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Fuelwood Marketing System and The Need for Sustainable Eco-Tax Policy in Nigeria

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Abstract

What obligations do fuelwood suppliers and end-users have to the environment in market-driven economy? Can fuelwood supply and demand behaviours be managed through tax governance to preserve the ecosystem? To provide answers to the questions, this study investigates environmental conscious supply and demand for fuelwood in rural and urban areas and implications for ethical argument and tax governance in Nigeria. To achieve the stated objective, primary data collected with questionnaire from randomly selected fuelwood suppliers and end-users, were analysed with mean, percentage, standard deviation and t-statistics. The findings show that respondents were mainly young females (45years), literate (64%), married with relatively large family size (8 persons). They depend on farming (41%) and trading (41%) as major sources of livelihood. Fuelwood market participants and channel involve fuelwood gatherers, wholesalers, retailers and end-users. The markets assume a competitive structure. The per capita fuelwood consumption in rural areas (19kg) is significantly ($p<0.05$) higher than the value (9.8kg) obtained in urban areas. Households' per capita expenditure on fuelwood was ₦3,800 (US$108.57) and ₦1,960 (US$5.60) in rural and urban areas, respectively. Environmentally consciousness of fuelwood end-users should be fine-tuned by eco-tax and eco-subsidy governance in Nigeria.

1. Introduction

Fuelwood (firewood) supplies energy needed to cook, process and preserve food for humans and animals. Its presence is vital to numerous purposes essential to the immediate needs of affected people, speeding up recovery and building resilience to future shock events.

Economists and global organizations place great premium on environmental taxes mainly due to their cost-effectiveness and incentive advantages (Endres, 2011; OECD, 2006). The policy procedure for the implementation of environmental taxes in Ghana is a case in point. Similar experiences were observed for developed countries (Glachant, 2002). It is important to find out if the situation will be different if eco-taxes are made popular in Nigeria and other African countries.

In urgent emergencies and duration of long crises, the provision of sustainable source of cooking fuel coupled with appropriate, efficient and clean cooking technologies, can function as a life-saving intervention. Fuelwood related interventions are crucial from food security and an environmental perspective regardless of whether food is provided in the form of rations or produced locally there is a need for safe, stable and sustainable energy for cooking and heating.

About 2.8 billion people in developing counties like Nigeria depend on biomass fuels (e.g. Fuelwood, charcoal and animal dungs to meet their energy needs for cooking food (IEA, 2010). Fuelwood plays an important role in ensuring the food security of millions of people and its consumption must be understood in order to address resource shortage and forest decline (Macdonald et al. 2001). Natural resources including fuelwood must therefore be carefully managed and monitored to meet current demands and ensure sustainability (Warner, 2000).

In highly populated areas ensuring access to natural resources including fuelwood can be relatively challenging. During protracted crises, camps for refuges and internally displaced person (IDPs) are often established in locations where natural resources are already scare, and where limited access to dwindling resource poses the risk of increased food insecurity and social conflict.

Interest in the “fuelwood crises” facing the world’s poor has been widespread since the late 1970s (Eckholm et al.1984; Soussan, 1988; Agerwal, 1986). Firstly the problem was over stated. In the extreme, analysts (foresters, economists and others) in many countries made fallacious projection of rapid total destruction of the biomass resources.

These are associated mainly with the drive to open up great land frontiers through government-sponsored urbanisation projects such as road construction, giant hydroelectric power schemes and other development infrastructures (Fearnside 1986; Monhiot 1989; Tyler 1990). Environmental compact resulting from unsustainable extraction, collection and the uses of fuelwood can be long lasting and causing damage. Sustainable natural resource management can reduce these impact and ensure a sustainable fuel supply in tandem with

reforestation fuelwood can be supply through a variety of tree and forest systems, such as mixed forest plantations, such as agro-forestry or multiple cropping systems (FAO, 2000).

Man is helped or hurt by the ecosystem condition of the environment. Therefore, there ought to be some ethics concerning the environment. Ethical considerations are important to environmental resource exploiters and end-users in order to protect and preserve the ecosystem.

