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ECONOMIC ANALYSIS OF YAM PROCESSING INTO YAM FLOUR IN SAKI AGRO ECOLOGICAL ZONE OF OYO STATE, NIGERIA

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ABSTRACT

The study examined the economic analysis of yam processing into yam flour in Saki Agro ecological Zone of Oyo State. It specifically described the profitability of yam processing; examined the technical efficiency of yam processors and determined the effect of the socio-economic characteristics on technical efficiency. Data were collected with the aid of structured questionnaire and analyzed using descriptive statistics, profitability and budgetary analysis as well as stochastic frontier model and Garrett scale. The study reveals that majority of the respondents were female (88%) with a mean age of 47. The result shows that the rate of return on investment was 12 percent. The mean technical efficiency of the processors was 85% indicating that the yam processors were relatively efficient in allocating their limited resources. Some observable variables relating to socioeconomic characteristics such as processing experience and sex of the respondents significantly explains the variation in technical efficiency. Factors such as high cost of yam tubers, poor weather condition and inadequate processing facilities are the major factors that hinder the processing activities in the study area. The study therefore recommends that government policies should be made to improve the provision of inputs such as yam tubers and capital equipment at affordable price.

Keywords: Yam processing, Yam flour, Profitability, technical efficiency

INTRODUCTION

Yam is one of the major starchy staple in sub-Saharan Africa where a major issue faced by the continuously increasing population is food security (Fu *et al.,* 2011). Yam is cultivated throughout the tropics and in many parts of the sub-tropics and temperate zones, and also serves as one of the primary agricultural commodities in West Africa and New Guinea (Babajide *et al.*, 2006). World yam production amounts to 74.3 million tonnes annually and 94% are grown in the yam production regions of West Africa. Yams are grown on 8.9 million hectares in about 47 countries of the world with Nigeria as the leading world producer followed by Ghana, Ivory Coast and Togo (FAO, 2020; IITA, 2009). Nigeria's yam production was 50 million tonnes in 2018 and by 2019 this increased to 50.5 million tonnes (FAOSTAT, 2020). Yams are a main source of earnings and a major employer of labor in West Africa.

Yam is consumed in different forms, mainly boiled or fried in oil and could be also processed into flour, poundo yam flour, yam chips, yam flakes and starch. In some West African countries such as Nigeria, Benin and Ghana, yams are processed into dry-yam tubers/slices and flour (Babajide *et al.*, 2007). The main quality attributes of yam flour (which is the center of interest of this study) are colour, texture, and taste and most consumers prefer a light brownish, elastic, non-sticky paste made from yam flour (Babajide *et al.*, 2006). Peoples preference for the product and hence its demand are affected by its taste, texture, colour and appearance of the paste made from the flour, which is a function of the specie of yam used and the time period in which the yam tuber is soaked before being processed (Adewale *et al.,* 2014)

Overcoming the problem of perishability of yam due to high moisture content and seasonal nature of their production, would require processing (Akissoe *et al.*, 2001). Processing of yam into flour adds value to its product by converting it into a form that is readily available and more acceptable to the consumer. The culinary nature of yam flour makes it a distinct addition to an array of appealing and nutritious foods available to consumers. Yams are full of nutrients and are sources of fiber, antioxidants, vitamins and minerals like potassium and copper. They are also known to boost brain health, reduce inflammation and improve blood sugar control. This makes yam flour all the more special. Processing of yam into flour include the following: washing the tubers to remove sand particles; peeling to remove the outer periderm; parboiling at 50^0C for 2 minutes and allowing to cool in the water; drying; milling; bagging and packaging in air-tight bags.

Due to the high demand and promising market for yam flour, it is expected that yam processors would be making substantial profit from the business. However, the level of yam processing in Nigeria is relatively low compared to substitute crops such as cassava and this is partly due to lack of access to affordable financing by the processors and difficulties associated in building a distribution network (Sahel, 2014). The problems militating processing activities include lack of suitable raw materials, drying and storage equipment, and poor quality of processed products (Osunde, 2008). Closely related to the problems of actual economic production, there are several post-harvest problems connected with yams, which affect the economics of their use for food. These problems have received much less attention than their magnitude appears to warrant. Yam flour processing and marketing is labour intensive and time consuming. If income from yam processing is low, this could further prevent the processors from expanding the enterprise. In Oyo State, Nigeria, traditional methods are still being used for the processing of yam to dry yam, which is then milled into flour (Hounhouigan *et al.,* 2003; Babajide *et al.*, 2007). The frequent use of local methods for yam processing in Oyo State indicates that many of the processors continue to operate on small scale level. Yam processors could face issues of inefficient resource use of inputs as revealed in the work of Ezekiel *et al.,* (2007). If the problems highlighted above persist, yam processors could continue to operate unprofitably and could be drawn into a vicious cycle of poverty, especially if they are already marginally poor. It becomes exceedingly vital to carry out an empirical study of the profitability of yam processors in order to determine the current status which would be invaluable for policy decision making.

