



**ECONOMIC ANALYSIS OF PADDY RICE PROCESSING IN WUKARI LOCAL
GOVERNMENT AREA, TARABA STATE, NIGERIA**

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ABSTRACT

The study assessed the economics of paddy rice processing in Wukari Local Government Area, Taraba State, Nigeria. The ban on the importation of some major staples left Nigerians with no option than to consider local rice as a necessary alternative, requiring it in processed form. A multi staged sampling procedure was adopted in arriving at the 80 respondents used for the study. Data were collected through the use of structured questionnaire. Data were analyzed using Gross Margin Analysis, multiple regression and Likert scale. Results showed that rice was a profitable business with an average revenue of ₦695, 082.48 per month of processing using an average input cost of ₦569, 846.23 and earning an average gross margin of ₦125, 236.58. Return per naira invested gave a ratio of 0.22, implying that for every naira invested 22k kobo was returned. Four socioeconomic factors were found to influence rice processing in the study area. These were household size (54.462) at $P \leq 0.1$, age (12.621) at $P \leq 0.5$ and level of education and processing experience at $P \leq 0.01$. The regression results for the determinants of rice processing, on the other hand, revealed that volume of paddy rice processed, drums, firewood, water and fuel were all significant at $P \leq 0.01$. Unpredictable weather (particularly during rainy season), pests and poor marketing ranked first, second and third, respectively as challenges to rice processing in the study area. It was therefore concluded that rice processing was a profitable business. It is recommended that processes be supported financially to improve upon the volume of their activity.

Keywords: Analysis, Paddy Rice, Processing, Taraba, Wukari,

INTRODUCTION

Rice (*Oryza sativa*) is valued as the most important staple food for over half of the world's population and serves as food for about 3.5 billion people worldwide (International Rice Research Institute, IRRI, 2013). It is the fundamental food for about half of the world's population, supplying about 20% of the calories consumed worldwide (Kubo and Purevdoj, 2004). Rice provides up to 50% of dietary caloric supply for millions living in poverty in Asia and is therefore, critical for food security. Record has shown that there has been an increase in the production of rice since the start of green revolution. The Green Revolution between the 1940s and the late 1960s resulted in an increase in agricultural production among the developing countries, mainly achieved through the transfer of series of research and technology initiatives (Food and Agricultural Organization, FAO, 2006). While population of low-income countries increased by about 90% between 1996 and 2000, the production of paddy rice during the same period increased by 130%. Approximately 480 million metric tons of milled rice is produced annually where China and India alone accounts for about 50% of rice grown and consumed (Muthayya *et al.*, 2014).

Rice processing has been playing a crucial role as major source of income and employment for Nigerians. Paddy rice is the end product of the harvesting and threshing of rice grains. The paddy rice is made up of the outer husk layer, germ and bran layer and the endosperm. Milling



process can be undertaken to remove the outer husk layer to yield brown or white rice kernels. In most parts of the world, rice is milled by farmers in thousands of small and medium sized mills located near their farms and then stored mostly for their own consumption. Small land-holding farmers in rural areas produce enough rice amounting to a year's stock for their own use. Other farmers with medium sized farms sell their produce directly to local mills. Due to lack of fair-trade programmes in Nigeria, farmers who do not have access to mills as a result of poor road conditions or high cost of transportation are forced to sell their produce at the offered rate. This in return has led to many farmers disposing their products with very little or no gain by ensuring that at least, a part of their capital is recovered.

Rice is an integral part of a balanced diet as it can provide nutrients without having any negative impacts on the health. The milling process of rice removes the husk, bran and germ thus increasing its shelf life. Although, this process removes much of its nutritional content including fibre, vitamins and mineral, rice is artificially fortified with nutrients to counteract this process (Corey, 2018). Most varieties of rice contain a high amount of carbohydrate and protein. The fibre content varies according to its different types. According to the United States Department of Agriculture (USDA) National Nutrient Database, it is also rich in minerals like calcium, iron, selenium, sodium, potassium, manganese and copper. The vitamins included in it are niacin - which helps to boost brain function and lower cholesterol level in the body, pantothenic acid - that helps to alleviate conditions such as asthma, hair loss, anxiety, allergies, respiratory disorders and heart problems and thiamin - which helps the body cells easily convert carbohydrates to energy (Meenakshi, 2021).

