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Investigation of the profit efficiency of garri processors in Rivers State, Nigeria

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ABSTRACT

Aim: The aim of this study was to investigate profit efficiency of *garri* processors in Rivers state, Nigeria.
Materials and Methods: A purposive sampling procedure and snow balling techniques were used to select 120 respondents for this study. The study utilized primary source of data collected with the aid of structures questionnaire, and the collected data were analyzed using descriptive statistics such as mean, frequency and percentage, and inferential statistics such as Stochastic (profit function) frontier model.
Results: The results revealed that more than 75% of the garri processors in Rivers State were female. The mean age of the sampled garri processors were 45.5 years, with average years in formal education, and experience in garri processing of 9.9 years and 19.8 years respectively. Majority of the garri processors does not have any extension contact, and are not a member of any association. Likewise, the results revealed that the sampled garri processors were 37% profit efficient.
Conclusion: It was concluded that cost of cassava roots; cost of grating/milling of the cassava; cost of hiring equipment used in garri processing; and cost of transportation were the factors that negatively affected the total profit made by the garri processors in Rivers State.

Keywords: Efficiency of garri processors; stochastic frontier model; profitability; rivers state.

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Introduction

Cassava (*Manihotesculenta*), is resistant to drought, and mostly grown in dry areas (Adesope *et al.,* 2020). Cassava is widely cultivated in Nigeria and contributes greatly to the nutrition and livelihood of the poor resource small holder farmers who predominated the sector (Adesope *et al.,* 2020). Nigeria is among the largest producers of cassava and cassava products in Africa (Philip *et al.,* 2004; AfDB, 2015; Elo-Oghene *et al.,* 2022), and it is considered as a basic food calories consumed in Africa (Elo-Oghene *et al.,* 2022). Cassava roots is said to contains 30 -40% dry matter and 25 – 30% starch, and contains nutrients such as potassium, calcium, iron, vitamin A, vitamin C, vitamin B-6, sodium, folic acid, and protein (Montagnac et al., 2009; Okuduwor et al., 2023).

Cassava has diverse uses and by-products. Traditionally, it is use as cassava flour, pounded cooked fermented cassava pastes known as fufu; granulated roasted cassava known as garri; starches; cooked fresh slice roots known as abacha; granulated cooked cassava (attieke); and drinks with cassava components (Aminu *et al.,* 2017). Cassava plays a major role in Nigeria's food security, in that more than 80% of poor Nigerians eat cassava and its by-products at least once in a day (Adesope *et al.,* 2020). Despite the roles plays by cassava in food security, its potentials have not been fully tapped due to its limitation.

One of the major limitation of cassava is the rapid deterioration of the root after post-harvest which often begins after 48 hours of its harvest, and the presence of cyanogenic compounds in cassava (Aminu *et al.,* 2017). Therefore, processing as a form of value addition appears to be the best method of preserving the cassava roots which are highly perishable, and removing the cyanogenic compounds in it. Processing of cassava is usually done in order to increase the

shelf life of the cassava and reduce post-harvest losses.One of the forms cassava is processed into is garri, cassava is mostly processed into garri in Rivers States, and in most cassava producing States in Nigeria (Aminu *et al.,* 2017; Elemasho *et al.,* 2023). To processed cassava into garri, the cassava roots must be first peeled, washed, grated into mash, dewatered, pulverized, sieved and finally roasted to produce the garri. These processes are mostly carried out by the women, and with the traditional technologies. Meanwhile, processing cassava using traditional methods is considered as tasking, time-consuming, ineffective and inefficient (Aminu *et al.,* 2017; Elemasho *et al.,* 2023). Cassava is processed into garri within a productioncycle that takes an average of five to seven days. Garri served as food for man, and livestock feeds. (Elo-Oghene *et al.,* 2022), and it is the most popular food product from cassava. It is consumed as processed or reconstituted with hot water to give a dough-like paste called "Eba", and it can be taken as snacks with cold water, milk, sugar and groundnut. Garri has become an essential food supply commodity in Nigeria, and some part of West Africa. This is evident in its high demand within Nigeria, coupled with its high price (Elo-Oghene *et al.,* 2022). The demand for garri has continue to increase in Nigeria despite its increased domestic production. Ozigbo *et al* (2020) reported that about 148 million people eat garri across the country, which made up of about 74% different tribes of people in Nigeria. Therefore, garri processing and marketing has a great potential of contributing immensely to economic empowerment and the development of the downstream component of the agribusiness sector in Nigeria (Elo-Oghene *et al*., 2022).