With these aforementioned issues in mind, the broad objective of this research is to assess the economics of yam processing into flour with Saki Agro-ecological Zone of Oyo state as a case study. The specific objectives are to:

i) describe the socio – economic characteristics of respondents;
ii) determine the profitability and viability of yam processing in the study area;
iii) estimate the technical efficiency of yam processors in the study area;
iv) determine the effects of the socio-economic characteristics of the processors on their technical efficiency;
v) rank the severity of constraints associated with yam processing in the study area.

LITERATURE REVIEW

Theoretical Background

An economic analysis is a systematic approach to determining the optimum use of scarce resources, involving comparison of two or more alternatives in achieving a specific objective under the given assumptions and constraints. It takes into account the opportunity costs of resources employed and attempts to measure in monetary terms the private and social costs and benefits of a project to the community or economy. The concept of economic analysis is usually in relation to the returns and hence the profitability or otherwise of any enterprise (Olayide and Heady, 1982). Also measurement of efficiency in both developed and developing countries has remained an area of important research especially in developing agricultural economics, where resources are merged and opportunities for developing and adopting better technologies.

Measurement of efficiency is very important because it helps to determine productivity growth by improving the neglected resources (Ali and Chaudry, 1990; Tadesse and Krishnavmoorthy, 1997). This implies that every resource would then be optimally allocated to serve each individual or entity in the best way while minimizing waste and inefficiency. In production process, profit being made does not imply there is high efficiency in the use of input resources. The best combination of input is that which maximize net gains, it is only then that production process can be said to be productive. For this paper, the stochastic frontier modelling would be used in determining the processors technical efficiency because of its flexibility and ability to closely marry economic concepts with modelling reality.

Technical efficiency (TE) is defined by Kumbhakar and Lovell (2000) as the ability of a decision-making unit (DMU) to obtain the maximum output from a set of inputs (output orientation) or to produce an output using the lowest possible amount of inputs which implies that technical efficiency is associated with the ability of a firm to produce on the isoquant frontier. According to Dawang *et al.* (2011), the stochastic frontier model enables one to measure firms level technical and economic efficiency using Maximum Likelihood Estimate (a corrected form of Ordinary Least Square-COLS). Aigner *et al.* (1992) and Meeusen and Van den Broeck (1977) were the first to propose stochastic frontier production function and since then many modifications had been made to stochastic frontier analysis.

The Empirical Model:

Yam Processing Business Analyses: This is to measure the strength and the weakness of the enterprise. The indicators used in this work were the Net farm Income (NFI), Gross margin (GM) and financial ratios. A commonly used tool of financial ratio analysis is profitability ratio which is used to determine the firm's bottom line (Enekwe *et al.,* 2013). Those used in this work include the benefit cost ratio (BCR) and return on investment (ROI). NFI is the difference between total revenue and total cost. The item of revenue was sales of total bag of flour in a month. The variable cost items considered were; Cost of yam tubers, labour, transport, packaging, storage, grinding and milling cost while the fixed costs considered were knife, baskets, milling and grinding machine. These fixed costs were measured by multiplying the number of fixed input by the cost per unit and then divided by the assigned useful life to obtain the depreciated cost for those with all the listed fixed items, while rental values were imputed for those who hire or use such items at a cost. The model used were represented by the following equation:

GM = TR (Total revenue) – TVC (Total variable cost)

Where GM = Gross margin in naira per kg

Net farm income = Gross margin (GM) – Total fixed cost (TFC)

