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Input Use Efficiency in Farm-Level Cassava Processing into Garri in Ivo LGA, of Ebonyi State, Nigeria

T. C. Nwaneri[1], J. A. Nwaneri[2]

[1]Federal College of Agriculture, Ishiagu, Ebonyi State, Nigeria
[2]National Root Crop Research Institute Umudike, Abia State, Nigeria

Email address:
nwanerithankgodc.@yahoo.com (T. C. Nwaneri)

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Abstract: In 2007, the input use efficiency in farm level cassava processing into garri in Ivo Local Government Area of Ebonyi State, Nigeria, was carried out. A random sampling technique was employed to select eighty cassava processors into garri. Scheduled interview was used to obtain cross sectional data. The quantity of cassava tubers processed by each garri producer, the inputs used and quantity of garri produced were extrapolated in metric tonnage for easy of analysis. Instrument of data descriptive statistical tools, production functional models, input use efficiency ratios and profitability ratios were used in data analysis. The result of the analysis shows that the average age of the cassava processors into garri was 52.10. Also 85% of the cassava processors are married and the average household size was 8. The average number of years in formal school was 10 and they had cassava farming occupation. The result further revealed that the farmers had 2.2 as their average farm size and 27.4 as the average garri production years of experience. From the survey, identifiable key resources include farm size, labour and other inputs as well as depreciated assets. The result indicated that the identified key resources (farm size, labour, other inputs, and depreciated assets) were inefficiently utilized by the garri producers, the enterprise however was profitable. The profit level could be increased if inefficiency in resource use is reduced through such measures as use of improved cassava varieties, improved processing equipment and facilities, and adult education and skill acquisition programmes.

Keywords: Input-Use, Efficiency, Profitability, Garri Production

1. Introduction

Cassava production has been estimated in Nigeria to be approximately 34 million tons and Comparing the output of various crops in Nigeria, cassava production ranked first (FAO, 2004). (FAO, 2004). Nigeria is presently the world's largest producer of cassava (Phillips et al, 2004). The North Central zone produced over 7 million tons of cassava a year thus ranking first on per capita basis at 0.72 tons/person in 2002 (PCU, 2003). Benue and Kogi in the North Central zone are the largest producers of cassava (IITA, 2004).

Ninety percent of cassava production in Nigeria is being consumed locally and efforts are being made to fully explore and exploit alternative uses of cassava products and by products in order to maximize the economic benefits and to diversify the nation's sources of foreign exchange earnings. The uses apart from garri production, include cassava flour, starch, chips, paper, pallets, adhesive, and a carrier for pharmaceuticals etc. Garri is the product of grated, dewatered, sieved and fried cassava granules (Anuebunwa et al, 2006, 2007). It is the most convenient food form from cassava that has higher market opportunities because of the ease of conversion into product. Garri is quite appealing to the working urban clan and rural consumers. It is an important staple food as well as major source of farm income among Ebonyi farm- household and features prominently in the internal food trade in the state (Anuebunwa, 2004, Anuebunwa et al, 2006, 2007). Achieving sustainable economic growth in Nigeria at large and Ebonyi State in particular, will confront three central challenges; alleviating wide spread poverty, meeting current and future food needs and efficiently using of the natural resource base to ensure sustainability. There are only two main ways to increase natural food availability; increase the land area planted; and increase the yield per unit of production resource (land, labour and capital). Efficiency of resource use can be defined as the ability to derive maximum output per unit of resource which is the key to effectively addressing the challenges of achieving food security and poverty alleviation.

Information on resource use in garri production in Ebonyi state, Nigeria, are relatively scanty. Hence there existed gaps in cassava tuber processing and development. This study was designed to fill this gap. The specific objectives of the study were to;

i. Examine socio-economic characteristics of the garri producers in Ivo LGA,
ii. Determine resource-use efficiency, process costs and economic returns in garri production in the study area,
iii. Determine the costs and returns in garri production in the study area,
iv. Determine the relationship between processing cost and per ton price differential between fresh cassava tubers and garri amongst producers in the study area.

