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Profitability of Cassava Processing: A Case Study of Otukpo Lga, Benue State, Nigeria

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Abstract. The study investigated the economics of cassava processing in Otukpo Local Government Area, Benue State, Nigeria. Data were collected using well-structured questionnaire administered to 60 cassava processors. Data collected were analyzed using descriptive statistics, Profit function, independent sample t-test and Analysis of Variance (ANOVA). Results showed that majority of the processors were within the age group of 31-40 years with mean year of experience of 34 years. They were mostly women with an average of 8 persons per household. Traditional technologies mostly were employed by the cassava processors. The profitability analysis showed that cassava processing into *garri* (fried cassava granules), *chips and fufu/akpu* (cassava dough) are profitable, (t =23.55, 11.95, 12.37: $P \leq 0.01$). Moreover, the result of the ANOVA showed that there was a significant difference (F=44.48:$P \leq 0.01$) in the profit level of cassava processed into *garri, chips* and *fufu/akpu*. The result of the post-hoc of ANOVA shows that among the three cassava products studied, *garri* had the highest profit. The cassava processors encountered many set-backs like poor equipment, high cost of transportation, inadequate capital and poor road network even though processing is a viable and profitable venture. Modern processing technologies should be developed and disseminated to processors while adequate infrastructural facilities and credits should also be provided.

Introduction

Cassava *(Manihot esculenta Crantz*) is a crop native of South America, which was believed to have been introduced into Nigeria during the period of slave trade proliferation by the Portuguese explorers and colonizers in the sixteenth century [1]. Cassava is a drought-tolerant, perennial woody shrub and staple food crop with up to 32% (fresh) starch content which is cultivated extensively as a food crop in Africa, [2, 3]. It is one of the most important staple food crops in sub-Saharan Africa, and its average consumption exceeds 300 kg per person annually in some areas of Africa [4]. Cassava is a very versatile commodity with numerous uses and by-products. The leaves may be consumed as a vegetable, or cooked as a soup ingredient or dried and fed to livestock as a protein feed supplement. The stem is used for plant propagation and grafting. The roots are typically processed for human and industrial consumption. Cassava root is a good source of carbohydrates.

Cassava is processed into various products such as cassava flour (*lafun*), fried cassava granules (*garri*), cassava dough (*fufu/akpu*) and cassava starch [5]. It is also a source for bio-fuel as well as animal feed. Apart from livestock feeds, processed cassava serves as industrial raw material for the production of adhesives, bakery products, dextrin, dextrose glucose, lactose and sucrose. Food and beverage industries use cassava products in the production of jelly caramel and chewing-gum, pharmaceutical and chemical industries also use cassava alcohol (ethanol) in cosmetic and drug production. Also, the peels are used in organo-mineral fertilizers formulation [6]. Thus, there is a very high demand for cassava products both in local and foreign markets [7]. Cassava is increasingly gaining ground as an insurance crop against hunger. Famine rarely occurs in the areas where cassava is grown since the crop provides a stable base for food production [8]: thus, it is commonly referred to as one of the major crops for food security in the tropics [9]).

Nigeria leads the world in cassava production [10, 11]. Going by the available FAO data [12], the country's production volume for 2015 was 57.64 million metric tons, representing 37.3% of Africa's or 20.8% of the world's total production for that year [10]. The national average yield of cassava was still very low at about 13.63 metric tons per hectare reflecting a shortfall of 65.9% away from the potential yield put at about 40.0 metric tons per hectare [10]. In fact, many commercial cassava agri-businesses operate below processing capacity due to the irregular supply of fresh cassava roots [13]. Nigeria is yet to tap the full potential embedded in cassava. The country still imports some cassava products like starch, flour, sweeteners and so on, due to underutilization of available resources [14].