It is a known fact that cassava production and processing in Nigeria are mostly done in traditional methods by small holder farmers, and processors who dominated the area (AfDB, 2015; Elo-Oghene *et al.,* 2022). This often results into inefficiency in the system especially profit inefficiency due to economic losses encountered in using traditional methods in the processing sector. It is generally observed in Rivers State, that there is a very low level of investment in cassava processing. It showcases itself by the predominance of women who are resource poor in the cassava processing business. One noticeable problem of the business in Rivers State, is the lack of/ inadequate data on how the business works and who and who are involved in it. Thereby, limiting the ability of the business in attracting the necessary attentions of the private entrepreneurs, non-governmental organizations (NGOs), and governmental organizations in the sector. These have a negative consequences for the achievement of food security, reduction of poverty, and employment generation in Rivers State. It is evident that a lot of socio-economic factors affects the performance of the cassava processing business, and the efficiency of the system, especially profit efficiency. Even with this facts, most works that attempt to looked at the cassava processing ventures, concentrated on its value chain, post-harvest technological needs of garri processors, and the profitability of the business, (Ani *et al.,* 2019; Adesope *et al.,* 2020; Okuduwor *et al.,* 2023; Naziri *et al.,* 2014; Anyoha et al., 2023; Elemasho et al., 2023;), without given adequate attention to whether the garri processors are profit efficient or not. It is on these note that this study was designed to assess the profit efficiency of the garri processors in Rivers State. The main aim of this research work is to assess the profit efficiency of garri processors in Rivers State, Nigeria. While the specifics objectives were to describe the socio-economics profiles of garri processors in Rivers, State; Determine the profit efficiency level of the garri processors, and Identify the factors that influences profit efficiency of garri processors.

Materials and Methods

The study was carried out in Rivers State, Nigeria. The State is one of the major oil producing States in Nigeria, and it is made up of 10 different ethnic groups with the dominant ethnic groups as Ijaw, Ikwere, Khana, Kalahbari and Ogoni. The total population of the State is about 6.9 million people (Nigeria Poverty Map (NPM), 2022). The major crops produced in Rivers State are Maize, cassava, plantain, banana, and leafy vegetables.

A purposive sampling procedure and snow balling sampling techniques were employed to select the required respondents for this study. Firstly, three (3) Local Government Areas (LGAs) were purposively selected from the seven (7) LGAs into agricultural productions. The three selected LGAs are Abuoa/Odua, Eche, and Ikwere. The reason for their selection is the predominance of cassava production and garri processing in those areas. Secondly, two

communities each from the 3 Local Government Areas were purposively selected, giving a total of 6 communities. Lastly, snow ball sampling technique was used to select 20 garri processors from each of the selected communities to give a total of 120 garri processors selected for the study. The study made use of primary source of data collected with the aid of structured questionnaire. The collected data were analyzed using descriptive and inferential statistics. Thus, objectives were analyzed using descriptive statistics such as mean, frequency, percentage, and standard deviation. Objectives two and three were analyzed using Stochastic (profit function) frontier model.