Benefit cost ratio (BCR) = Total benefit/ total cost

Return on investment (ROI) =

$$\frac{\text{Total benefit} - \text{Total cost}}{\text{Total cost}}$$

Stochastic Frontier Production Function Analysis (SFA): The Maximum likelihood estimate (MLE) and Ordinary least square (OLS) stochastic frontier estimates of input were obtained. The MLE has the advantage of separating the impacts of factors not under the control of the processors such as weather and luck from contribution of variation in technical efficiency. The Cobb Douglas stochastic frontier model with output-oriented technical efficiency is specified in its implicit form as:

$$Y = f(X_I \beta_I) + e$$

Where: Y = output

β_i = Parameters

e = error terms

X_i = Vectors of input

While the Cobb Douglas stochastic frontier production model in its explicit form is given as:

$$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + V_i - U_i$$

Where:

X_1 = Total input of yam tubers (kg)

X_2 = Total labour (mandays)

X_3 = Number of capital equipment

X_4 = Number of simple tools

V_i = Random error which are assumed to be independent of U, identical and normally distributed with zero and constant variance.

U_i = Non- negative random error which are assumed to account for technical inefficiency.

Thus if $U_i = 0$ then $e = V_i$ which suggest that the production lies on the frontier and production can be said to be technically efficient. If $U_i > 0$, production lie below its optimal level and thus there is evidence of inefficiency (Dawang *et al.,* 2011). The technical efficiency (TE) of each individual is then given as TE = Y/Y*, where Y is the observed output and Y* is the maximum possible output or the frontier output. The range of technical efficiency is in the range of 0-1, where TE = 1 represents the achievement of maximum output for the given input under the available technology. Thus the technical efficiency is the observed output divided by the maximum possible output, which is the frontier output.

Technical inefficiency model: In the inefficiency effect model, the one_ sided error term is represented as:

$$U_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + \delta_6 Z_6 + \delta_7 Z_7 + \delta_8 Z_8 + \delta_9 Z_9$$

Where Z's are socio economic variables used to explain efficiency differentials among yam processors. δ's are unknown parameters to be estimated. U_i is the individual's technical inefficiency measure. Z_1, Z_2, Z_3, Z_4, Z_5, Z_6, Z_7, Z_8, Z_9 represents sex of the yam processors (Male = 1 or Female = 0), age (years), education level (No formal education = 1, adult education = 2, primary school = 3, secondary education = 4, tertiary education = 5), household size (number), processing experience (years), membership of association (Yes = 1, no = 0), access to credit (Yes = 1, no = 0), source of yam tubers (Self production = 1, market = 2) and method of processing respectively (Traditional = 1, modern/mechanical = 2).

METHODOLOGY

Study area

The study was carried out in Saki west, Saki east, and Atisbo local government area of Oyo state, Nigeria which has been grouped as the Saki Zone by Oyo State Agricultural Development Programme (OSADEP). Oyo state lies within the geographical coordinates of longitude 8º 00´ North and 4º 00´ East & latitude 8.000º North and 4.000º East of the Greenwich. Saki West has its headquarter in the town of Saki which lies between the geographical coordinates of longitude 8º40´ North and 3º24´ East and latitude 8.667º North and 3.400º East. It has an area of 2014 km² and a population of 278,002 at the 2006 census. Saki lies near the source of the Ofiki River, the chief tributary of the Ogun River, about 40 miles (60 km) from the Benin border. It is referred to as the food basket of Oyo state because of its agricultural activities, there is a vast-cattle ranch in Saki.

Saki East has its headquarter in the town of Ago-Amodu. It has an area of 1,569 km² and a population of 110,792 at the 2006 Census. Atisbo has its headquarters in the town of Tede, it has an area of 2997 km² and a population of 110,792 at the 2006 census.

Sampling Technique

A multi-stage sampling technique was adopted for this study. In the first stage, proportional random sampling was used to select 3 out of 5 processing centres in Saki West L.G.A, 2 out of 4 processing centres in Atisbo L.G.A and 1 out of 2 processing centres in Saki East L.G.A. This was obtained by taking 50% of the total processing centres present in the zone. Secondly, simple random sampling technique was used in selecting 20 respondents from each of the processing centres, making a total of 120 respondents.

Data Collection

Primary data was used for this study. These were obtained using structured questionnaire which was administered to the respondents. The primary data collected were on socio-economic characteristics of processors (such as age, sex, family size, years of processing etc.), factors affecting yam processing, cost and returns of yam processing into flour, profitability and production constraints of yam processing into flour.

