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The utilization pattern and economic evaluation of fuelwood enterprise: A case study of some areas in Ibadan Metropolis, Oyo State

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Abstract

The problem of cooking fuel scarcity was exacerbated by increasing energy crisis in the world which makes conventional fuel derived from crude oil less affordable. Yet the current reserve potential of 80 million cubic metres of fuelwood per year in Nigeria is still underutilized.This study therefore evaluated the profitability and factors influencing fuelwood profitability among marketers in the study area. Oja'ba, Mapo - Beere, Ayeye, Orita – merin and Opo-oyiosa were purposely selected for this study while a total of 100 households were used for the study. Both Descriptive and quantitative techniques were employed in the analysis of the data gathered through questionnaire administration. The result showed that majority of households used fuel wood for cooking purposes and that the marketing of this product is highly profitable. A total of N718, 500.00 is realized as total revenue while a total cost of ₦177, 700.00 is incurred per year in fuel wood marketing. Labour cost accounted for the highest percentage (42.2%) followed by cost price of the log of fuel wood itself (37.2%) and then transport expenses (10.69%) of the total cost. The total variable cost constituted 95% while the fixed cost constituted 5% of the total cost. The enterprise had an average net income of ₦540, 800.00 per year. The average Profitability Index for all farms was 0.75, indicating that out of every ₦10 earned; about ₦7.5 accrue to the marketer as profit after accounting for all cost. Also, an RRI of 304% revealed that a marketer earns ₦304 profit on every naira spent on fuel wood business while the RRVC of 397.28% indicates that every ₦1 cost incurred on variable inputs generates about ₦397. Moreover, the OR of 0.23 indicates that every ₦10 spent on total variable cost yields ₦2.30 as total revenue. Since the marketing of fuel wood holds a great potential for income generation as it was found to be a very profitable business, the study therefore recommends that unemployed youths can be trained on the rudiments of sustainable harvesting and marketing of fuel wood products as a way of alleviating poverty in areas where forest is very dense and under-utilized, thereby easing the burden of unemployment without necessarily resulting into deforestation in Nigeria. Also government policy on promoting family planning and entrepreneurial education to the citizens in an informal setting is hereby canvassed.

Keywords

Fuel Wood, Utilization, Supply, Profitability and Ibadan Metropolis

1. Introduction

The burning of wood is currently the largest use of energy derived from a solid fuel biomass. Fuel wood can be used for cooking and heating, and occasionally for fueling steam engines and steam turbines that generate electricity. Fuel wood may be available as firewood, charcoal, chips, sheets, pellets, and sawdust. The most important sources of fuel, which are the necessities for mankind, are fuel wood (charcoal and firewood), petroleum and peat. Of these, wood makes an outstanding fuel as it is 99% flammable if completely dry (Hill, 1952; Kochhar, 1998). The particular

form used depends upon factors such as source, quantity, quality and application. Sawmill waste and construction industry by products also includes various forms of lumber tailings. Although the use of fuel wood has been hitherto considered as injurious for the environment, it is has however been discovered that proper production techniques that uses wood heat as against carbon producing fuels in the production of firewood has a positive impact on the carbon footprints (Source).

The forest has been a source of many human needs. The rural population traditionally relies on the forest for various food products and fuel wood (NTFPs), both for own consumption and for sales to the urban sector. Chukwu (2001) observed that over 70 percent of the total population of Nigeria relies on fuel wood or charcoal as their major source of energy for cooking and heating purposes. Also, half of the nation's energy consumed by agriculture and other domestic food processing came from fuel wood (Onyema, 2010), Furthermore a recent study put the Nigeria's consumption of fuel wood energy at 87 percent with the household sector accounting for 15 to 25 percent of primary energy use in developed countries (The Solar Cooking Archive, 2011) it is therefore clear that fuel wood is very critical as an household source of energy.

The recent energy crisis in the world which makes conventional fuel derived from crude oil less affordable exacerbated cooking fuel scarcity. While the fossil-fuel crisis affected the households in developed countries, the firewood crisis was said to be affecting households in developing countries. This manifested itself as a severe shortage of firewood, the main cooking and heating fuel used by such households (Arnold *et al*., 2003). It is therefore worrisome to observe that the current reserve potential of 80 million m^3 of fuel wood per year in Nigeria, is still underutilized (CREDC, 2008). Increasing demand for fuel wood in urban areas and rural areas of Nigeria has thus created new business opportunities that is capable of reducing poverty among the rural dwellers who have access to the Savannah and forest vegetation of Nigeria where fuel wood are mostly found (Remedio, 2004) as marketing of fuel wood is very profitable (Ebe, 2006). Despite the significance of fuel wood in both rural and urban households in Nigeria, it is surprising to observe that not much research has been carried out to verify the determinants of its profitability. To this end, this study therefore seeks to determine the pattern of fuel wood utilization, its profitability and factors influencing fuel wood profitability in the study area.