Cassava displays an exceptional ability to adapt to climate changes. It is tolerant to low soil fertility, resistant to drought conditions, pests and disease and suitability to store its root for long periods underground even after maturity [15]. Hence it is grown throughout the year making it preferable to the seasonal crops of yam, beans, pea, etc. Use of fertilizer is limited and it is also grown in fallow lands. The crop also grows very well on marginal soils, replacing crops that require greater soil fertility [16]. Its ability to fight hunger and poverty has made it an important commodity for intervention by the government and stakeholders in the Agricultural sector. Since most government interventions and policies are aimed at integrating the rural poor into the mainstream of the economy, one of the ways of achieving this is by adding value to their produce. The evaluation of the present state of small scale-cassava processing is therefore imperative. In order to tap the full potentials that cassava presents, there is, therefore, the need for a study on value addition to cassava and the factors that are likely to influence value addition so that rural communities whose livelihoods depend on it will benefit from the present traditional food market and new emerging markets.

Fleshly harvested cassava has a very short storage life. Processing procedures are aimed at reducing cyanide, improving storability, providing convenience and palatability [18]. Processing can increase the efficiency of land use by releasing land after harvest for other crops or for fallow to sustain soil productivity, also reduces food losses and stabilizes seasonal fluctuation in supply of the crop (Nweke, 1988). Cassava processing and marketing are agro-allied activities with substantial backward and forward linkages which can enhance income generation and employment creation capable of breaking the vicious cycle of poverty. Cassava processing is mostly done by women using traditional method which is labor-intensive and time consuming. Cassava processing was observed to be one of the ways of improving the revenue base of the rural population and meeting the demand of the urban food needs in the country. Processing of cassava provides an avenue for diversification of farming activities for farmers which has been identified as a strong panacea towards alleviating poverty from rural farming community [19].

Since profit is a major driving force in any investment; it is an indicator that will encourage or discourage participation. Profitability is the key to sustainability of agricultural innovations. Olomola [17], in analyzing the value chain of cassava, cotton, maize, rice, soybeans and sugarcane industries, placed cassava third after rice and maize based on operating profit. In terms of yield, cassava is far ahead of other crops. It is observed that cassava is a competitive commercial agricultural crop with attendant benefits to its farmers, processors, marketers and consumers.

Various initiatives on cassava are yet to yield the expected results. This may be due to the fact that they do not take account of the economic circumstances under which cassava is processed occasioned by inadequate statistics of those who engage in different cassava products particularly at the grassroots level [20]. Lawal et al. [21], in their study of the economic analysis of cassava processing in Kwara State found out that the cassava processing enterprise can be profitable. Similarly, Omolara et al. [22] in their study titled "Cost and Return Analysis of Cassava Flour (*Lafun*) Production among Women in Osun State, Nigeria" found that every single respondent made use of local method of processing in the study area and none of them use semi-modern and modern methods. Omotayo and Oladejo [4] worked on Profitability of Cassava-based Production Systems found that that the Gross Margin of rural farmers in Oyo state is 62,449.11K/Ha and profit of 54,069.57K/Ha; implying that cassava business is a profitable venture in the study area. Thus, this

study focused on the processing of cassava into fried cassava granules (*garri*), cassava dough (*fufu or akpu*) and cassava *chips*.

Objectives of the Study

The broad objective of the study was to carry out an economic analysis of cassava processing in the study area. The specific objectives were to:

i. identify the various forms of cassava products and the level of technology used in the study area;
ii. assess the costs and returns in cassava processing;
iii. compare the profitability of the various forms of processed cassava products; and
iv. identify the constraints to cassava processing.

The contribution of this research to the existing literature are three fold: first, it identified the level of technology used in cassava processing, compared the profit level of three cassava products and identified the problems of processing in the study area.

Theory

Managerial Efficiency Theory of Profits

This theory recognizes that some firms are more efficient than others in terms of management of productive operations and successfully meeting the needs of consumers. Firms with average level of efficiency earns average rate of return. Firms with higher managerial skills and production efficiency are required to be compensated by above-normal profits (i.e. economic profits). Therefore, this theory is also called compensatory theory of profits. Frank Knight argued that economic profit is a return to the entrepreneur in exchange of the risk undertaken by him (her) in the operation of a business enterprise. Because the other three factors of production (viz., land, labour and capital) have contractual agreements of payment for their services – wages, rent and interest, economic profit is a residue that may exist after these other factors have been compensated. No other factor income can be zero or negative' but profit can be, since at times there may be no profit at all or even a loss.

