ECONOMIC EFFICIENCY OF SMALL AND MEDIUM SCALE CASSAVA PROCESSING ENTERPRISES IN IMO STATE, NIGERIA

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ABSTRACT
This study examined the economic efficiency of small and medium scale cassava processing enterprises in Imo State, Nigeria. The study was based on primary data obtained in a cross sectional survey that involved 80 randomly selected small and medium scale cassava processing mills in Orlu and Owerri Agricultural Zones. The data was analysed by both descriptive and Stochastic Translog Profit Function Techniques. The study reveals that small and medium scale cassava processing enterprises were not efficient. The small scale enterprise was more efficient than the medium scale enterprise.. There were no significant differences in mean efficiency between the small and medium scale enterprises. Profit was influenced by labour, credit status, number of people employed and extension visit for small scale and number of people employed, credit status and labour for medium scale enterprises. Small and medium scale cassava processor should therefore focus more on ways of accessing credit while government should ensure more extension visits to the processors.

Key words; Economic Efficiency, Small and Medium Enterprise, Cassava Processing Enterprise, Nigeria, Agribusiness

INTRODUCTION

Cassava is one of the important sources of carbohydrate food in Nigeria. Nigeria is the largest producer of cassava in the world with total output currently put at about 34 million metric tonnes a year (FAO, 2002). Presently, cassava is primarily produced for food especially in the form of garri, tapioca and fufu for human consumption. But the crop can be processed into several secondary products for industrial market value (World Bank survey, 1981). These products include chips, pellets, flour adhesives, alcohol, and starch, which are vital raw materials in the livestock, fee, alcohol/ethanol, textile, confectionery, wood, food and soft drinks industries. They are also tradable in the international market.

Estimates of industrial cassava use suggest that approximately 16 percent of cassava root production was utilized as an industrial raw material in 2001in Nigeria 10 percent of which was used as chips in animal feed while 5 percent was processed into a syrup concentrate for soft drinks and about 1 percent was processed into high quality cassava flour used in biscuits and confectionary, dextrin pre-gelled starch for adhesives, starch and hydrolysates for pharmaceuticals, and seasonings (Kormawa and Akoroda, 2003). This estimate leaves 84 percent or 28.9 million tonnes of production for food consumption, a portion of this of course being lost in post harvest and waste. But, the methods used in achieving these are almost tedious which may lead to inefficient use of resources and perhaps low quality and quantity of products. These implies that for the product from cassava to compete favorably in the international market, there is need to go beyond tedious methods of processing which perhaps seem inefficient (Ogbonna, et al, 2007). The method used by small and medium scale cassava processing in Imo State seem to be tedious, may lead to inefficient use of technological inputs and low products. An efficient processing technique in food could lead to increase in the quality and quantity of food available for consumption (Nelson and Donald, 1980, Ogbonna and Ezedinma, 2005). According to IFC, (2003) the small and medium processing operations typically employ four to fifty or more workers. The need for innovative cassava processing technologies is enormous. Traditional cassava processing has a number of undesirable attributes. It is time consuming, provides low yields and lacks storages capacities. Many described it as drudgery.

Thus, this study aims at analyzing and compares the economic efficiency and its determinants in small and medium scale cassava processing enterprises in the area, with the general believe that smallholder cassava processing enterprises are more efficient than medium and large scale processing enterprises.

METHODOLOGY

The study was conducted in Orlu and Owerri agricultural zone of Imo State Nigeria. The area lies between latitude of 5.2^0N and 6.08^0N and longitude of 6.6^0E and 7.5^0E. The area has tropical climate characterized by high rainfall and temperature range of 15000mm – 20000mm and 34^0c – 37^Oc respectively. Agriculture is the major occupation

of people and the major arable crops cultivated in these areas include cassava, yam cocoyam, maize, pepper, and other vegetables. The plantation crops such as oil palms, coconuts, rubber, cocoa, plantain and bananas. Livestock reared in the zones include poultry, goat and sheep. A multistage sampling technique was adopted for the selection of respondents. Four Local Government Areas were purposively selected from the two zones and ten small and medium scale cassava processing mills each were purposively selected per LGA making a total 160 enterprises. Primary data was collected to capture such variables as capital, labour in man-days, transportation, water and petroleum used in processing and their prices. This was done by the use of well structured questionnaire. Data were analyzed using descriptive statistics such as frequencies, percentages, means and t-test
statistic.