Data Analysis

Data were analyzed using descriptive statistics, profitability and budgetary analysis (such as Net income, gross margin, benefit cost ratio and return on investment), as well as stochastic frontier model and Garrett scale.

The Garrett ranking method was used to identify the problems associated with yam processing in the study area. In the Garrett ranking method, the respondents are allowed to rank their constraints faced, which is then given a percent position by the Garrett scale

Percent position = 100 (R_{ij}- 0.5)/ N_j where R_{ij} = Rank given for ith item by the jth sample respondents, N_j = Total rank given by the jth sample respondents. The percent positions for the ranks are then transmitted into Garret value using the Garret Ranking Conversion table. The total Garret score for each constraint is then given by:

Total Garret score for each constraint = $\sum_{i=1}^{n}$(Garret value * Frequency of respondents in each rank)

$$\text{Average Garret score for a constraint} = \frac{\text{Total Garret score for each constraint}}{\text{Total number of respondents}}$$

Then the average scores are arranged in descending order with the highest values taking 1st rank (largest constraint) and the lowest values taking 10th rank (smallest constraint).

RESULTS AND DISCUSSION

Descriptive Statistics

The descriptive statistics of the variables are presented in Table 1. The result shows that 15 (12%) of the respondents were males and 105 (88%) were females. The involvement of more females may be as a result of little demand for heavy labour in the processing process. The result for age distribution of the respondents shows that the mean age in the study area was 47 years, which indicates that majority of the yam processors are relatively young and active. This also corroborate with research done by Salawu *et al.* (2014), which indicated that majority of yam processors were between the age bracket of 41-60 (53%). A total of 74% had some exposure to formal education. A likely implication of this is that respondents may be more willing to adopt and utilize new technologies when given access to such innovations which could improve the processing process and also improve their standard of living. One major issue confronting developing countries however is that access to state-of-the-art technologies is severely limited.

Findings as indicated in table 1 also reveal that 78% yam processors were married. Marriage indicates a sense of responsibility and could prompt individuals to put more commitment to the business to enhance productivity. A high percentage of processors being married indicates that whatever income earned from processing would need to be sufficient to cover the needs of families. This is also an important factor that influences the supply of labour. In developing countries, marriage and childbearing are critically linked to the use of family labour in processing and backward integration (production). Unsurprisingly, 49% of processors strictly employed family labor compared to just 11% who strictly employed hired labor.

Another key point from table 1 is that 99% of processors used traditional methods for processing. This is not promising. It shows how far away yam processors are from a normative society. If this issue can be addressed, it will go a long way in improving producer surplus and oiling the economic wheels of the country.

The table also shows that there was no backward integration, with 100% of processors getting their yams from the market. Backward integration has been touted as an effective way for cost savings and vertical integration. Doing this however, requires sufficient funding for expansion which as we have discussed above eludes these small scale processors. Finally, although 49% of processors have no access to formal credit, only 28% of respondents use individual savings to finance their business suggesting that the remaining 21% is a subset of those who rely on friends and families for funding. The bottom line is that there is a huge gap to fill to help these processors to become more financially independent and stable - a recipe for economic progress.

Table 1: Distribution of Respondent based on their Socioeconomic Characteristics

Socioeconomic characteristics		Frequency count	Percentage%
Sex	Male	15	13%
	Female	105	88%
Marital status	Single	13	11%
	Married	93	78%
	Divorced	0	0%
	Widowed	14	12%
Level of education attained	No formal Education	31	26%
	Adult Education	10	8%
	Primary Education	59	49%
	Secondary Education	20	17%
	Tertiary Education	0	0%
Membership of Cooperative Society	Yes	60	50%
	No	60	50%
Access to formal credit	Yes	61	51%
	No	59	49%
Source of Finance	Individual Savings	34	28%
	Bank Loans	1	1%
	Friends and Family	60	50%
	Cooperative Societies	25	20.8%
	Others	0	0%

Source of Tuber	Backward Integration	0	0%
	Market	120	100%
Labour source	Family	59	49%
	Hired	11	9.2%
	Both	50	41.7%
Processing Method	Traditional	119	99%
	Modern	1	1%
Age	25 – 34	23	19%
	35 – 44	27	23%
	45 – 54	31	26%
	55 – 64	34	28%
	65+	5	4%
		Mean = 47	