The compensatory theory of profits focuses on "the notion that above-normal rates of return (or economic profits) are the result of the ability of certain firms and entrepreneurs to outperform their competitors. This superior performance may stem from the fact that they are better able to satisfy current consumer demands or predict future demands."

High profits are the signal that consumers want more of the output of the industry, high profits provide the incentive for firms to expand output and for more firms to enter the industry in the long run. For a firm of above average efficiency, profits represent the reward for greater efficiency. On the other hand, lower profits or losses are the signal that consumers want less of the commodity and that production methods may not be efficient. Thus, profits provide the incentive for firms to increase their efficiency and/or produce less of the commodity, and sometimes to leave the industry for more profitable ones. It is often argued that profit arises as a result of managerial efficiency. It can be shown in many instances that management, through more efficient operations, can reduce the cost of doing business, anticipate and offset changes that will adversely affect the company's income, adopt new marketing techniques, improve product quality and expand the product line in order to increase profit.

There is hardly any doubt that business acumen regarding product development, pricing structure and marketing models can enhance profits. Yet all profits cannot be attributed to managerial efficiency. In certain instances, reasonable amount of profits exist in spite of poor management. In other cases a capable manager may be in a position where no profit can be made whatever the efficiency of his management, because of certain factors which are external to and beyond the control of his enterprise. External forces like a business recession, a sudden change in consumer taste, restrictive legislation affecting the manufacture of his product, or other unforeseen adverse external factors may depress profits and affect his true managerial skills adversely.

Materials and Methods

The Study Area

The study area is Otukpo Local Government Area (LGA), Benue State Nigeria. Benue State is regarded as the food basket of the Nation and has 23 LGAs. Benue is located in the middle belt of Nigeria, approximately between latitudes $6^0$30′N and $8^0$10′N of the equator and longitudes $6^0$35′E and $8^0$10′E of the Greenwich meridian, at an elevation of 97 meters, above sea level in the Southern guinea savannah agro-ecological zone [23]. Otukpo town is also the traditional headquarters of Idoma land. It is strategically located at the intersection of the Eastern railway line; the only road linking the Northern parts of the country to the Eastern parts. At present, Otukpo Local Government Area is made up of four districts, namely: Otukpo, Akpa, Ugboju and Adoka. It experiences a typical tropical climate with two distinct seasons, the wet or rainy season and the dry season, annual rainfall of 150mm and an average temperature which ranges between 21^0C to 35^0C [23]. Otukpo Local Government Area is intentionally chosen due to the fact that the production of cassava is highly predominant in the area.

Out of the four districts, Adoka was purposively chosen for this study due to predominant cassava processing in the area. Simple random sampling technique was employed to select 60 cassava processors which represent about 10% of the population. They were interviewed using well-structured questionaire. Data collected for this study were analysed using descriptive statistics, profit functions. Descriptive statistics was used to analysed socio-economic characteristics and constraints to cassava processors, profit functions were used to analyse the profitability level of cassava processing. Independent sample t-test was used to estimate the profitability of the various enterprises while Analysis of Variance (ANOVA) was used to compare the profitability levels of the different enterprises. The profit functions used were Gross margin, Net Farm Income and Rate of Returns to Investment, Operating cost ratio and Cost-Benefit Ratio. The Net farm income adopted the pattern and structure used by Ater and Umeh [24].