The traditional method of processing rice paddy involves soaking of the paddy in water for 2-3 days to soften the kernel, followed by steaming of the soaked paddy for 5-10 minutes and drying in the sun, after which the dried paddy is pounded in a mortar and pestle deice to remove the husk or use of simple machines for deshelling /milling. Then the grain is cleaned using a winnowing basket. However, in modern method of processing paddy, the rough rice is first cleaned to remove contaminants and the husks are then removed by shellers. The rice and hulls are separated by aspiration and any paddy remaining with the rice is removed in a paddy separator.

One of the problems of processed Nigerian rice is the appearance of the final milled rice which is often discoloured with stones, sands and other contaminants (Johnson and Masias, 2016). The locally milled rice is often said to be of low quality due to the presence of high level of impurities, and the mixture of whole and broken grains (Demont and Neven, 2013). Another problem associated to Nigerian rice is the offensive odour given out. The causes of the preference of imported rice to home grown rice are the appearance, swelling capacity, taste, homogeneity and its minimal use of ingredients. These differences are the main determinants of the price between the home-grown rice and the imported rice (Cadoni and Angelucci, 2013). This being the case, improving the quality, use of good bagging and branding, improving the organoleptic properties of home-grown rice will give it a higher chance of competing with imported rice. Furthermore, in order to benefit from the best market conditions, the value chain must be capable of processing and destoning the locally produced rice so that it adheres to the quality criteria of the consumers (Cadilhon and Even, 2012).

Due to the rise in rice demand, to reduce the foreign exchange loss and the influence of unstable global market on rice prices, Nigerian government encourages the efforts toward attaining rice self-sufficiency and is motivating farmers to produce better paddy by ensuring they plant good seed and follow proper way of cultivation. We expect better paddy to be produced by farmers and



this will result into good quality rice. However, if the paddy is not processed well by the local rice millers, local rice will not be accepted by the affluent modern consumers and consequently cannot compete with the imported rice and will not meet the increasing demand for rice. Hence, this study focuses on local rice milling industry in Nigeria and explores how rice quality can be controlled by considering the miller's decision to invest in new technology. The goal of this paper is to clarify whether this rather positive development is financially worthwhile thus ensuring food security among the local rice processors. Thus, this study will belong to the growing body of empirical literature on the impact of technology adoption in sub-Saharan Africa (Pan *et al.*, 2018). This study, therefore, intends to estimate the profitability of rice processing, determine the socioeconomic factors influencing rice processing, the input factors influencing rice processing and identify the problems associated with rice processing in the study area.

MAERIALS AND METHOD

The Study Area

The research setting is Wukari Local Government Area of the Taraba state. Wukari is a Local Government Area in Taraba State, and it was created in 1976. Its headquarters is in the town of Wukari on the A4 highway. The Local Government Area is bordered to the North by Ibi Local Government Area, to East by Gassol Local Government Area, to the South by Donga Local Government Area and to the West by Ukum Local Government Area of Benue State. The Local Government is traceable at Latitudes 70 and 5°N of the Equator and between Longitude 90 and 47° East of the Greenwich Meridian. Wukari Local Government Area covers an area of approximately 4,308 square kilometers and has a total population of 241,506 with 10 wards (NPC, 2006) and estimated population of 337,163.09 from a growth rate of 2.6% by 2019.