Model Specification

Stochastic Frontier (Profit function) Model

Stochastic frontier (Profit function) model was used to determine the profit efficiency level of the garri processors and the factors that affect the profit efficiency of the garri processors. Cobb Douglas function is fitted into the stochastic frontier model and the empirical stochastic production model was expressed as;

$\ln Pi = \beta_0 + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \beta_4 \ln X_{4i} + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + v_i + u_i$ ……..(1)

Where:

ln = natural logarithm

P_i = Profit realized by garri processors (naira)

β_0 = Constant

β_1–β_7= parameters to be estimated

X_1 = Cost of cassava roots (Naira)

X_2 = Cost of peeling, and washing of the cassava Naira)

X_3 = Cost of grating /milling

X_3 = Cost of sieving and frying of the garri (Naira)

X_4= Cost of hiring the equipment used in garri processing (Naira)

X_5 = Cost of firewood (Naira)

X_6 = Cost of transportation of the garri to the market for sales (Naira)

The cost inefficiency effect is a non-negative with half normal distribution. It is assumed that it is truncated at zero and thus it is specified as;

$U_i = \theta_0 + \theta_1 \ln Z_{1i} + \theta_2 \ln Z_{2i} + \theta_3 \ln Z_{3i} + \theta_4 \ln Z_{4i} + \theta_5 \ln Z_{5i} + \theta_6 \ln Z_{6i} + \theta_7 \ln Z_{7i}$ …….. (2)

Where

U_i = profit inefficiency

θ_0= constant

θ_1–θ_6= parameters to be estimated

Z_1= age of the garri processors (years)

Z_2 = Experience in garri processing (years)

Z_3 = Education (years in formal education)

Z_4 = Household size (number of people)

Z_5 = quantity of cassava processed (kg)

Z_6 = cost of the cassava roots (years)

X_7 = Membership of organization (years)

Gross Margin Model

Gross margin model is expressed as follows:-

GM = TR – TVC…… (3)

Where:

GM = Gross margin,

TR = Total revenue made by the garri processor,

TVC = Total variable cost incurred by the garri processor.

Results and Discussion

Socio-economic characteristics of the garri processors in Rivers State

The results of the socio-economic characteristics of the garri processors in Rivers State were presented (Table 1). The variables in the analysis includes age of the garri processors, sex, educational level, household size, marital status, and experience in garri processing, membership of association and extension contact.

The results of the socio-economic variables in Table 1 revealed that 54.1% of the garri processors in Rivers State are within the age range of 41 - 60 years. While, 3.3% falls within the age range of 71 – 80. The mean age of the garri processors in Rivers State were 45.5 years. This showed that majority of the garri processors in Rivers State are within their productive age. it was in line with Okuduwor *et al* (2023). Furthermore, the results revealed that majority (78.3%) of the garri processors in Rivers State were female. While, minority (21.7%) were male. It implied that women are more into garri processing in Rivers State than their male counterpart. This validates the statement made by Muhammad-Lawal *et al*. (2012). Education influences the decision making process, and also helps in the adoption of innovative ideals. The results (Table 1) revealed that about 51.7% of the garri processors in Rivers State spent between 7 – 12 years in formal education, while 6.7% had no formal education. The average years spent in formal education by the garri processors in Rivers State were 9.9 years. This implied that the garri processors are literate enough to make a good decision. Household size is a vital socio-

economic variable in any agricultural operation. It has the ability of reducing the cost of labour by supplementing with family labour. It showed that 70.83% of the garri processors in Rivers State had family size of between 1 – 5 persons, while 8.33% had household size of between 11 – 15 persons (Table 1). The average household size of the garri processors in Rivers State were 8 persons. This implied that the garri processors in Rivers State have a good family labour for the processing operation. This is in line with Adesope *et al*. (2020). Majority (70.8%) of the sampled garri processors are married while only about 13.1% of them are single, while minority (4.2%) of them was widowed. Results (Table 1) revealed that 84.2% of the garri processors had between 1 – 30 years of experience in the garri processing business, while 1.6% had garri processing experience of above 45 years.