Model Specification

Net Income Model

$$NP = (TR\text{-}TVC) – TFC$$

where NP - Net Income or Net Returns in Naira; TR = Total Revenue in Naira; TVC - Total Variable Cost in Naira; TFC - Total Fixed Cost in Naira = Total Amount of Depreciation on durable equipments (₦); TR-TVC = Gross Margin in Naira

The Rates of return was calculated as:

$$\text{RRI=Rate of Return on Investment} = \frac{NI}{TC}X100 \text{ or } \frac{Grossmargin}{TVC}$$

$$\text{Operating Costs Ratio} = \frac{TVC}{TR}$$

$$\text{B/C ratio} = \frac{Total\ Revenue}{Total\ cost};$$

If B/C > 1 = profitable, B/C = 1 = neither profitable nor loss, and B/C < 1 = not profitable

Costs were divided into two parts: fixed and variable costs. Fixed costs include depreciation of tools and equipment used, namely knife, basin, brush, grater, buckets, bamboo sieve, presser; plastic bowl, drying mats, bags, wheel barrow, headpan, The average life span for these equipments was five years and straight-line method was used. Variable costs include the cost of raw materials (cassava tubers), labor, fuel for mechanized grater, and supporting materials. Again, unpaid family labor was included in the cost component [25] which was estimated according to the predominating wage rate in the villages and the calculation of labor tasks started from peeling and did not include harvesting and transporting cassava roots from farm to the house. Valuing family labor is

considered essential to evaluate the profitability of cassava processing in the context of cassava commercialization as economically successful business should be able to pay for all costs including realistic opportunity costs [26].

Results

Forms of Cassava Processing and Technology used in Processing

The result (Table 1) shows that majority of the respondents (53.3%) use traditional method while only 46.7% use improved technology. The study also found that most respondents (41.7%) process cassava into *garri* and *fufu/akpu*; 21.7% process into *garri* and *chips* while 11.7% processs cassava into *garri, chips* and *fufu/akpu*. The result further shows that none (0%) process cassava into *chips* only in the study area.

Table 1: Forms of Cassava Processing and Technology Used in Processing

S/No	Variables	Frequency	Percent
1.	**Cassava products**		
	Garri only	9	15
	Chips only	-	-
	Fufu/Akpu only	1	1.67
	Garri + *chips*	13	21.67
	Garri + *Fufu/Akpu*	25	41.67
	Chips + *Fufu/Akpu*	5	8.33
	Garri+ *chips* +*Fufu/Akpu*	7	11.67
2.	**Method of Processing**		
	Traditional	32	53.3
	Improved	28	46.7

Source: Field Survey, 2016

Costs and Returns in Cassava Processing

The result of costs and returns in cassava processing is presented in Table 2. The result shows that in processing cassava into *garri*, the total variable costs per 100kg raw tuber was ₦2,574.33 while fixed costs accounted for 27.83% of the total cost. Meanwhile, the mean price of a 100kg bag of *garri* was ₦10,616 that is ₦106.6/kg ($28/100kg). However, the gross margin realised was ₦8,041.68 which suggests that it is profitable. Specifically, raw tuber accounted for 36.26% of the total variable cost, labour accounted for 18.13% while 23.05% of the total variable cost was for firewood. Bag, water and transportation accounted for 5.28%, 4.66% and 6.73% respectively of the total variable cost. Also, some of the processors added palm oil to their *garri* in order to differentiate it and add more value to their product and this amounted to 5.89% of the total variable cost. For every Naira invested, ₦197 was generated as the rate of return on investment for *garri* was 1.976. Operating cost ratio was 0.24 meaning that the variable cost consumed 24% of sales. The benefit-cost ratio was 2.976 which depicts that cassava processing into *garri* is highly profitable.

In processing cassava into *chips*, 8.11% of the total variable cost was spent on transportation while the cost incurred on sacks accounted for 4.14% of the total variable cost. More so, the gross margin accounted for 200.28% of the total variable costs. The total variable costs of cassava *chips* accounted for ₦1,764.33 and the net profit was ₦2, 838.1. The minimum and maximum gross margin calculated were -₦1825 and ₦13,000; implying that while some processors incurred loses, others made high profits. Meanwhile, the mean price of chips was ₦5297.93/100kg i.e. ₦53/kg ($14.32/100kg). The rate of return on investment for *chips* was 1.15 indicating that for every naira invested, ₦115 was realized. Variable cost consumed 33% of sales. The benefit-cost ratio was 2.15; thus, cassava processing into *chips* is considered profitable and viable.