Ecosystem governance is a policy that advocates environmental consciousness and sustainability as the ultimate considerations for controlling all human environment - based activities (Kombat and Wätzold, 2019). Governance encapsulates and emphasizes whole system management by government, civil society and business. Environmental governance often employs various systems of governance to capture the diverse elements and natural resources (e.g. unregulated exploitation of fuelwood) that are involved (Kombat and Wätzold, 2019).

Hence an eco-tax is levied to control activities which are harmful to people and the natural environment. It is often intended to promote environmentally friendly economic and social activities through economic incentives. Policy can avert environmental degradation through human activities (Kombat and Wätzold, 2019).

The dynamics of environmental conscious demand and supply of fuelwood deserves analysis with special emphasis on ethical argument and eco-tax governance. The essence is to deepen our understanding of its economic and environmental significance. Demand-supply management of fuelwood via tax policy has implications for environmental sustainability. The analysis of fuelwood demand and supply gap will shed some light on the capacity of the environment to satisfy its demand. These underlying assumptions deserve investigation and clarification in the rural and urban societies.

The broad objective of the study was to investigate fuelwood marketing system and the need for sustainable eco-tax policy in Nigeria. The specific objectives were to;

i. describe the socio-economic characteristic of respondents;
ii. describe fuelwood market in the study area;
iii. examine the quantity of fuelwood demanded by households;
iv. ascertain the quantity of fuelwood supplied and sold by marketers; and
v. assess the supply-demand gap for fuelwood in rural and urban areas in Delta State

The following hypotheses were tested to guide the study.

Ho_1: There is no significant gap between fuelwood supply and demand in rural areas.

Ho_2: There is no significant gap between fuelwood supply and demand in the urban areas.

2. Materials and Methods

2.1. The Study Area and Population

The study was conducted in Delta State of Nigeria. The area was chosen for the study due to the massive dependence on fuelwood as source of energy and the noticeable adverse effects on the ecosystem. The vegetation consists of secondary vegetation which provides land in areas of high population concentration. However, in rural areas with low population density are forest reserves. The rural people are mainly farmers. Both the civil servants and self-employed artisans and trades engaged in farming. The crops grown include yam, cassava, maize, cocoyam, okra, pepper, tomatoes, melon and vegetables. It should be noted that Delta state is one of the food baskets of Nigeria. The wet and dry seasons which last from April to September and from October to March respectively favour the cultivation and harvesting of variety of crops.

2.2. Sampling Techniques

A multi-stage procedure was adopted in selecting the respondents. The first was the purposive sampling of two communities from the Local Government Area. Based on the constraints of time and cost, the following communities were selected, Owa, and Umunede. The second stage involved the proportionate use of random sampling technique in selecting 50 fuelwood end-users from the each community. This gave a total of 100 fuelwood users. Furthermore, 25 fuelwood sellers were randomly selected from each of the selected communities. This made up to 50 fuel sellers that were selected and used for the study.

2.3. Data Collection

The data for this study were generated from primary sources using questionnaire and interview schedules. The questionnaire was structured according to objectives of the study. The questionnaire captured information on the socio-economic characteristics of respondents, fuelwood end-users with the demand and supply of fuelwood.

2.4. Data Analysis Techniques

Analysis of socio-economic characteristics of respondents was achieved using descriptive statistics (mean, percentage, standard deviation). Analysis of fuelwood market was achieved using descriptive statistics. In addition, the quantity of fuelwood supplied by marketers was achieved using descriptive statistics (mean, percentage and standard deviation). Finally, supply-demand gap was achieved using t-statistics.

This was achieved using t-statistics. It is stated as;

$$t = \frac{FW_s - FW_d}{\sqrt{\frac{S^2_{FWS}}{n_{fws}} + \frac{S^2_{fwd}}{n_{fwd}}}}$$

where:

FW_S = Quantity of Fuelwood supplied (kg)
FW_d = Quantity of Fuelwood demanded (kg)
S^2_{FWS} = Variance of fuelwood supplied
S^2_{fwd} = Variance of fuelwood demanded
n_{fws} = Number of cases of fuelwood supplied
n_{fwd} = Number of cases of fuelwood demanded.