Costs, Return and Profitability Analysis of Yam Processing

The results as presented in table 2 show that the total variable cost items incurred on an average in the processing of 4212 kg of yam into yam flour in a month was ₦444,884.108 with the cost of yam tubers constituting a greater percentage of the variable cost. The total fixed cost on the average was ₦518.243 per month, indicating that small amount of money was spent on fixed inputs, hence the total cost incurred was ₦446,513.14 in the processing of 4212 kg of yam per month. From the table, gross margin (returns over variable cost) values show that yam processors made a return of ₦54,155.14 on the average over variable cost i.e. the yam processors were able to cover their variable cost and make an excess of ₦54,155.14. This has severe impact on investment into the enterprise by potential investors, as the gross margin obtained is relatively low and less attractive as compared with some other investment opportunities. A net profit of ₦53,636.9 was obtained per month and this shows that the yam processors were able to make a profit of ₦53,636.9 per month after all expenses are covered. Also from the table, the benefit cost ratio (BCR) was 1.12 and the return on investment was 0.12, which implies that the investment generated a return (net benefit) that amounts to 12.16% of the cost of processing yam into yam flour. Although the result of the return on investment is positive, processors net income remains relatively low because most of these processors continue to operate in the realm of small or medium scale which affects their turnover. This returns on investment would be attractive if processors took advantage of economies of scale (large scale processing). Having access to greater funding for the purpose of expansion could therefore prove crucial for a significant improvement in processors' income.

Table 2: Profitability Analysis Result of Processing Yam into Flour in the Study

	Minimum	Maximum	Mean
Quantity in kilogram	2160	7560	4212.00
Price per kg	117.80	120	118.81
Total Returns	255600	893970	500150.04
Cost of Yam Tubers	213864	747600	412482.80
Family labor/month (mandays)	0	208	75.17
Cost of family labor/mandays (N)	0	300	190.00
Total Cost of family labor (N)	0	41600	15538.33
Hired lab(mandays)	0	104	28.73
cost hired labour/mandays	0	300	119.35
Total Cost of hired labour (N)	0	31200	6879.32
Pooled labour cost (N)	0	52000	22417.65
Total transport cost	499.70	3400	2270.83
Packaging cost	400.	5000	583.25
Storage cost	0	6000	2425.00
Grinding and milling cost	2700	6000	5815.42
Total Variable Cost			445994.90
Total Fixed Cost			518.24
Total Cost			446513.14
Gross Margin			54155.14
Net Farm Income			53636.90
Return on Investment			0.12
Benefit Cost Ratio			1.12

Stochastic Frontier Production Analysis

The result of the maximum likelihood estimate (MLE) and ordinary least square (OLS) stochastic frontier estimates of input used in the processing of yam into flour are presented in table 3 below. The MLE model presented two error terms hence it was adopted for further economic and econometric analysis. All the variables included in the model had a positive effects on the output of the processors which conforms to a priori expectation. Simple equipment which includes number of knives, basket, and capital equipment which includes number of milling machines, grinding machines were both significant at 10% while total labour used was significant at 5% which implies that a 1% increase in these variables used will increase the output by their respective coefficients. This implies that the data had come from a population whose true values of the parameters were significantly different from zero (i.e. they are useful in explaining the variation the in output) and an increase in the quantity of inputs would cause a corresponding increase in output. Also the sigma squared (0.0045165) is statistically significant at 1% and different from 0.

Table 3: Ordinary Least Squares (OLS) and Maximum Likelihood Stochastic Frontier Estimate

Variables	MLE Coefficient	t-ratio	OLS Coefficient	t-ratio
Constant	2.6608***	12.1794	2.2522***	9.9309
Yam Tuber	0.6051***	22.2038	0.6425***	20.5069
Total Labour	0.0673 **	2.3715	0.0858***	3.1289
Capital Tools	0.00378*	1.6311	0.0053**	2.2252
Simple Tools	0.0769*	1.8042	0.0338	0.7316
Sigma-squared	0.0045***	5.4597	0.0049	-------------
Gamma	0.9999***	134.2218	-------------	-------------
Log Likelihood Function =161.2189			151.1945	
LR test of the one-sided error = 20.0489				