Model Specification

The normalized translog profit function model was used to analyse the economic efficiency and the determinants in small and medium scale cassava processing enterprises. This can be specified as follows

$\prod^* = \prod/p = F^*_i (r_1;Z)$

Where

$\prod$ = normalized profit of the ith enterprise

r_1 = vector of variable input prices

Z = vector of fixed input prices

Alternatively, the above equation can be written in transcendental logarithmic form as stated below:

$In\prod_E = \beta_0 + \beta_1 Inr_1 + \beta_2 Inr_2 + \beta_3 Inr_3 + \beta_4 Inr_4 + \beta_5 Inr_5 + 0.5\beta_6 Inr_1^2 + 0.5\beta_7 Inr_2^2 + 0.5\beta_8 Inr_3^2 + 0.5\beta_9 Inr_4^2 + 0.5\beta_{10} Inr_5^2 + 0.5\beta_{11} Inr_1 Inr_2 + 0.5\beta_{12} Inr_1 Inr_3 + 0.5\beta_{13} Inr_1 Inr_4 + 0.5\beta_{14} Inr_1 Inr_5 + 0.5\beta_{15} Inr_2 Inr_3 + 0.5\beta_{16} Inr_2 Inr_4 + 0.5\beta_{17} Inr_2 Inr_5 + 0.5\beta_{18} Inr_3 Inr_4 + 0.5\beta_{19} Inr_3 Inr_5 + 0.5\beta_{20} Inr_4 Inr_5 + V_i - U_i$

Where:

$\prod_E$ = normalized profit in Naira per enterprise

r_1 = wage rate normalized by the price of output per enterprise

r_2 = price of other inputs normalized by the price of output per enterprise

r_3 = price of petroleum/fuel used normalized by the price of output per enterprise

r_4 = unit cost of transportation normalized by the price of output per enterprise

r_5 = capital inputs (interest rate) Naira

U_1 = error term under the control of the enterprise

V_1 = error term not under the control of the enterprises

β_0 = intercept

$\beta_1 - \beta_{20}$ = estimated coefficients

The economic inefficiency effects, U_i is defined by

Exp $(-U_i)]$ = Efficiency of the ith enterprise

Z_1 = Age of the enterprise (in years)

Z_2 = Labour (in Mondays)

Z_3 = Credit status (dummy variable; 1 = access, 0 = no access)

Z_4 = Business Experience (in years)

Z_5 = membership of cooperative society (dummy variable; 1 = member, o = non member)

Z_6 = Number of Employees

2_7 = Extension visit (number of times)

ε = Error terms

The βs and bs are scalar parameters that were estimated. To estimate the model and separate inefficiency (U_i) some assumptions about the distribution i. e v_i N (O, σ^2_v) while U_i has a half normal distribution i. e U_i = (O, σ^2_v). The estimates for all the paramenters of the stochastic frontier function and the inefficiency were simultaneously obtained, using the program frontier version 4.1 (Coelli, 1996). The enterprises were compared for the presence of economic inefficiency effects using generalized likelihood ration test which is defined as follows γ = -2 In [L $(H_0)/2(H_i)$]

Where L (H_0) is the value of the likelihood function for the frontier model, which the parameter restrictions specified by the null hypothesis, H_o, are imposed; H_1 is the value of the likelihood function for the general frontier model. The efficiency indices were compared using t-test as shown below

$$Tcal = \frac{X_1 - X_2}{\sqrt{\frac{S_1^2}{} + \frac{S_2^2}{}}}$$

n_1 n_2

Where:

X_1 = the mean economic efficiency indices of small scale cassava enterprise

X_2 = the mean economic efficiency indices of medium scale cassava enterprise

S_1^2 = the variance economic efficiency indices of small scale cassava processing enterprises

S_2^2 = the variance of economic efficiency indices of medium scale cassava processing enterprises

N_1 = the number of sampled small scale enterprises

N_2 = the number of sampled medium scale enterprises

RESULTS AND DISCUSSION

Features of the enterprises: The results in table I indicate that the majority (51.25%) of small scale cassava processing enterprises were within the age range of 1 – 10 years while 46.25% of medium scale cassava processing were within the age range of 11 – 20 years. About 37.56% of small scale cassava processing enterprise had between 6 – 10 years of business experience while 35% had between had between 11 -16 years experience for medium scale enterprise. The percentage of small scale cassava processing enterprise that employed between 1 and 10 people were 75% while medium scale enterprise that employed between 21 to 30 people were 50%.

Economic Efficiency Analysis: Table 2 depicts the maximum likelihood estimates of the profit frontier function. The variance and variance ratio are 0.398 and 0.108 respectively and are significant at 1 and 5 percent probability levels respectively. The significance of the total variance ($\sigma 2$) confirms the goodness of fit and the correctness in the specification of the assumption of the composed error terms distribution. The gamma (γ)which signifies the unexplained influence by the production function are the major sources of the random errors, indicates also that variation in small scale cassava processing is attributed to economic inefficiency. The coefficients of variables (wage rate, price of cassava tubers, price of petrol and of transportation) were significant at 1.0% level of probability, with wage rate and cassava tubers positively signed price of petrol and cost of transportation where negatively signed which conforms to a priori expectation. A 1.0% increase in wage rate and cassava tubers resulted in a 28.601% and 15.499% increase in profit of the enterprise. This gives an indication of the importance of wage rate and cassava tubers in the enterprise profit structure. Any increase in procurement of fuel and transportation would lead to decrease in profit by 2.104 and 14.034 percent (Emesowum, 2008 and Nwachukwu, 2006).

The results for medium scale cassava processing enterprise (Table 3) revealed that coefficients of wage rate, price of petrol and cost of transportation were statistically significant but negatively signed. The coefficient of wage rate is 48.475 indicating that 1% increase in price of labour would lead to 48.475% decrease in the profit of the enterprise. This result disagrees with Idiong, (2005). Obwona, (2000) who noted the positive impact of wage rate on profit structure of the enterprise. The coefficients of price of fuel and cost of transportation were significant at 5.0% and 1.0% probability level and negatively signed which agreed with a priori expectations. This implies more acquisition of fuel and transportation would decrease the profitability of the enterprise. The diagnostic statistics have coefficients that are highly significant at 1.0% level of probability. The coefficient for total variance (σ^2) is 0.211 indicating a good fit and the correctness of the distributional assumption specified, while variance ration 0.871. This would mean that 87.71% of the variation in profit among the medium scale cassava processing enterprises is due to economic inefficiency and not related to random variability. Small and medium cassava processing enterprises exhibited varied economic efficiency with a mean of 55.6 and 53% respectively, the maximum and the minimum economic efficiency were 89%, 85% and 11% and 9% respectively. This implies that small scale cassava enterprises are more efficient than medium enterprises (Emesowum, *et al* 2008).

Determinants of Economic Efficiency: There was presence of economically inefficiency effects in small and medium scale cassava processing enterprises in the study area confirmed by a test of hypothesis for the presence of inefficiency effects, using the generalized likelihood ratio test. The estimated results of determinants of economic efficiency in small scale cassava processing depicts that the coefficient for labour is negative and significant at 1.0% level. A one percent increase in labour of enterprises decreases the level of economic efficiency by 0.00007. The coefficients of access to credit and extension contact are positively signed and statistically significant at 1.0% and 10.0% respectively. This result agrees with Ajibefun, *et al* (2007), that extension agent frequently induces packages and information which stimulates the productivity of the enterprise and promotes their efficiency.