3. Results and Discussion

3.1. Socio-economic characteristics of Respondents

Table 1 shows the distribution of socio-economic characteristics of fuelwood suppliers and consuming households.

Age: The majority of the respondents (56%) are within the age bracket of 41-50yrs. Hence the mean age of respondents is 45yrs. The result implies the respondents are mainly young adults.

Gender: The finding in Table 1 indicates the respondents are mainly females (62%) while 38% are males. This implies that fuelwood suppliers and consumers are mainly females. This could be attributed to their domestic role of food preparation.

Marital Status: The result shows that most of the surveyed fuelwood suppliers and consumers are married with families. They use the fuelwood as source of energy to cook for their families.

Family Size: Table 1 shows the distribution of family size of respondents. The result shows that majority of the respondents have household size that falls within the age bracket of 5-10 persons (46%). Hence the average family size is about seven persons. This is a relatively large family. Large families are expected to consume more fuelwood.

Educational Level: The finding in Table 1 reveals that the majority of respondents (64%) have one form education or the other. These include primary, secondary and tertiary education. 36% of them received no formal education. Hence the

respondents be described as a literate group. Literally could influence the typical level of fuelwood consumption in a family.

Occupation: Table 1 presents the result of major and minor occupations of respondents in the study area. The finding shows that the major occupation of respondents is farming (45%), while trading is the minor occupation (41%).

Table 1: Socio-economic Characteristics of respondents

	Frequency	Percentage (%)	Mean/Mode
Age:			
<20	1	1	45yrs
20-30	4	4	
31-40	30	30	
41-50	56	56	
Above 50	9	9	
Gender:			
Male	38	38	62 female
Female	62	62	
Marital Status			
Single	14	14	
Married	35	35	Married
Divorce	26	26	
Widow	25	25	
Family Size			
<5	34	34	
5-10	46	46	5 – 10 family size
Above 10	20	20	
Educational level			
Primary	19	19	
Secondary	25	25	64
Tertiary	20	20	
No formal education	36	36	64 literate
Main Occupation			
Farming	41	41	
Trading	23	23	41 farming
Civil service	23	23	
Artisan	13	13	
Minor Occupation			
Trading	41	41	
Civil service	0	0	41 trading
Artisan	25	25	
Farming	34	34	

3.2. Description of Fuelwood Market

The description of fuelwood market is shown in Table 2. The result shows that fuelwood marketers in terms of volume of operation can be categorized into fuel wholesale market and fuelwood retail market.

The fuelwood market channels involve the following actors and pattern;

Fuelwood gatherers – fuelwood wholesalers – fuelwood retailers – fuelwood users or consumers.

Table 2: Description of Fuelwood Market

	Frequency	Percentage %	Mean/Mode
Indicate the units of sales			
200	45	45	45
400	30	30	
600	25	25	
Indicate the mode of sale			
Whole sale	42	42	42
Retail sale	28	28	
Both wholesale & Retail	30	30	
Indicate daily sale			
200-4000	50	50	50
500-1000	30	30	
1200-1400	20	20	
Is fuelwood alternative to other business			
Yes	72	72	72
No	28	28	
If yes rate			
Good	40	40	40
Not too good	17	17	17
Better	18	18	18
Best	28	25	25
Does fuelwood marketing require registration?			
Yes	40	40	
No	60	60	60
Do you pay tax			
Yes	40	40	
No	60	60	60
If yes how?			
N200	60	60	60
N500	40	40	
When did you start trade in fuelwood (years)			
<1			
1-3	40	40	40
-6	35	35	
7-10	25	25	
Main job			
fuelwood sale	60	60	60
the other job	40	40	
Initial capital use to start the business			
<10000	15	15	
1000-3000	40	40	40
4000-6000	20	20	
7000-10000	25	25	
Above 10,000	0	0	
Source of initial capital			
Personal saving	40	40	40
Loan from my spouse	15	15	
Gift from my spouse	25	25	
Gift from relative	20	20	
Bank			
Means of fuelwood transportation			
Pick up	40	40	40
Truck vehicle	35	35	
Toyota dyna	25	25	
Estimation of Fuelwood sale			
<5000	45	45	45
6000-10,000	20	20	
16000-20,000	35	35	
How frequent			
Once a day	45	45	45
Twice a week	25	25	
Every 2 weeks	15	15	
Monthly	15	15	
Once a month	0	0	