Mean Efficiency = 0.8549

*Significant at 10% **Significant at 5% ***Significant at 1%

Technical Efficiency of Yam Processors in the Study Area

The technical efficiency of yam processors in the study area are presented in table 4 below. The minimum efficiency in the study area ranged from 0.70-0.75 while the maximum efficiency value ranged from 0.95-0.99, with only 6.7% of the yam processors operating at this level. A mean efficiency level of 0.85 indicated that an average yam processor was operating 15% below their efficient frontier output. This value is relatively high, suggesting that the yam processors were relatively efficient in the use of their resources, however there is need for policies to be focused on inefficiency factors that are reducing the technical efficiency of the yam processors in the study area, to make majority of the processors operate at the frontier level.

Table 4: Distribution of technical efficiency range of yam processors in the study area

Technical efficiency range	Frequency count	Column N%
<0.70	0	0.0%
0.70-0.75	7	5.8%
0.75-0.79	16	13.3%
0.80-0.85	40	33.3%
0.85-0.89	29	24.2%
0.90-0.95	20	16.7%
0.95-0.99	8	6.7%

The Inefficiency Model Estimate

The results of the inefficiency model are presented above in table 5. A negative sign of the parameters in the inefficiency function, implies that the associated variables has positive effect on technical efficiency and a positive sign indicates the reverse is true. In the light above, education years, membership of cooperative society, processing experience and yam source had negative coefficients, but however only processing experience was statistically significant, being significant at 10% thus there is a probability that the true parameter of education years, membership of association and yam source is not statistically different from zero and hence has no positive effect on technical efficiency. The positive coefficients of age, sex, household, access to credit, and processing method, indicated that these variables reduced the technical efficiency of the processors and increase their technical inefficiency. However apart from sex and processing method which were significant at 5% and 1% respectively, the t-ratio revealed that the parameters were not statistically significant.

Table 5: Estimate of the Inefficiency Effect on Yam Processing Technical Efficiency

Inefficiency Effects	Coefficient	Standard Error	t-ratio
Constant	-0.0398	0.8950	-0.0445
Age	0.0014	0.0018	0.7664
Sex	0.0711**	0.0315	2.2568
Household Size	0.0009	0.0047	0.1952
Education Years	-0.0015	0.0021	-0.6846
Membership	-0.0227	0.1010	-0.2246
Access to Credit	0.0610	0.0997	0.6122
Processing Experience	-0.0031	0.0019	-1.6299
Yam Source	-0.0797	0.4518	-0.1764
Processing Method	0.1637***	0.0593	2.7602

*Significant at 10% **Significant at 5% ***Significant at 1%

Constraints Faced by the Processors of Yam into Flour

Result in table 6 showed the severity of constraints faced by yam processors in the study area. Several possible constraints that could be affecting yam processing activities in the study area were identified and ranked using Henry Garrett ranking method. From Table 9 it is seen that high cost of yam posed a major constraint to the processors. This could affect the quantity of yam being purchased by the processors and hence their output. Poor weather condition was ranked as 2nd position. This factor could significantly affect the processing ability of the processors, as they rely mostly on traditional method of processing in which case adequate sunlight is required for keeping the yam slices dried for processing. Inadequate processing facilities was also identified by the processors as an important constraint being ranked as 3rd position. The absence of adequate processing facilities could affect the processors efficiency and hence their output. Unstable market prices ranked fourth. This might result from the fluctuation in the price of dried yam during different seasons. During peak seasons, an oversupply of yam may lead to cheaper yam prices to the benefit of processors (who basically buy from the marketplace). On the other hand, lean seasons may lead to shortage of yams, in which case processors will pay larger prices for yam tubers which could eventually reduce their surplus especially if the selling price of yam flour is relatively stable. High cost of wood was ranked as 10 having an average score of 18.00, and thus considered as the least constraint faced by yam processors in the study area. This is probably due to the fact that majority of yam processors prefer to purchase dried yam for processing process, rather than drying it themselves.