The result shows that processing cassava into *fufu/akpu* constitutes total variable costs of ₦1,688.33 from which labour and transportation accounted for 44.92% and 13.84% respectively

and a net profit of ₦3,216.9. The minimum and maximum gross margin calculated for *fufu/akpu* were ₦-3360 and ₦26,000; implying that while some processors incurred loses, others made high profits to the tone of ₦26,000. In *fufu/akpu* processing, for every Naira invested, ₦155 was generated (RRI=1.55). Again, variable cost consumed 32% of sales. The mean price of *fufu/akpu* was ₦52/kg. However, the mean revenue was ₦5,293 which represents 254.9% of the total variable costs. The enterprise is viable and profitable since the BC ratio was greater than 1 (2.55). A comparison of the returns to cassava processing revealed that *garri* had the highest gross margin which was about 197.63% of the total cost.

Table 2: Cost and Returns in Cassava processing (100kg of raw cassava tuber)

S/N	Variables	Mean (₦)	Std Devi	Min(₦)	Max(₦)	% of TC
1.	***Garri***					
	Revenue	10,616	5446.39	1,500	21,600	297.63
	Variable costs					
	Cassava tubers	933.33	472.06	0	2200	26.17
	Labour	466.67	236.031	0	1100	13.08
	Transportation	173.33	162.383	0	600	4.86
	Fire wood	593.33	427.05	150	1500	16.63
	Water	120	105.155	0	500	3.36
	Palm oil	151.67	222.05	0	750	4.25
	Bags/sacks	136	68.771	100	400	3.81
	Total Variable costs	2,574.33	1035.70	700	5370	72.18
	Fixed cost					
	Depreciation of equ	992.467	602.78	0	2500	27.83
	Total cost	3,566.8	1353.24	1900	7870	
	Gross Margin	8041.6833	5.27934E3	170	20,250	
	Net profit	7049.2167	5.07847E3	-400	19,690	
	Rate of Return	1.9763	2.00331	-0.21	10.31	
	Operating Cost ratio	0.24249	0.20965	0.05	0.93	
	Benefit-Cost ratio	2.976	2.00331	0.79	11.31	
2.	***Chips***					
	Revenue	5,297.93	3704.98	0	14,700	215.38
	Variable costs					
	Cassava Tubers	645.00	449.561	0	1500	26.23
	Labour	473.33	537.530	0	3000	19.25
	Water	430.00	299.71	0	1000	17.48
	Transportation	143.00	160.38	0	500	5.81
	Sacks	73.00	69.98	0	200	2.97
	Total Variable costs	1764.33	1129.37	0	4750	71.73
	Fixed cost					
	Depreciation of equ	695.50	653.48	0	2300	28.28
	Total cost	2459.8	1571.54	0	6100	
	Gross Margin	3533.6	3096.63	-1825	13000	
	Net profit	2838.1	2719.27	-2075	11800	
	Rate of Return	1.1537	1.196	-1.00	5.40	
	Operating Cost ratio	0.333	0.230	0	0.88	
	Benefit-Cost ratio	2.1538	1.36059	0	6.40	
3.	***Fufu/Akpu***					
	Revenue	5,293.0	6,346.46	0	19,000	254.9
	Variable costs					
	Cassava tubers	316.00	273.85	0	800	15.22
	Labour	758.33	599.59	0	1800	36.53

Transportation	233.67	243.46	0	740	11.26
Water	73.33	75.52	0	400	3.53
Sacks/bags	307.0	283.61	0	1100	14.79
Total Variable costs	1688.33	1232.81	0	4500	81.32
Fixed cost					
Depreciation of equ	387.80	408.009	0	1350	18.68
Total cost	2,076.1	1512.45	0	49500	
Gross Margin	3604.7	5865.16	-3360	26,000	
Net profit	3216.9	5683.97	-3560	25,200	
Rate of Return	1.5494	2.13	-1.0	8.33	
Operating Cost ratio	0.31897	0.30	0	1.34	
Benefit-Cost ratio	2.5495	2.19	0	9.33	