2. Methodology

2.1. Area of Study

The study was carried out in Ibadan metropolis. Oja'ba, Mapo-Beere, Ayeye, Orita–merin and Opo-Oyiosa were purposively selected because the inhabitants of these areas are low income earners with a very low living profile where the houses lack basic amenities such as toilets, kitchen, water and electricity supply (Source). Therefore fuel wood usage and marketing is common in areas. These areas can be considered as typical traditional areas of Ibadan metropolis, where the highest concentration of the indigenous population resides. The inhabitants are mainly artisans, petty traders, drivers, self-employed individuals with low level of educational status.

2.2. Method of Data Collection

The multistage random sampling method was used in collecting data used for the subsequent analysis. A purposive selection was used to select the core traditional areas of Ibadan metropolis in the first stage. At the second stage, five contiguous compounds were randomly selected out of which 20 households were also randomly at the third stage to give a total of 100 respondents used for this study. Questionnaires were personally administered on both fuel wood users and marketers.

2.3. Method of Data Analysis

Descriptive statistics such as frequency distribution and percentages were used to present the utilization pattern of fuel wood. Also cost and return associated with fuel wood marketing was captured using the gross margin and profitability (Π) analysis. Profitability ratio such as profitability index (PI), rate of return on investment (RRI), rate of return on variable cost (RRVC) as well as the operating ratio (OR) were used in determining the profitability of fuel wood marketing. The ordinary least square regression was further employed to determine the factors influencing the profitability of fuel wood in the study area.

Details of the various analytical formula as follows:

$$GM = TR - TVC \quad (1)$$

$$\Pi = \mathrm{GM} - \mathrm{TC}\ (\mathrm{TVC} + \mathrm{TFC}) \quad (2)$$

$$PI = \frac{\Pi}{TR} \quad (3)$$

$$RRI = \left(\frac{\Pi}{TC}\right) X100 \quad (4)$$

$$RRVC = \left(\frac{TR-TFC}{TVC}\right) X100 \quad (5)$$

$$OR = \frac{TVC}{TR} \quad (6)$$

Where, GM = Gross Margin, Π = Profit, TR = Total Revenue, TVC = Total Variable Cost, TFC= Total Fixed Cost, TC= Total cost, TR = Total revenue, PI= Profitability index, Π=Profit, rate of return on investment (RRI), rate of return on variable cost (RRVC) as well as the operating ratio (OR).

The regression analysis helps one to understand how the typical value of the dependent variable (or 'Criterion Variable') changes when any one of the independent variables is varied, while the other independent variables are held fixed. The implicit form used in this study is

$Y = f(x_{1,}x_{2,}x_3 \ldots\ldots\ldots\ldots x_{8,} + e)$ while the linearized

form is

$$Y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 \ldots\ldots\ldots\ldots b_8x_8)$$

Where Y = Profitability Index (PI) of fuel wood enterprise.
x_1= Years of formal education
x_2= Transportation cost in Naira (₦),
x_3= Household size
x_4 = Years of business experience
x_5 = Labour Cost/annum (₦)
x_6 = Other Energy Substitutes (₦)
x_7= Distance to the forest (Km)
x_8 = Marketing Cost
b_0 is the intercept while $b_1 \ldots b_8$ are parameters associated with the independent variables earlier defined.

3. Results and Discussion

This study seeks to establish the utilization pattern, profitability and factors influencing the profitability of fuel wood marketing. The following sections therefore give the result of the various analyses in pursuit of these objectives.

Table 1. *Distribution of Users and Non-Users by Fuel Types*

Energy Type	Number	Percentage Users	Number	Percentage Non-Users
Fuel wood/any other	96	96.0	10	10.0
Fuel wood/Kerosene	45	40.0	5	5.0
Fuel wood /Charcoal	50	50.0	17	17.0
Fuel wood /Gas	01	1.0	89	89.0
Fuel wood/ Electricity	13	13.0	79	79.0