Table 6: Constraints faced by yam processors

Ranking Constraints

Ranks (from most serious to least serious)	Percent Position	Gareth Values
1st	5	82
2nd	15	70
3rd	25	63
4th	35	58
5th	45	52
6th	55	48
7th	65	42
8th	75	36
9th	85	29
10th	95	18

Table 7: Frequency of respondents in each Rank for each constraints

Constraints	1st Rank	2nd Rank	3rd Rank	4th Rank	5th Rank	6th Rank	7th Rank	8th Rank	9th Rank	10th Rank
High Transport Cost	0	0	0	1	11	4	37	40	27	0
Problem of Climate Change	21	85	8	3	3	0	0	0	0	0
Non-availability of yam in right quality	0	0	0	8	16	78	15	3	0	0
Inadequate Processing Facilities	3	15	81	13	8	0	0	0	0	0
High Cost of Yam	86	6	10	8	10	0	0	0	0	0
High Storage Cost	0	0	0	4	8	7	23	62	16	0
High Wood Cost	0	0	0	0	0	0	0	0	0	120
Unstable Market Price	6	8	14	79	1	7	4	1	0	0
High Labour Cost	0	0	0	0	3	7	22	9	79	0
Poor Distribution Network	4	6	6	5	57	19	17	6	0	0

Table 8: The Product of Frequencies of Rank Occurrences and Gareth Values

Constraints	1st Rank	2nd Rank	3rd Rank	4th Rank	5th Rank	6th Rank	7th Rank	8th Rank	9th Rank	10th Rank	Total Garret Score	Average Score
High transport cost (A)	0	0	0	58	572	192	1554	1440	783	0	4599	38.33
Problem of climate change (B)	1722	5950	504	174	156	0	0	0	0	0	8506	70.88
Non-availability of yam in right quality (C)	0	0	0	464	832	3744	630	108	0	0	5778	48.15

Inadequate processing facilities (D)	246	1050	5103	754	416	0	0	0	0	0	7569	63.08
High cost of yam (E)	7052	420	630	464	520	0	0	0	0	0	9086	75.72
High storage cost (F)	0	0	0	232	416	336	966	2232	464	0	4646	38.72
High wood cost (G)	0	0	0	0	0	0	0	0	0	2160	2160	18.0
Unstable market price (H)	492	560	882	4582	52	336	168	36	0	0	7108	59.23
High labour cost (I)	0	0	0	0	156	336	924	324	2291	0	4031	33.60
Poor distribution network (J)	328	420	378	290	2964	912	714	216	0	0	6222	51.85

Table 9: Summary Table of Identified Constraints by Garetts Ranking Method

Constraints	Average Score	Rank
High Cost of Yam	75.72	1
Poor Weather Condition	70.88	2
Inadequate Processing Facilities	63.08	3
Unstable Market Prices	59.23	4
Poor Distribution Network	51.85	5
Non- availability of yams in right Quality	48.15	6
High Storage Cost	38.72	7
High Transportation Cost	38.33	8
High Labour Cost	33.59	9
High Cost of Wood	18.00	10

CONCLUSION AND RECOMMENDATION

The research indicates that yam processing into flour in the study area is profitable, as confirmed by the values of the Benefit Cost ratio and Return on investment. The average net profit though is relatively low and this is attributable to the fact that processors basically operate on a small scale level. It is also established that the respondents in the study area are relatively technically efficient in their processing endeavors given the technical inputs they have at hand, although they operate below their frontier output (i.e. the maximum possible output). The coefficient of yam tubers, total labour, capital and simple equipment in the technical efficiency model are statistically significant, and thus can be concluded that increasing these inputs will increase technical efficiency in the study area, which in turn would increase their output and hence profitability.

The following recommendations are thus given:

- In order to support yam processors and curb the effect of high cost of dried yam tubers on income, government pricing policies can be enacted to stabilize prices possibly by using a price floor to prevent yam tuber prices from soaring too high in lean seasons

- Use of state of art technologies is highly recommended. So relevant policy bodies should target the provision of modern capital equipment such as grinding and milling machines at affordable price.

- Effort to reduce the reliance of the yam processors on natural elements of weather requires that extension activities focus on training of yam processors on the improved processing methods to enable them use the available resources efficiently and increase productivity. Government could also assist in the provision of technologically improved dryers to the processors.

- Yam processors should be encouraged to form cooperatives to enable them pool their resources together and have advantage of economies of scale. This would enable the yam processors solve the problems relating to high cost of yam and also enable easy procurement of modern processing facilities required to enhance their production endeavors.