Note: $1= ₦370 as at the time of the survey
Source: Field Survey, 2016

Profitability Test

The result of profitability test is presented in Table 4. The test employed independent sample t-test to ascertain whether there will be significant difference in the Total Costs (TC) and revenues of processors of different cassava products. The number of processors in each case differs. The results show that there was significant difference (t=9.73; 5.46; 3.82 p≤ 0.01) between the total costs and revenues in cassava processing into *garri, chips* and *fufu/akpu* This implies that cassava processing into *garri, chips* and *fufu/akpu* are profitable. This is in line with the findings of Lawal et al. [21] and Ehinmowo et al. [27] who found that cassava processing to *garri, flour/lafun* and *akpu* are profitable.

Table 3: Profitability Test result showing the difference between Total Cost and Revenue in cassava processing

Cassava products	Group Variables	Mean (₦)	Standard Dev	Mean Diff	t- Value	Df	Sign (2-tailed)	n
Garri	Revenue	10,616	5446.39	7049.22	9.730***	118	0.000	48
	Total Cost	3,566.8	1353.24					
Fufu/Akpu	Revenue	5,293.0	6346.46	3216.87	3.82***	118	0.000	29
	Total Cost	2,076.1	1512.46					
Chips	Revenue	5,297.9	3704.98	2838.100	5.46***	118	0.000	15
	Total cost	2,459.8	1571.54					

Note: $1= ₦370 as at the time of the survey, n= number of processors
*** Significant at 1%

Result of ANOVA Showing the Difference in net Profit among Cassava Products

Table 5 presents the result of Analysis of Variance (ANOVA) showing the difference in net profits of different cassava products. The result shows that there was a significant difference (F=14.92; P≤0.01) in the profit levels of *garri, chips* and *fufu/akpu*. This means that net profits derived from processing cassava into *garri, chips* and *fufu/akpu* vary significantly. Moreover, the result of the post-hoc of ANOVA (Table 6) shows that *garri's* profit is significantly higher than both *chips* and *fufu/akpu*. However, between *chips* and *fufu/akpu*, *fufu/akpu*'s profit is higher than that of *chips* although the difference is not significant. In other words, among the three cassava products studied, *garri* had the highest profit while *chips* had the least profit.

Table 4: Result of ANOVA showing the difference in net profits among cassava products

Garri/chips/akpu	Sum of squares	Degree of freedom	Mean square	F	Sig
Between groups	651300000	2	325600000	14.916***	0.000
Within groups	3864000000	177	21830000		
Total	4515000000	179			

Table 5: Result of Post-Hoc ANOVA showing the difference in net profits among products

Products		**Mean diff**	**Standard error**	**Sign**
Garri				
	Chips	4211.117*	853.0	0.000
	Fufu/Akpu	832.35*	853.0	0.000
Chips				
	Garri	-4211.117*	853.0	0.000
	Fufu/Akpu	-378.767	853.0	0.658
Fufu/Akpu				
	Garri	-3832.35*	853.0	0.000
	Chips	378.767	853.0	0.658

*. The mean difference is significant at the 0.05 level.
Source: Field Survey, 2016

Constraints to Cassava Processing

The major constraints to cassava processing are presented in Table 6. The result shows that 70% of the respondents had transportation problem; absence of good road resulted in high cost of transportation and this affected proper distribution of the raw materials in the study area. Majority (76.7%) of the respondent reported labour scarcity. More so, 76.7% of the respondents reported poor road respectively. Scarcity of water supply was reported by 70% of the respondents.