The mean years of experience in garri processing by the sampled garri processors were 19.8. It implied that garri processors in Rivers State are well experienced in the business. This validated the work of Aminu *et al.* (2017). Results revealed that only about 38.3% of the garri processors belonged to an association while about 61.7% were not a member of any association. This has a serious negative implication in providing support to the garri processors, and accessing loan from financial institutions. Also, extension is a vital variable because it is through extension that agricultural value chain actors are informed about new innovations in the agricultural operations. The results showed that about 13.3% of the garri processors had contact with the extension agents while about 87.7% were never visited by the extension agents.

Table 1. Socio-economic factors of the sampled garri processors (Source: Field Survey 2023)

Variables	Frequency	Percentage	Mean (Std Dev.)
Age (Years)			
21-30	15	12.5	
31-40	33	27.5	
41-50	31	25.8	**45.5 (11.73)**
51-60	34	28.3	
61-70	3	2.5	
71 -80	4	3.3	
Sex			
Female	94	78.3	
Male	26	21.7	
Years of formal Education			
0 years			
1 – 6	8	6.7	
7 – 12	40	33.3	**9.9 (3.52)**
13 - 18	62	51.7	
	10	8.3	
Household Size			
1-5	85	70.83	**8 (3.06)**
6 10	25	20.83	
11 - 15	10	8.33	
Marital Status			
Single	16	13.3	
Married	85	70.8	**(0.50)**
Widowed	5	4.2	
Divorced	14	11.7	
Years of Experience			
1-15	53	44.2	**19.8 (5.32)**
16 -30	48	40.0	
31 - 45	17	14.2	
46-60	2	1.6	
Membership of association			
Yes			
No	46	38.3	
	74	61.7	**(0.49)**
Extension contact			
Yes	**16**	**13.3**	
No	**104**	**86.7**	**(0.06)**

Table 2. Profitability of Garri Processors in Rivers State

Variables	Average quantity (kg)	Price (₦)	%TVC
Quantity of raw cassava processed in the study area	1338.84		
Cost of the cassava roots		24, 916.67	55.32
Cost of peeling, and washing of the cassava		4, 134.17	9.18
Cost of grating/milling		1600.41	3.55
Cost of sieving and frying of garri		5,169.30	11.48
Cost of hiring equipment used in garri processing.		1,535.42	3.41
Cost of firewood		5,000.10	11.10
Cost of transportation to the market for sales		2,687.08	5.97
Total Variable Cost (TVC)		**45,043.15**	**100**
Quantity of garri sold (Q)	128.37	433.16/kg	
Total Revenue (TR) = Q x Price		**55,604.75**	
Gross Margin (Total Revenue - Total variable cost)		**10,561.60**	

Source: Field Survey 2023.

Table 3. MLE estimates of stochastic frontier on factors of profit efficiency of the garri processors

Variables	Coefficients	Standard error	t-ratio
Cost of cassava roots	-0.9372	0.5140	-1.882*
Cost of peeling, and washing of cassava	0.2710	0.3741	0.724
Cost of grating/milling	-1.9181	0.7135	-2.689***
Cost of sieving and frying of garri	0.2302	0.3746	0.615
Cost of hiring equipment	-1.4416	0.5474	-2.63***
Cost of firewood	-0.1505	0.3484	-0.432
Cost of transportation	-0.8238	0.4518	-1.823*
constant	0.8166	2.6504	0.308
Inefficiency variables			
age	0.8776	1.0652	0.824
Experience in garri processing	-0.5831	0.3387	-1.722*
Education	-0.8042	0.2037	-3.947***
Household size	0.2717	0.3956	0.687
quantity of cassava	0.2906	1.0019	0.290
cost of cassava roots	0.5110	0.2989	1.709*
Membership of organization	1.5931	1.7654	0.902
Constant	6.5462	3.2233	2.0309**
sigma-squared	0.5601	0.2719	2.060**
gamma	0.9999	0.3768	2.654***
log likelihood function	-141.67		
LR test	45.91		

Source: Field Survey 2023.
Note ***,**, * is significant at 1%, 5% and 10% respectively.