2. Materials and Methods

This study was conducted in Ivo LGA of Ebonyi state, Nigeria in 2007.The area lies between Latitudes $5^{\circ}.43^{1}$ and $5^{\circ}.5^{1}$ north of the equator and Longitudes of $7^{\circ}.29^{1}$ and $7^{\circ}.35^{1}$ East of the Greenwich meridian. It has an annual rainfall range of about 1,200mm to 1,600mm and temperature range of $27^{\circ C}$ to $33^{\circ C}$. The local government area is made up of two autonomous communities; Ishiagu and Akaeze which comprises of total of 32 villages. Eight villages were randomly selected from the list of villages in Ivo LGA. Ten garri producing households were sampled from each of the eight villages and studied. Cross sectional data using scheduled interview were collected from the 80 garri producers in 2007. They processed cassava tubers using hydraulic press machines. The quantity of fresh cassava tubers produced by each producer, the resources used and quantity of garri produced with these were extrapolated to the tonnage measure for easy of analysis. Descriptive statistics, production functional models and gross margin analysis were used for the data analysis. Four functional forms of the production model were tried and expressed in explicit forms as follows:

Linear:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + e \quad (1)$$

Cobb Douglas (Double log):

$$LogY = b_0 + b_1logX_1 + b_2logX_2 + b_3logX_3 + b_4logX_4 + b_5logX_5 + b_6logX_6 + b_7logX_7 + b_8logX_8 + b_9logX_9 + e \quad (2)$$

Semi – log:

$$Y = b_0 + b_1logX_1 + b_2logX_2 + b_3logX_3 + b_4logX_4 + b_5logX_5 + b_6logX_6 + b_7logX_7 + b_8logX_8 + b_9logX_9 + e \quad (3)$$

Exponential:

$$LogY = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + e \quad (4)$$

Where

Y= Value of garri output (₦)
X_1 = Size of cassava farm (hectares)
X_2 = Labour used (Man-days)
X_3 = Value of other inputs used (₦)
X_4 = Value of depreciated assets (₦)
X_5 = Off Farm Income (₦)
X_6 = Age of garri producer (years)
X_7 = Household size (Number)
X_8 = Education (Number of years spent in formal school)
X_9 = Garri production experience (years)
e = Error term.
$B_0 \ldots b_9$ = Regression coefficients.

Ordinary Least Square (OLS) criteria were used for estimation. The lead equation was chosen on the basis of value of coefficients of multiple determination R^2 and conformity of coefficients of variables with a priori expectation of signs and statistical significance of the estimated repression parameters. The marginal analysis of production function was used to assess the resource use efficiency. This was done by obtaining the ratio of marginal value product to marginal factor cost or the unit price of the input. This is expressed as:

$$MVP_{xi} = P_{xi} \; or \; P_yC_i = P_{xi} \quad (5)$$

Where

MVP_{xi} = Marginal Value Product of the i^{th} input
P_{xi} = Unit input price or marginal factor cost of the i^{th} input
C_i =Marginal physical product of the i^{th} input = ∂У/∂x
P_y =Unit output price

Theoretically, an efficient utilization of resources will give a ratio equal to unity, a ratio greater than unity implies underutilization of resources while a ratio less than unity implies over utilization. Probability analysis was used to assess the performance of operators of the enterprise. The profit was determined as the difference between total production cost and the value of the total quantity of garri produced. The capital return estimated as the profit-cost ratio was estimated as quotient of value of total quantity of garri produced to total production cost. The relationship between processing cost and price estimated using simple correlation analysis of the two variables was expressed as:

$$P_{ctk} = b_0 + b_i(P_{rg}) + e \quad (6)$$

Where

P_{ctk} = Processing cost at time t in location k
P_{rg} = Price differential between fresh cassava tubers and garri at time t in location k
b_o = Constant Intercept
b_i = Coefficient
e = Error term.

The correlation coefficient(r) was used to measure the degree of association and the level of significant at 5% alpha level of probability.

3. Results and Discussions

Table 1 shows the socio – economic characteristics of garri producers in Ivo LGA of Ebonyi State, Nigeria. The mean age of the producers was 53years, dominated by married men and women (85%). The older the producer, the less his manual labour input. Age affects the working ability and rate of working (Anuebunwa, 2005). Age is known to affect the level of adoption of innovation (Henry et al, 1994). The older the producer, the less adoptive he becomes to innovation which negatively affects the efficiency of resource use. The garri producers at least completed primary school education. This indicated that they were amenable to changes in the production of garri within their enterprise. Education and experience in garri production were also important variables that significantly affected their resource-use efficiency. The level of education of a producer should be improved through adult learning and skill acquisition programs to enable them to improve on their input combination in order to attain optimality in resource use. This will help them increase output and maximize their profit. The study revealed that farmers' performance in their enterprise was economically viable and that the magnitude of their profit was a reflection of the degree of efficiency of resources use.