Another major obstacle to cassava processing in the study area is poor equipment (80%). Grating and milling machines were owned by very few in the study area. In a community of about 600 farm families, only three (3) families own and operate the machine as business ventures. This resulted to long queues thereby causing delay in processing. Inadequate capital was also mentioned by most respondents (90%). This problem was as a result of farmers limited access to loan from financial institutions. Again, 100% of the cassava processors reported unpredictable climate as a constraint in processing, in the case of sun-drying of *chips* especially in the raining season.

Table 6: Constraints to Cassava Processing

S/No	**Constraints**	**Frequency**	**Percent**
1.	Unpredictable Climate	60	100.0
2.	Inadequate Capital	54	90.0
3.	Poor Equipment	48	80.0
4.	Labour Scarcity	46	76.7
5.	Poor Road	46	76.7
6.	Poor Water Supply	42	70.0
7.	High Cost of Transportation	42	70.0

Multiple responses recorded. **Source: Field Survey, 2016**

Discussion

Forms of Cassava Processing and Technology used in Processing

The result shows that majority of the respondents use traditional method. This implies that modern processing technologies are highly non-existent. In cassava processing to *garri*, cassava roots are traditionally grated into a mash or pulp as part of the process to remove cyanide and make

the roots safe to eat. Traditional cassava graters are usually made from perforated metal sheets. These rust quickly and are difficult to keep clean. Moreover, they are also very slow and labour-intensive to use. Cassava processing in the study area is still rudimentary which is time consuming and energy sapping. In cassava processing to *garri,* the traditional method was adopted during peeling, washing, sieving and frying while the improved method are only employed at grating and jacking stages. However, in processing to *chips* and *fufu/akpu*, all the processes were done manually or traditionally with no improved technology. This supports the findings of Omolara et al. [22], Bamidele [29]; and Oladejo et al. [28] who found that processors of *lafun and Pupuru/flour* respectively, made use of local method of processing but contrasts the findings of Ashaye [30] who observed the use of semi-modern method of processing. The study also found that most respondents process cassava into *garri* and *Fufu/akpu*. *Garri* processing was high due to easily available rudimentary tools, ready market and inherent high profit. The efficiency of the processing process could be enhanced through the use of highly modernized equipment which will ensure timely performance and improved output. As a consequence of the above constraint, processors limit their processing to mainly *garri* and *fufu/akpu* that require simple rudimentary tools. It was observed that none of the processors process cassava into *chips* only in the study area as a result of the absence of mechanized dryer as it can only be processed in dry season when there can be adequate sun. The processing of cassava mainly into *garri* as obtained in this study is consistent with the findings of Muhammad-Lawal et al. [20], Ehinmowo et al. [27] and Okeowo [31] and who found majority of the processors (49 percent) processed cassava into *garri*.

Costs and Returns in Cassava Processing

The variable costs involved in cassava processing into *garri, chips* and *akpu* are numerous but specific to each processing enterprise. While the mean revenue in each case far exceeds the mean total variable costs; it follows that the processing exercise gives incentives to the processors in form of profit and this has ensured the sustainability of the business in the area. In the processing of cassava into *garri,* the major constituents of costs include cost of tubers, firewood and labour. Bags, water and transportation exerts minimal costs in *garri* processing. Palm oil was occasionally added to improve quality and enhance the nutritional value. The benefit-cost ratio was 2.976 which depicts that cassava processing into *garri* is highly profitable and viable. This is consistent with the findings of Muhammad-Lawal et al. [20] who found that *garri* gave the highest Gross Margin among four cassava products.

Similarly, the major cost elements apart from cassava tubers include labour, water and transport in cassava processing into *chips*. Labour costs include cost of peeling, washing and sun-drying. However, the mean gross margin for *chips* was approximately less than half of *garri* while the mean total variable cost was less than that of *garri*. The price of *chips* was ₦57.50/kg. However, the mean gross margin of *chips* was about one-third of *garri*. The benefit-cost ratio was 2.15; thus, cassava processing into *chips* is considered viable and profitable.