- Yam processing into flour is profitable, hence individuals should be encouraged to engage in the enterprise. However, yam processors remain in business so long as yams are produced in plentiful supply by farmers. Thus, policies should be vigorously directed to yam production to make sure that the supply of yams continue to flow. To this end, backward integration is highly recommended.

- Virtually all beneficial actions by processors come to a standstill if funds are not available. Thus, relevant governmental and financial institutions should make fund availability to entrepreneurs a very significant agenda which in turn can encourage many more processors to be involved in large scale production.

REFERENCES

Adewale, O. O., Bukonola, O. B., Ifeoluwa. O. 2014. Changes in nutritional composition, functional and sensory properties of yam flour as a result of presoaking. *Food Science Nutrition* 2(6): 676-681. doi:10.1002/fsn 3.150.

Aigner, D. J., Lovell, C. K., Schmidt. P. 1992. Formulation and estimation of stochastic frontier production models. *J.Econs.,* 6: 21-23.

Akissoe, H. N., Hounhouigan, D. J., Bricas, N., Vernier, P., Nago, C. M., Olorunda, O. A. 2001. Physical, chemical and sensory evaluation of dried yam (*Dioscorea rotundata*) tubers, flour and 'amala', a flour-derived product. *Trop. Sci.* 41(3): 151–155.

Ali, M., Chaudhry, M. A. 1990. Inter-regional farm efficiency in Pakistan's Punjab: a frontier Production function study. *Journal of Agricultural Economics* 41(1): 62-74.

Babajide, J. M., Babajide, S. O., Oyewole, O. B. 2007. Survey of traditional dry-yam slices (Gbodo) processing operations in southwest, Nigeria. *Am.- Eurasian J. Sustain. Agric.* 1(1): 45-49.

Babajide, J. M., Oyewole, O. B., Henshaw, F. O., Babajide, S. O., Olawasantan, F. O. 2006. Effect of local preservatives on quality of traditional dry-yam slices "Gbodo" and its products. *World Journal of Agricultural Sciences* 2(3): 267-273.

Dawang, N. C., Dasbak, A., Matawal. O. M. 2011. Estimates of profitability and technical efficiency of artisanal fishermen. *Asian Journal of Agricultural Sciences* 3(6): 516-523.

Enekwe, C. I., Okwo, I. M., Ordu, M. M. 2013. Financial ratio analysis as a determinant of profitability in Nigerian pharmaceutical industry. *International Journal of Business and Management 8*: 8. doi:10.5539/ijbm.v8n8p107.

Ezekiel, A. A., Fabiyi, Y. L., Oladeebo, J. O., Adetunji, M. O., Adeleke, O. A. 2007. Economics of yam flakes processing and distribution in Ogo-oluwa LGA of Oyo state, Nigeria. *Research Journal of Applied Sciences* 2(9): 970-973.

Food and Agriculture Organisation. 2020. FAOSTAT statistics division of food and Agriculture organisation. Retrieved from http://www.faostat.org.

Fu, R. Y., Kikuno, H., Maruyama, M. 2011. Research on yam production, marketing and consumption of Nupe farmers of Niger state, central Nigeria. *African Journal of Agricultural Research* 6(23): 5301-5313.

Hounhouigan, D. J., Kayode, A. P., Bricas, N., Nago, C. M. 2003. Desirable culinary and sensory characteristics of yams in urban Benin. *Benin Journal of Agric. Sc.* 21(12): 2815-2820.

Kumbhakar, S. C., Lovell, C. A. K. 2000. Stochastic Frontier Analysis. Cambridge University Press, Cambridge, Pp 244.

Meeusen, W., Van den Broeck, J. 1977. Efficiency Estimation from Cobb-Douglas Production Functions with Composed Error. *International Economic Review* 18(2): 435-444. doi:10.2307/2525757.

Olayide, S. O., Heady, E. O. 1982. Introduction to Agricultural Production Economics. Ibadan, Nigeria: Ibadan university press.

Osunde, Z. D. 2008. Minimizing post-harvest losses in yam (Dioscorea spp): Treatment and techniques. In G. L. Robertson & J. R. Lupien (EDS.), *using food science and technology to improve nutrition and promote national development* (Chapter 12). Minna: International union of food science & technology.

Sahel capital (Mauritius) limited. Unlocking opportunities in yam chain (Volume 3). West Africa: Sahel Newsletter.

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