Profitability of Garri processing in Rivers State

Gross Margin and Return on Investment were used to analyze the profitability of garri processing in Rivers State. The results of the findings were presented (Table 2).

The results (Table 2) revealed that the average quantity of cassava roots processed into garri in the study area by the sampled garri processors were 1338.84kg, and it costs about N24, 916.67 averagely to purchase this quantity of cassava roots, which accounted for 55.32% of the total variable cost. Likewise, the sieving and frying of garri and firewood costs about N 5,169.30, and N 5,000.10 respectively, and accounted for 11.48%, and 11.10% of the total variable cost respectively. The least cost incurred was cost of hiring equipment used in garri

processing (N 1,535.42), and it accounted for 3.41% of the total variable cost. The analysis also revealed that the total cost of processing 1338.84kg of cassava into garri in the study area was N 45,043.15, while the total quantity of garri gotten from the 1338.84kg of cassava roots was 128.37kg, which was sold at. N 433.16/kg to give total revenue of N 55,604.75. The results revealed that the Gross Margin in garri processing in Rivers State was N10,561.60. This showed that garri processing is profitable in the study area. These findings were in agreement with Aminu *et al.* (2017).

Profit Efficiency of the Garri Processors in Rivers State: The profit efficiency of the garri processors in Rivers State, and the factors influencing the profit efficiency were analyzed using the Stochastic (profit function) frontier model and presented (Table 3).

The results (Table 3) revealed that sigma-squared (σ2) estimate of 0. 56 which is significantly different from zero at 5% level indicates a goodness of fit and correctness of the distribution form assumed for the composite error term. The gamma estimate of 99% was significantly different from zero at 1% level of significant. This implied that 99% of the variation in profit obtained by the garri processors was as a result of profit inefficiencies of the garri processors. This also implies that 99% of discrepancies between observed profit and the frontier profit are due to profit inefficiency of the garri processors.

The result as presented (Table 3) revealed that cost of cassava roots, cost of grating/milling of the cassava, cost of hiring equipment used in garri processing, and cost of transportation were negative and statistically significant at 10%, 1%, 1% and 10% level of probability respectively. This indicates that they negatively determine the total profit made by the garri processors in Rivers State. Thus, an increase in these variables will lead to a decrease in the total profit made by the garri processors in Rivers State. The result showed that the coefficient of cost of cassava roots was negative and statistically significant at 10%, which implies that 1% increase in the cost of cassava root will decrease the total profit made by the garri processors by 0.94%. Also, the coefficient of the cost of grating/milling of the cassava was negative and statistically significant at 1% level of probability. This implied that 1% increase in the cost of grating/milling of the cassava will decrease the total profit by 1.92%. Likewise, the coefficient of the cost of the equipment used in garri processing was negative and statistically significant at 1% level of probability. This showed that a 1% increase in the cost of the equipment, will decrease the total profit made by garri processors by 1.4%. In line with *aprior* expectation, the coefficient of transportation cost was negative and statistically significant at 10% level of probability. This implies that a unit increase in this variable will decrease the total profit made by the garri processors by 0.82 unit. The possible explanation could be that all these charges were not put into consideration before the final market price for the garri was set by the garri processors. This finding is in line with the work of Bamigboye, Sodiq, Oluwasusi and Williams (2018) on profit efficiency of goat marketing.