Furthermore, the mean revenue from *fufu/akpu* was the least when compared to *garri* and *chips*. However, its gross margin was higher than *chips* but less than *garri*. This implies that its mean total variable cost was the least. However, the major components of cost in *fufu/akpu* processing are labour, cassava tuber, sacks/bags and transportation. Labour costs include cost of peeling, washing, sieving, draining of water and bagging.The rate of return on investment to *fufu* processing estimated at 155% indicates that fufu processing is a profitable enterprise in the study area. A comparison of the returns to cassava processing revealed that *garri* had the highest gross margin which was about 213.51% of the total variable cost. A similar result was obtained by Okorie et al. [32] where *garri* gave the highest value-added to cassava processing in Imo State and Ehinmowo et al. [27] who found Benefit-Cost-Ratio (BCR) for *garri* processing in Ondo as 2.24, Oyo as 1.75 and Ogun as 1.85, emphasizing the profitability of the business.

Profitability Test

When the total variable costs and revenue in cassava processing into the various products were compared, there was a significant difference between them. This means that the difference between revenue and total variable costs was not by chance; hence processing of cassava into *garri,*

chips and *fufu/akpu* were profitable. This result corroborates previous reports that in Nigeria and other African countries processing of cassava into *garri* [21, 33, 27], *fufu* [21, 27], dried *fufu* [34] and *lafun* [21, 27], were profitable.

Result of Analysis of Variance (ANOVA)

Moreover, the result of the post-hoc of ANOVA (Table 5) shows that *garri*'s net profit was significantly higher than both *chips* and *fufu/akpu*. This contrasts the findings of Okeowo [31] who found that *fufu* had the highest margin in Epe LGA, Lagos State Nigeria, although other products such as *garri* and *chips* were equally profitable. However, between *chips* and *fufu/akpu*, *fufu/akpu*'s profit is higher than that of *chips* although the difference was not significant. In other words, among the three cassava products studied, *garri* had the highest net profit while *chips* had the least net profit. This could be attributed to the ease of processing and the ready market for the products: as *garri* had the highest demand in the locality compared to *fufu/akpu* and *chips*.

Constraints to cassava processing

The major constraints as outlined by the respondents include inadequate capital, poor equipment, poor road, labour scarcity and inadequate water supply. Absence of good roads was a major limiting factor as majority of the roads are not motorable and hence do not encourage large-scale processing. Again, the bad roads lead to high transportation bills which further decimate the profit. Furthermore, water scarcity and labour were other problems. There is scarcity of water especially during dry season when streams and wells dry up. This makes getting water a serious problem for the processors. Again, there is always scarcity of labour especially during season as most operations are done manually.

Another major constraint is poor equipment. This resulted to long queues which were regular at grating and jacking stages thereby causing delay in processing. This is caused by the near absence or few machines in the community. This is in line with Omolara et al. [22] who found that 81.5% of women processors in Osun State were faced with equipment problem. Processors complained about inadequate capital. This problem was as a result of farmers limited access to loan from financial institutions. This is consistent with the result found by Omolara et al. [22], Muhammad-Lawal et al. [20], Oladejo et al., [28] and Ehinmowo et al. [27].

Conclusions and Recommendations

Processing of cassava into *garri, cassava chips* and *fufu/akpu* are still being carried out using traditional technologies. Cassava processing is a viable and profitable enterprise that will boast food production vis-à-vis reduce the syndrome of poverty in the study area, if properly managed. It is also one of the enterprises that has potential of adding value to our Gross Domestic Product (GDP) and as well create employment opportunities for the teeming population. High sales/turnover is the key to profitability; hence market development is the key driver of the profitability we desire in the Nigerian cassava industry.

Efforts should be made by technology developers in making modern processing technologies and devices to ease the processing process. There should be capacity building for the processors to improve their social and wellbeing for optimal output The government should as a matter of urgency provide adequate infrastructure such as storage facilities and good road network to solve the present problems of processors in the area. Soft loans or grants should be advanced to processors in order to increase their capital base.

Conflict of Interest

There is no conflict of interest.

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