In the result, Table 2 shows that of fuelwood marketers (42%) were wholesalers while (58%) operated at retail level. The findings indicated that fuelwood marketing assumes relative competitive structure since majority of the marketers (60%) agreed that it does not require registration fee. This implies that there is free entry and exit of participants. Further more the result shows that fuelwood marketing does not require tax payment from participant (60%). Majority of them (60%) have been operating fuelwood marketing for the past 4-10 years ago. About (50%) indicated that fuelwood is sold in bundles measuring 9.8kg per bundle. A bundle was sold for (9kg) 200 naira. About 50% of the respondents agreed that their daily sale was 19-57kg. Further result in Table 2 shows 40% of fuelwood sellers got initial for capital from fuelwood business from personal savings (40%) (15%) loan from spouses and 25% loan from relatives. Furthermore results in Table 2 indicate that the major mode transportation of fuelwood is vehicle (40%) keke (35%) wheelbarrow (25%).

3.3. Description of Fuelwood Demand

Table 3 shows the distribution of fuelwood demand among respondent. The result shows that (35%) demanded 19-38kg of fuelwood daily (30%) demanded 19kg of fuelwood (14%) while (11%) demanded 57kg and above on daily bases, result in

Table 3: Distribution of fuelwood Demand among Respondents

Source of energy use	Quantity Dd in Kg	Amount (₦)	Frequency	Percent (%)	Mean/mode
Electricity			10	10	
Gas			15	15	
Fuelwood			55	55	Fuelwood
Kerosine			25	25	
Others			25	25	
Fuelwood only					
Yes			54	54	Yes
No			21	21	
Others			25	25	
If No, with what source of energy used					
Electricity			17	17	
Gas			10	10	
Kerosine			28	28	
Others			55	55	55 others
Quantity of fuelwood used	<19	400	30	30	
	19-38	800	35	35	19-38kg
	38-57	1200	14	14	
	>57	1600	11	11	
Why do you use fuelwood?					
It's cheap			40	40	Its cheap
it's readily available			25	25	
It fulfills my large family size			35	35	
How long have you been a user of fuelwood (years)					
<1			12	12	
2-3			30	30	
4-6			20	20	
7-9			36	36	9 years
10 above					

Table 3 shows that majority of respondent demand fuelwood as source of energy because it's cheap. 25% agreed that they make used of fuelwood as household energy source because it's readily available while (35%) agreed that fuelwood can satisfy their large household energy demand. Most of the respondent about (36%) have been using fuelwood as source of energy for 7 – 10 years. Furthermore most of the fuelwood users agreed to have other alternative energy sources; electricity (10%), gas (15%), kerosene (25%).

3.4. Demand-Supply Gap of Fuelwood in Rural Area

Table 4: Test of Hypothesis 1 Statistical analysis of Demand – Supply gap for fuelwood in rural areas

Items	Mean	Std. deviation	Degree of freedom	t.cal	Remark
Quantity of fuelwood demand (kg)	19.0kg	9.5	4.9	0.67	Not significant
Quantity of fuelwood supplied kg	28.5kg	14	49		

Table 4 shows the results of statistical analysis of the demand/supply gap for fuelwood in rural area. The findings shows that a mean 19kg of fuelwood was demanded by households on daily basis while a mean 28.5kg of fuelwood supply on daily bases. The test of hypothesis of not significant difference in the demand to supply gap of fuelwood gave t-calculated value of 0.67 which indicates that there is no significant difference between fuelwood demand and supply. This finding implies that there is high demand for fuelwood in the rural areas investigated.