Household was the main source of labour used in processing and the average household size was 7. A farm family with a large household was expected to process more cassava tubers than a household of smaller size. The mean number of years of experience in garri production was 27 years. The number of years a producer spent in garri production is an indication of the practical knowledge acquired (Nwaru, 1993, 2000). Olomola (1988) opined that farmers will count more on their educational attainment, however, it is expected that the experiences acquired over the years will increase efficiency in resource usage. The results (Table 1) indicated that larger number of the garri producers use combination of local and improved varieties of cassava. It was also obtained that producers who use improved cassava varieties for their garri processing were significantly smaller (15%). There is therefore a need to educate the producers on the need of using improved cassava varieties for their optimum production.

Table 1. *Socio – economic Characteristics of Garri producers in Ivo LGA of Ebonyi state.*

Characteristics	Characteristic factors
Marital status	
Married	85(%)
Single	15(%)
Respondent characteristics	
Mean household size (Number)	8
Mean age (years)	52.10
Mean number of years in formal school (years)	10
Farming characteristics	
Mean farm size cropped per unit (Hectare)	2.2
Mean garri production experience (years)	27.4
Farm input characteristics	
Improved varieties (%)	15
Local varieties (%)	25
Mixture of local and improved varieties (%)	60

Source: Field survey, 2007

Table 2 shows the result of multiple regression analysis for the garri producers. The linear, exponential, semi-logarrithm and Cob-Douglas functional forms were tried with data on the production function.

Table 2. *Multiple Regression Estimates for Garri producers, in Ivo LGA of Ebonyi state.*

Variable	Linear	Semi-Log	Exponential	Cobb-Douglas
Constant term	-448.339	7.620***	-67441.059	-1.391
	(-0.053)	(14.232)	(-1.075)	(-0.418)
X_1= size of farm	-5438.532	-0.633**	-3388.367	-0.442**
	(-1.119)	(-2.058)	(-0.838)	(-2.063)
X_2= Labour	103.04***	0.003114***	20984.096***	0.843***
	(6.661)	(3.184)	(4.488)	(3.403)
X_3= Input	0.08005	0.00001092	2567.096	0.409**
	(0.645)	(1.392)	(0.785)	(2.357)
X_4= Assets	0.09102	0.0000109**	-1098.304	0.08824**
	(1.349)	(2.553)	(-0.560)	(2.005)
X_5 = Off farm income	-0.02774	0.0000077	-977.881*	-0.217
	(-0.175)	(0.765)	(-0.169)	(-0.540)
X_6= Age	-20.636	0.001404	-7861.197	-0.217
	(-0.384)	(0.413)	(-1.038)	(-0.540)
X_7= HHS	199.621	0.007805	6328.273	1.166***
	(0.214)	(0.132)	(0.784)	(2.724)
X_8 = Education	841.589*	0.005916	9859.250	0.558**
	(1.728)	(0.192)	(1.549)	(2.354)
X_9= Experience	-245.793	0.02290	-6718.846	0.306
	(-0.820)	(1.209)	(-1.164)	(0.999)
R^2 Value	0.486	0.327	0.374	0.405
R^2 Adjusted	0.419	0.241	0.282	0.317
F. ratio	7.342***	3.782***	4.049***	4.608***

Source: Field Survey, 2007.

Dependent variable = Value of garri output
Figures in parenthesis are t-ratios
R^2 = 40.5%, F = 4.608
* = Significant at 10.0%
** = Significant at 5.0%
*** = Significant at 1.0%

The Cobb – Douglas functional form gave the best fit and was chosen as the lead equation, the choice based on conformity of estimates with the a prior expectation of their signs and statistical significance as well as on having the highest value of coefficient of multiple regression R^2. The estimated Cobb-Douglas mode is specified as:

$$Log\ Y = -1.391 - 0.442 log X_1 + 0.843 log X_2 + 0.409 log X_3 + 8.824 log X_4 + 4.597 log X_5 - 0.217 log X_6 + 1.166 log X_7 + 0.558\ log X_8 + 0.306 log X_9 \quad - 0.418$$

Table 2 shows that the constant term was -1.391 with standard error -0.418. The overall coefficient of determination (R^2) with 80 observations was found to be 0.405. This implies that about 40.5% of the total variation in garri output was experienced by the variables indicated in the models. Regression coefficients of labour and size of households were statistically significant at 1% alpha level of probability. Labour and households size have regression coefficient of 0.843 and 1.66 respectively. This implies that by increasing the total labour force and household size by 1% each will lead to 0.843% and 1.66% increase in value of garri output respectively. The regression coefficient for education (0.558) was statistically significant at 5% implying that by increasing cassava producers level of education by 5% will to 0.588% increase in value of garri output. This probably because, the more educated the producer is, the higher he accepts new innovations or technologies. The size of cassava farms had a negative regression coefficient (-0.442) and was significant at 5% alpha level of. This implies that the size of cassava farms has a negative effect on the value of garri output.