In medium cassava processing, the coefficient of labour and number of employees were positive and a significant at 5% and 1% signed. The result implies that any increase in the labour and number of employees, the lower the profit and economic efficiency of the enterprise. Coefficients of business experience and access to credit were 0.144 and 3.839 respectively. The implication is that the more experienced and access to credit an enterprise has, the higher the level of economic efficiency. This is consistent with Bravo-Ureta and Pinheiro (1997) who identified positive impact of experience on efficiency.

CONCLUSION

The results suggest that there was inefficiency among the small and medium scale mills sampled were economically inefficient but small scale enterprise is more efficient than medium scale enterprise. The average predicted economic efficiency was 55.6% and 53% respectively, implying that economic efficiency could be increased by 44.4% and 47%. The profit was influenced by labour, credit status, number of people employed and extension visit for small scale enterprise and number of people employed, credit status and labour for medium scale enterprise. There is need for more access to credit and extension visits on the small and medium scale cassava enterprise processors. Therefore, the processors should adopt cost reducing strategy known as vertical integration and indirect measures by private organization/s should support small and medium cassava processor with credit facilities to enhance its activities.

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Table 1: Distribution of small and medium scale agribusiness enterprises by Age, Business Experience, Number of Employees, Membership to cooperative organization and credit status

	Cassava processing Enterprises			
	Small		Medium	
Age of the Enterprise (year)	**Freq**	**%**	**Freq**	**%**
1-10	41	51.25	24	30
11-20	24	30	37	46.25
21-30	9	11.25	13	16.25
31-40	5	6.25	3	3.75
41.50	1	1.25	3	3.75
Total	80	100	80	100
Mean	13.29		15.26	
Business Experience (year)				
1-5	18	22.5	15	18.75
6-10	30	37.5	13	16.25
11-16	15	18.75	28	35
17-22	7	8.75	10	12.5
23-28	10	12.5	14	17.5
Total	80	100	80	100
Mean	12.21		13.95	
No of employees				
1-10	60	75	0	0
11-20	18	22.5	7	8.75
21-30	2	2.5	40	50
31-40	0	0	14	17.5
41-50	0	0	4	5
51-60	0	0	15	18.75
Total	80	100	80	100
Mean	8.98		39.24	

Table 2: Maximum likelihood estimates of the stochastic profit function model (Translog) for small scale cassava processing enterprises in Imo State

Production factors	Parameters	Coefficient	Standard error	t-value
Constant term	β_0	-41.476	0.993	-41.779***
Wage rate	β_1	28.601	0.911	31.390***
Price of cassava tubers	β_2	15.499	0.957	16.2001***
Price of petrol	β_3	-9.164	0.918	-9.988***
Unit of transportation	β_4	-14.034	0.900	-15.602***
Interest rate	β_5	-0.316	1.107	-0.310
Wage rate^2	β_6	1.999	0.881	2.270**
Price of cassava tuber^2	β_7	-14.940	0.927	16.124***
Price of petrol^2	β_8	-0.775	0.725	1.070
Unit cost of transportation^2	β_9	-0.896	0.484	-1.852*
Interest rate^2	β_{10}	0.111	2.384	4.633***
Wage rate x price cassava tubers	β_{11}	-2.930	0.836	-3.530***
Wage rate x price of petrol	β_{12}	-6.723	0.720	-9.341***
Wage cost x unit cost of transport	β_{13}	2.895	0.708	4.087***
Wage rate x interest rate	β_{14}	0.022	0.075	0.288
Price of cassava tubers x price of petrol	β_{15}	10.039	0.778	12.908***
Price of cassava tubers x unit cost of transport	β_{16}	0.564	0.711	0.793***
Price of cassava tuber x interest rate	β_{17}	-7.066	0.151	-0.469
Price of petrol x unit cost of Trans	β_{18}	-3.113	0.546	0.050
Price of petrol x interest rate	β_{19}	0.142	0.076	1.868*
Unit cost of transport x interest rate	β_{20}	-0.156	0.048	-3.477
Diagnostic statistics				
Log-likelihood function		-76.556		
Total variance	δ^2	0.398	0.058	6.813***
Variance ration	γ	0.108	0.012	9.053***
LR test		10.631		

Source: computed from frontier 4.1 MLE/survey data, 2008
,, are significant levels at 1.0%, 5% and 10% respectively.