The Stochastic Frontier Maximum Likelihood (ML) Estimate of Profit Inefficiency Model: The Maximum Likelihood (ML) estimate of profit inefficiency model of the garri processors in Rivers State were presented (Table 3). Socio-economic variables were considered and estimated in the model as the likely factors influencing the profit inefficiency of the garri processors in Rivers State. The results as presented (Table 3) revealed that the coefficient of years of experiences in garri processing by the garri processors in Rivers State was negative and statistically significant at 10% level of probability. Thus implying that a year increase in the number of years of experiences of the garri processors will increase the profit made by the garri processors by 0.58%, and decreases the profit inefficiency of the garri processors by 0.58 unit. This could be because of the adequate knowledge of the modality, nature and timing of the business due to long duration in the business. These findings were in line with the work of Oladimeji *et al*. (2017) on profit efficiency of Broiler Production. Likewise, education was significant (1%) and negatively related to profit inefficiency of the garri processors in Rivers State. This implies that the profit made by garri processors from the sales of their garri, depended on the level of education acquired by the garri processors. The results showed that a year increase in the level of education will decrease profit inefficiency of the garri processors, and increases their total profit made from garri salesby 0.8%, and this is in line with the *a priori* expectation. This could be because the literate

garri processors were expected to be more innovative because of their ability to get information more quickly and their ability to take more risk. These were in line with the work of Hamidu (2015) on profit efficiency of sheep production.

Also, the result (Table 3) showed that the coefficient of the cost of the cassava roots purchased by the garri processors was positive and statistically significant at 10% level of probability. This implied that the profit made by the garri processors in Rivers State, is largely depended on the cost of the cassava roots purchased by them. Thus, a 1% increase in the cost of the cassava roots purchased by them, will decrease their profit and increase their profit inefficiency by 0.51%. This could be that most garri processors with low barging power will tend to buy the cassava roots more expensive than those with high bargaining power due to flexible prices of the cassava root as sold by the cassava farmers.

Profit Efficiency of the Garri Processors in Rivers State: The frequency distribution of the profit efficiency of the garri processors in Rivers State, were presented (Table 4).

Table 4: Frequency Distribution of the profit efficiency of the garri processors

Ranges	Frequency	Percentage
0 - 0.2	39	38.6
0.21 -0.4	21	20.8
0.41- 0.6	17	16.8
0.61-0.8	13	12.9
0.81-1.0	11	10.9
Total	101	100
Maximum	0.990	
Minimum	0.002	
Average	0.367	

Source: Field Survey 2023.

The results (Table 4) revealed that the mean profit efficiency of the garri processors in Rivers State was 0.37, which suggested that on average, the observed profit was 63% less than the optimum profit. This implies that an average garri processors were 0.37 profit efficient and 63% less from the maximum possible level due to their inefficiency. The results revealed that out of 120 sampled garri processors in Rivers State, only about 101 (84.17%) garri processors made some profit from the business, even though they are not up to 40% profit efficient on the average. While, about 19 (15.83%) garri processors in Rivers State encountered losses in their business, and were dropped in the analysis of profit efficiency.

The profit efficiency indices indicated that the minimum and maximum profit efficiency scores ranged from 0.002 and 0.99 showing that there was a high variation between the least profit efficient and the most profit efficient garri processors in Rivers State, with an average of 0.37. This implied that if an average garri processors were to achieve the profit efficiency level of its most efficient counterpart, then 63.3% extra profit could be realized i.e (1-0.37/0.99 x100).

Conclusions

Efficiency is said to be one of the major determinants of the performance of any business. This research work which dwells on the profit efficiency of garri processors in Rivers State, established that the sampled garri processors were 37% profit efficient. Cost of cassava roots; cost of grating/milling of the cassava; cost of hiring equipment used in garri processing; and cost of transportation were the factors that negatively affected the total profit made by the garri processors in Rivers State. Also, the study established that years of experiences in garri processing and education decreases the level of profit inefficiency of garri processors, while cost of the cassava roots purchased increases the level of profit inefficiency of the garri processors in the study area. Thus, the study recommended that adequate training should be conducted for the garri processors in Rivers State by the extension agents and Nigeria Stored Products Research Institute (NSPRI) in order to improve the efficiency of garri processors for more profit.

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