Source: Computed from Field Data, 2013

Table 1 gives the distribution of various combination of preferred energy source used by households. Virtually every sampled household (96%) uses fuel wood in combination with any other energy source. This is closely followed by fuel wood and charcoal (50%) and then fuel wood/kerosene (45%)/ while fuel wood and gas (liquefied natural gas) is the least (1%) combination used by the respondents. The majority (96%) of the households stated that fuel wood is readily available, conservable, easy to use and less risky when compared with most other energy types. They further claimed that it is manageable and cost effective unlike other energy types that may require additional facility (e.g. stove or burner, gas cylinder etc) as accessories before they could be put into use. They however affirmed that fuel wood has its own disadvantages most especially its tendency to blacken the cooking utensils and ability to generate smoke. When asked to weigh the advantages against the disadvantages, the respondents still prefer fuel wood to other energy types as its advantages outweigh the disadvantages. Some of the respondents (45%) used kerosene as catalyst to enhance burning ferocity of the fuel wood and mostly to lighten their houses (Hurricane Lamps). Virtually all the sampled respondents however showed apathy to the use of gas claiming that it is very dangerous, requires some technicality and expensive considering the fact that most of these respondents were low income earners, illiterate or semi-literate. As for electricity, few respondents opted for it due to its initial capital requirement for installation, irregularity in supply and high cost of charges associated with it.

3.1. Utilization Pattern of Fuel Wood in Ibadan Households

Table 2. *Utilization Pattern of fuel wood*

	Uses of fuel wood	Frequency	Percentage
1	Cooking	60	60.00
2	Drying/Preservation	21	21.00
3	Ironing	5	5.00
4	Heating	14	14.00
	Total	100	100

Source: Computed from Field Data, 2013

Table 2 gives the frequencies and percentages of the various uses of fuel wood in the study area. The results indicated that fuel wood is utilized mainly for cooking (60%) corroborating the earlier claim of Chukwu (2001) that over 70 percent of the total population of Nigeria relies on fuel wood or charcoal as their major source of energy for cooking and heating purposes. The Table further revealed that drying/preservation (21%) is the next major activity fuel wood is used for followed by heating (14%). It is not surprising that about one third (21%) of the consumers of fuel wood in the metropolis used fuel wood for drying and preservation as Oyo State is one of the major producers of fish, cassava products (such as garri) and other food products which require preservation and drying.

3.2. Profitability Analysis of Fuel Wood

Table 3. *Cost and Revenue Analysis fuel wood marketing.*

Items Revenue	Amount (₦)	Amount (₦)	Share of Total cost (%)
Annual Sales	718,500		
Total Revenue (TR)		718,500.00	
Costs			
Cost of fuel wood logs	65700		37.2
Transportation	19000		10.6
Cost of discharge	8500		4.8
Splitting of log	75250		42.2
Total Variable Cost (TVC)	168450		94.8
Gross Margin GM (TR - VC)		550,050.00	
Fixed Costs:			
Cost of Rent / annum	7500		4.2
Depreciation on Barrow	750		0.4
Depreciation on axe	500		0.2
Depreciation on matchet	500		0.2
Total Fixed Cost (TFC)	9250		5.2
Total cost TC (TFC+TVC)	177000		
Profit P (GM-TC))	540,800.00		

Source: Computed from Field Data, 2013

The result of the cost-return analysis is as presented in Table 3. The average revenue per annum obtained by fuel wood sellers/farmers in the study area is ₦718, 500.00 while a total cost of ₦177, 700.00 is incurred per year in the enterprise. Labour cost accounted for the highest percentage (42.2%) followed by cost price of the fuel wood itself (37.2%) and then transport expenses (10.69%) of the total cost. The total variable cost constituted 95% while the fixed cost constituted 5% of the total cost. The enterprise had an average net income of ₦540, 800.00 per year.

To further ascertain the profitability of fuel wood marketing, the following profitability ratios were computed. They include Profitability Index (PI), Rate of returns on Investment (RRI), Rate of Returns on Variable Cost (RRVC) and Operating Ratio (OR). The result is as shown in Table 4.

Table 4. *Profitability Ratio Estimates of Fuel wood enterprise.*

Profitability Ratio	Estimates
Profitability Index (PI)	0.75
Rate of Return on Investment (RRI)	304.3
Rate of Return on Variable Costs (RRVC)	397.28
Operating Ratio (OR)	0.23

Source: Computed from Field Data, 2013

The average PI for all farms was 0.75, indicating that out of every ₦10 earned; about ₦7.5 accrue to the marketer as profit after accounting for all cost. Also, with an RRI of 304%, a marketer earns ₦304 profit on every naira spent on fuel wood business while the RRVC of 397.28% indicates that every ₦1 cost incurred on variable inputs generates about ₦397. Moreover, the OR of 0.23 indicates that every ₦10 spent on total variable cost yields ₦2.30 as total revenue. It can therefore be concluded that fuel wood business in the area is very profitable. During the field survey, the marketers also expressed a high level of satisfaction with the profit level of the business.