3.5. Analysis of Demand–Supply gap of Fuelwood in Urban Areas

Table 5 shows the result of statistical analysis of demand-supply gap for fuelwood in urban area. The result of the test hypothesis shows that there is significant difference ($p<0.05$) between fuelwood demand and supply in urban area. This result implies that there is low demand for fuelwood in urban area is low compare to supply in urban area. This finding can be attributed to the fact that households in urban area use less of fuelwood and more of kerosene and electricity. The implication of this result is that the demand of fuelwood in urban area is less likely to significantly and negatively affect neighbouring forests.

Table 5: Test of Hypothesis Statistical analysis of demand–supply gap for fuelwood in urban area

Items	Mean (kg)	Std. deviation	Degree of freedom	t.cal	Remarks
Quantity of fuelwood demand (kg)	9.8	8.5	49	34.6	Sig.
Quantity of fuelwood supplied kg	38.5	18	49		

3.6. Implications for Ethical Argument

There is widespread ethical argument that the goal of an economic system is to attain the dual objective of economic efficiency and welfare. It implies that aggregate income generated by the economic system and maximum welfare equally important.

If rural and urban dwellers in an economy, an equal purchase price for any given commodity would result in a greater sacrifice by the rural poor than the urban rich. In this case the urban rich is sacrificing less utility to purchase fuelwood than the rural poor. Thus the rural poor urgency of need for fuelwood must be greater than that of urban rich, since he is willing to sacrifice more utility (in terms of the foregone money income) to obtain an extra unit of fuelwood.

Household energy consumers are free to choose what energy source they wish to purchase out the energy sources that the government makes available. They are not able to tell the state via the price mechanism what energy sources should be produced or provided. The tenable ethical argument is that energy end-users are free to purchase the quantity of fuelwood they desire or can buy. Some sort of regulatory mechanism could be adopted by the government

3.7. Implications for Tax Governance

Environmental pollution has become a huge problem in many parts of Africa. Until a few years ago, the prevalent response of African governments was the introduction of command and control instruments. This trend has changed and some African countries are now turning their attention to the use of economic instruments including taxes. The response of African societies and governments to rising environmental pollution and resource problems has changed over the past decades (Kwashirai, 2013). Environmental impact is one of the major causes of tax and subsidy interactions between the government and firms. Eco-tax governance mechanisms could reverse fuelwood supply chains (Li et al. 2016b). The government sets the tax of the upstream impact. Government could also design tree seedling subsidy to promote the green effort of wood exploiters. Strict eco-tax legislation could reduce adverse environmental impact from fuelwood end-users' end (Li et al. 2018).

4. Conclusion

The study investigated environmental conscious supply and demand for fuelwood in rural and urban areas and implications for ethical argument and tax governance in Nigeria. The following conclusions were drawn:

Fuelwood supply is market-driven and has no restriction as to the entry and exit of participants. Rural dwellers were observed to consume more fuelwood than urban dwellers. Urban dwellers have many alternatives to fuelwood utilization and thus exert less pressure on the forest unlike rural dwellers that depend solely on fuelwood as source of household energy. If rural people are made to access alternative energy sources, quantity of fuelwood consumed by them and its effect on the forest and environment will be reduced drastically. The present study has extended our knowledge of the applications of the theories of demand, supply and tax governance in addressing the menace of fuelwood over exploitation and its adverse effect on the ecosystem.

Based on the research findings, the following recommendations were made;

i. Rural dwellers should be encouraged to make use of alternative household energy sources like urban dwellers. This will make them use less fuelwood.

ii. Eco-tax should be levied on fuelwood supply and demand to regulate its exploitation and consumption.

iii. There should be subsidy on tree seedlings and planting to replace tree felling as sustainable policy choice for setting the environment green.

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