Table 3: Maximum likelihood estimate of the stochastic profit function model (Translog) for medium scale cassava processing enterprises in Imo State

Production factors	Parameters	Coefficient	Standard error	t-value
Constant term	β_0	231.251	213.251	227.844***
Wage rate	β_1	-48.475	-48.475	14.234***
Price of cassava tubers	β_2	-3.353	-3.353	-0.657
Price of petrol	β_3	-5.174	-5.174	-2.305***
Unit of transportation	β_4	-9.531	-9531	-3.846***
Interest rate	β_5	0.321	0.321	-0.400
Wage rate^2	β_6	9.998	1.142	8.758***
Price of cassava tuber^2	β_7	-0.208	0.583	-.0356***
Price of petrol^2	β_8	-0.862	0.437	-1.973*
Unit cost of transportation^2	β_9	-0.189	0.287	-0.656
Interest rate^2	β_{10}	0.0.22	0.025	-0.946
Wage rate x price cassava tubers	β_{11}	-4.453	1.760	-2.531**
Wage rate x price of petrol	β_{12}	0.588	0.797	0.737
Wage cost x unit cost of transport	β_{13}	-0.039	0.523	0.074
Wage rate x interest rate	β_{14}	0.020	0.081	0.249
Price of cassava tubers x price of petrol	β_{15}	1.965	0.831	2.365**
Price of cassava tubers x unit cost of transport	β_{16}	2.949	0.867	3.401***
Price of cassava tuber x interest rate	β_{17}	0.033	0.137	-0.242
Price of petrol x unit cost of Trans	β_{18}	-0.344	0.563	0.612
Price of petrol x interest rate	β_{19}	0.009	0.051	0.168
Unit cost of transport x interest rate	β_{20}	-0.053	0.032	-1.659*
Diagnostic statistics				
Log-likelihood function		-77.511		
Total variance	δ^2	0.211	0.046	4.590***
Variance ration	γ	0.811	0.053	16.345***
LR test		16.081		

Source: computed from frontier 4.1 MLE/survey data, 2008
,, are significant levels at 1.0%, 5% and 10% respectively.

Table 4: Maximum likelihood estimates of the determinants of economic efficiency of small scale cassava processing enterprise.

Variable	Parameters	Coefficient	Standard error	t-value
Constant	Z_0	0.4664	0.318	1.467
Age of enterprise	Z_1	-0.007	0.022	0.244
Labour	Z_2	-0.002	0.000	-3.152***
Credit status	Z_3	0.067	0.020	3.308***
Business experience	Z_4	0.003	0.223	0.128
Membership to cooperative organization	Z_5	0.119	0.257	0.465
Number of employees	Z_6	0.0107	0.004	-3.012***
Extension visit	Z_7	0.0353	0.022	1.615*

Source: computed from frontier 4.1 MLE/survey data, 2008.
***, **, * are significant levels at 1.0%, 5% and 10% respectively.

Table 5: Maximum likelihood estimates of the determinants of economic efficiency of medium scale cassava processing enterprises

Variable	Parameters	Coefficient	Standard error	t-value
Constant	Z_0	7.070	2.07	3.415***
Age of enterprise	Z_1	-0.019	0.080	-0.232
Labour	Z_2	-0.000	0.000	-1.972*
Credit status	Z_3	3.839	1.504	-2.552**
Business experience	Z_4	0.144	0.024	6.075***
Membership to Cooperative organization	Z_5	0.158	0.201	0.789
Number of employees	Z_6	0.173	0.091	-1.897*
Extension visit	Z_7	0.034	0.028	-1.209

Source: computed from frontier 4.1 MLE/survey data, 2008.
***, **, * are significant levels at 1.0%, 5% and 10% respectively.