3.3. Factors Influencing Profitability of Fuelwood Enterprise in Ibadan Metropolis

The influence of various factors on the profitability of fuel wood marketing was captured by the ordinary least square regression model. The overall goodness of fit (F-value) showed that the model is significant at 1% and that all the co-efficient estimated by the model are not all equal to zero. The adjusted R-squared value of 0.35 indicates that about 35 percent of the variation in the profitability index of fuel wood marketing was brought about by variation in the explanatory variables used in the model.

The coefficient of the household size was negative and significant at 10 percent. This negative relationship implies that the larger the household size, the lesser the profitability of such household in the business. It is therefore against a-priori expectation that large household size will provide necessary labor for the enterprise, such abundant labor is however inefficient in terms of profitability. This may not be unconnected with the tediousness of the log splitting which household members may not be able to efficiently handle. Years of marketing were also significant with a negative influence on the profitability index. This may simply be due to the fact that the new entrants into the fuel-wood enterprise are more business minded and effective than the long term actors who sees the business as more of a hobby. The relevance of these two socio-economic factors in influencing profitability of fuel wood had earlier been established by Ebe (2006) and the supply theory in Samuelson and Nordhaus (2008) who noted that socio-economic variables such as educational attainment, age of suppliers, professional experience and government policy could influence the supply level of fuel wood positively.

The Marketing cost incurred during the cycle of the business was negative and significant; indicating that the higher the marketing cost the less profitable the business could be. This might be due to increased cost of transportation. This also corroborates the economic theory which held that the cost of doing business should be minimized as much as possible to enhance high profitability (Samuelson and Nordhaus, 2008). While the fixed cost involved in starting off the business has positive coefficient in relation to the profitability index, it is however not significant. The other variables (education of the entrepreneur, labor cost, alternative energy source and distance to the forest) were also not significant but with a negative relationship to the profitability index.

All these variables that were not significant are of no policy value in respect of influencing the profitability of fuel wood enterprises in the study area. Therefore, it is valid and of importance to note that whether the residence of an entrepreneur is close to forest or not is not a factor for profitability but rather having the right business approach in such a way as to reduce the cost of doing business (marketing cost).

4. Conclusion and Recommendations

The major conclusions of this study are that fuel wood is used by majority of households for cooking purposes and that the marketing of this product is highly profitable. The mode of utilization of fuel wood in the study areas largely depends on the socio-economic characteristics of the sampled households. Most of the respondents are semi-literates, self-employed, artisans and low income earners which made it difficult for them to be able to shift over or adopt the modern technology with respect to household's energy consumption and substitution. Price of other fuel types and their accompanied accessories also made the utilization pattern of these energy substitutes to be skewed towards fuel wood and consequently increased its demand and supply in the study area. Therefore, the demand for firewood, including from woodland species, should be reduced by encouraging the use of alternative fuel sources, such as plantation timbers and manufactured fuels. Since the marketing of fuel wood holds a great potential for income generation as it was found to be a very profitable business, unemployed youths can be trained

on the rudiments of sustainable harvesting and marketing of fuel wood products as a way of alleviating poverty in areas where forest is very dense and under-utilized, thereby easing the burden of unemployment without necessarily resulting into deforestation in Nigeria.

Table 5. *Regression Analysis of Factors Influencing Profitability of Fuel wood Enterprise*

Dependent Variable	**Profitability Index**	
Independent variables	**Coefficient**	**t-value**
Constant	1.0442	12.29
Education	-0 .0117	-0.65
Household Size	-0.0208*	-1.98
Year of Experience	-0.0301**	-2.28
Labour Cost	-9.67E-06	-1.48
Energy Substitutes	-0.0205	-1.52
Marketing Cost	3.0E-06***	-6.06
Fixed Cost	3.0E-05	1.00
Distance to forest	1.0442	-0.62
MODEL FIT TEST		
Number of observations	89	
F (8, 80)	6.94	
R-squared	0.4098	
Adjusted R-squared	0.3508	
Prob > F	(0.0000)***	

Source: Computed from Field Data, 2013
***------ Statistically significant at 1 percent (P<0.10)
**------ Statistically significant at 5 percent (P<0.05)
*------ Statistically significant at 10 percent (P<0.01)

The three policy driven factors that are very relevant and important in this study include household size, years of business experience and marketing cost. These factors had negative effect on profitability of fuel wood marketing and it is thereby consequently recommended that government policy on promoting family planning and entrepreneurial education to the citizens in an informal setting should be canvassed. This is imperative for the profitability of the business and poverty reduction as well as the sustainability and conservation of forest resource. Therefore, appropriate orientation and awareness should be given to people to replant tree whenever they cut one while the practice of agro-forestry practices to solve the problem of forest resource depletion and at the same time provide alternative income source for the people through sustainable farming systems should be encouraged.

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