Table 3. *Marginal Analysis to Determine Efficiency of inputs Used.*

Resource	Marginal Physical Product (MPP)	Marginal Value Product (MVP)	Marginal Factor Cost (MFC)	Marginal Efficiency Index (MVP/ MFC)
Cassava farmlands(ha)=(X1)	-6025.39	-241015.6	2753	-87.547
Labour = (X2)	144.82	5792.8	600	9.655
Other inputs = (X3)	0.318	12.72	1.03	12.350
Implements = (X4)	3.803	152.2	1.03	147.767

Source: Field Survey 2007

Table 3 shows the marginal analysis and efficiencies of the inputs used in the production of garri. From the lead equation, (Cobb–Douglas function), all the identification key resources indicated inefficiency in their utilizations. The cassava farmlands were over utilized, while labour, implements and other inputs, were under-utilized.

Table 4. *Costs and Returns Analysis for Garri production in Ivo LGA of Ebonyi State.*

Items of Cost	Average Cost (₦)	Percentage of Processing Cost (%)	Percentage of Production Cost (%)
Cassava tubers & handling Cost: One metric ton (MT)	8,000	?	50.45
Transportation, assemblage, loading & offloading one MT	610	?	3.85
Processing Cost/ MT			
Peeling, washing & bagging	892	12.31	5.62
Grating and dewatering	1490	20.56	9.40
Transportation	445	6.14	2.81
Fuel wood	820	11.31	5.17
Sieving and frying	3246	44.78	20.47
Bagging materials	300	4.14	1.89
Depreciation for equipment*	55	0.76	0.34
Total processing Cost	7,248	100.00	
Total garri production cost	15,858		100
Revenue items:			
Quantity of garri produced 226kg at ₦80	18,080		
Profit	2,222		
Return on Capital (%)	14.01		
Product – Cost ratio	1.14:1		

Source: Field Survey 2007

Table 4 shows the distribution of cost components in processing cost of one metric ton of fresh cassava tubers was

₦7, 248. About 45.7% of the total garri production cost (₦15, 858) was accounted for. The mean quantity of garri produced from one metric ton of fresh cassava tuber was 226kg. This implies a conversion rate of 22.6%. The high processing cost may have little or no relationship between the per ton price differentials of fresh cassava tubers and garri.

The conversion rates are known to vary with variety, time of harvesting, age of plant, location (soil type) and other environmental factors (Anuebunwa, 2005, 2009). By implication 4.425 metric tons of fresh cassava tuber was required to produce one valued at ₦18, 080. This gave a wait profit of ₦2, 22 and return on Capital of 14.01% and a product – cost ratio of 1.14:1. The study revealed that the enterprise was economically viable one. The size of the profit reflects the degree of efficiency in resource use in garri production.

4. Conclusions

The input – use efficiency and profitability production of garri was studied in Ivo LGA of Ebonyi State. The study showed that all the inputs used in garri production were inefficiently utilized and so economic policies and programmes that will encourage the reallocation and redistribution of cassava processing inputs for increased garri productivity should be put in place. The study also showed that variables associated to the garri producers had influence in their resource – use efficiency. Labour resource was the most important and featured prominently at the peeling, washing, sieving of de-watered lumps and in frying activities of garri production. This resource was under-utilized meaning that improve efficiency of resources will reduce drudgery, attract new entrants into the enterprise and improve production efficiency and profit.

Government should put in place appropriate policies that would enable people to take up garri production confidently as a means of livelihood. Efforts should be concerted more by cassava farmers towards adopting more cassava varieties known to have high 'garrification' quality since improved cassava varieties are known to have high quality 'garrification' than the local varieties. Policies and programs that will enable garri producers to have access to new innovation and new technologies should be initiated by government. This implies putting in more research efforts in cassava breeding and improving extension delivery system.

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