-.967	.334
	Preference	.112	.019	.300	5.799	.000

Table 7: Coefficientsa
Source: Researchers' Computation, 2019
a.   Dependent Variable: Sources of Cooking Energy

4.3.1. Interpretation

The regression results of model employed in answering research questions in the study are shown in table 5, table 6 and table 7. Table 5 shows that 56.4% (R^2=.564) of the variations in sources of cooking energy is caused by price, economic status, household size, Social background and preference. Table 6 shows the F statistics as well as the significant value. The table reveals the value of F statistic of 88.110 and significant value of .000. This implies that the model is fit to achieve the objectives of the study.

The results further show price has a positive and significant effect on source of cooking energy (β = 0.198, t = 7.711, p-value= .000) in table 7. Based on this, the study accepts that price determines the source of cooking energy to be used. Economic status has a positive and significant effect sources of energy (β = 0.237, t = .14.170, p-value= .000). The study asserts that economic status does predict the use of sources of cooking energy. Household size has a positive and significant effect on sources of cooking energy (β = 0.225, t = 8.612, p-value= .000). Thus, household size determines the use of sources of cooking energy. The results also shows that social background has a negative effect and insignificant effect on Sources of cooking energy (β = -.023, t = -0.967, p-value= .334). Thus, the study affirms that social background does not determine the use of source of cooking. Finally, preference has a positive effect and significant effect on sources of cooking (β = 0.112, t = 5.799, p-value= .000). The study affirms that preference does determine the source of cooking energy to be used.

5. Discussion of Findings

Cooking is one of the predominant activities in human lives and it has become part and parcel of human activities. This activity cannot just be done without the use of cooking tools such as woodfuel, kerosene, electricity, solar, gas among others.

It is indicated that price, household size, economic status, and preference have positive and significant effect on sources of cooking energy in Ekiti State. This implies that an increase in these factors which are price, household size, economic status, and preference will result to increase in the sources of cooking energy in the study areas in Ekiti State. However, the social background of the respondents has negative effect and insignificant effect on sources of cooking energy. This means that social background of the respondents does not determine the sources of cooking energy. This could be as results of technology advancement that is making people in this part of the world to be exposed and enlighten to modern methods or ways of doing things. The findings of this study are in line with the findings of past studies such as Adeyemi and Adereleye (2016); Oteh, Agwu, Nwaogu and Nto (2015); Nwofe (2014); Audu (2013) among other studies

but disagree with the findings of Akintan (2014); Naibbi and Healey (2013); Bojnec and Papler (2011); Ibrahim and Ukwenya (2010) among other studies.

7. Conclusion and Recommendations

From the findings of the results, the study concludes that the most used alternative source for cooking is liquefied petroleum gas in Ekiti State. It is further displayed that the most used alternative source of cooking in rural areas is Kerosene and in the urban areas, the most used alternative sources of cooking is liquefied petroleum gas.

The study concludes that there is moderate variation of sources of cooking energy is caused by price, economic status, household size, social background and preference. The study asserted that price, economic status, household size and preference have positive and significant effect on sources of cooking energy. However, social background has a negative and insignificant effect on sources of cooking energy.

Thus, it is recommended that the government should ensure prompt availability of alternative sources of cooking energy such as liquefied petroleum gas, kerosene, and electricity for the populace of Ekiti State; and Government should discourage deforestation in Ekiti State so as to make woods available as source for cooking energy in the state

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