The Local Government experiences a tropical climate while the local vegetation is the guinea savannah type. It is marked by dry and rain seasons. The rain season commences in April, and lasts till October. While the dry season lasts from November to March. The harmattan; dry, cold and dusty wind is the driest period and occurs from the months of December to February with humidity put at 13per cent. The wet season starts in April and last up to October of every year. The rainfall pattern support rain fed rice production while the dry season with abundant sun shines enhances the sun drying of rice for milling. The area also has high temperature ranging from 27% to 32% respectively. The major ethnic groups in the area are the Jukun, Tiv, Ichen, Kuteb, Chamber, Fulani and Hausa. But Hausa, English and Jukun languages are widely spoken in the area. On the economic sense, Wukari LGA has a viable agricultural sector with the area known for the cultivation of a variety of crops such as yams, cassava and rice.

Sampling Technique and Sample Size

A Multistage sampling procedure was used in arriving at the 80 respondents selected for the study. In the first stage, four (4) wards were purposely selected due to the concentration of rice processors. Secondly, two communities (2) were selected from each of the four (4) selected wards, totaling eight. In the last stage, 10 rice processors were selected using snowball sampling technique, resulting in eighty respondents for the study.

Method of Data Analyses

Data were analyzed using gross margin analysis, multiple regression and three-point Likert scale.

Model Specification

Descriptive statistic

The descriptive tools include tables, the construction of simple frequency distribution and measures of central tendency, particularly, mean, percentage and frequency was used to describe the socioeconomic characteristics of the farmer households.

Gross margin analysis

$$GM = GI - TC \quad \dots(1)$$

Where;

GM=Gross margin (₦)

GI=Gross Income (₦)

TC=Total Costs (₦)

Return per naira invested (RNI)

$$RNI = \frac{\text{Gross Margin (GM)}}{\text{Total Variable Costs (TVC)}} \times \frac{100}{1} \quad \dots(2)$$

Multiple regression

Socioeconomic factors influencing rice processing

$$Y = b_0 + b_1Z_1 + b_2Z_2 + b_3Z_3 + b_4Z_4 + b_5Z_5 + b_6Z_6 + e_i \quad \dots(3)$$

Where,

Z_1 = Age in years Z_2 = Gender (0=Male, 1=Female) Z_3 = Educational Level in years

Z_4 = Household size Z_5 = Marital Status (1=Household head, 0=Not a household head)

Z_6 =Experience in years e_i =Error term. B_0 =constant (b_1-b_6) =coefficients of independent variables

Determinants of rice processing

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + e_i \quad \dots(4)$$

Where;

Y = Processed rice in Kg

B_0 = Constant

X_1 = Padded rice in Kg X_2 = Number of drums X_3 = Number of firewood

X_4 = Number of Labour X_5 = Litres of water/day X_6 = Litres of fuel/day

The explicit forms represented are as follows:

Linear

$$Y = b_0 + b_1Z_1 + b_2Z_2 + b_3Z_3 + b_4Z_4 + b_5Z_5 + b_6Z_6 + e_i \quad \dots(5)$$

Double Log

$$\log Z = b_0 + b_1 \log Z_1 + b_2 \log Z_2 + b_3 \log Z_3 + b_4 \log Z_4 + b_5 \log Z_5 + b_6 \log Z_6 + e_i \quad \dots(6)$$

Semi Log

$$Z = b_0 + b_1 \log Z_1 + b_2 \log Z_2 + b_3 \log Z_3 + b_4 \log Z_4 + b_5 \log Z_5 + b_6 \log Z_6 + e_i \quad \dots(7)$$

Likert scale

Likert scale is a rating scale used to indicate the respondent's degree of agreement or disagreement with a variety of statement about some attitude, object, person or event (Hamed, 2019). This was used to determine the constraints associated with rice processing in the study area.

The likert scaling type measuring instrument is represented by the formula:

$$X = \frac{\sum x}{n} \quad \dots(8)$$

Where X = mean score, $\sum$ = summation sign, n = No of respondents, x = No of nominal value of each response category

$$X = \frac{3 + 2 + 1}{3} = 2$$

RESULTS AND DISCUSSION

Profitability of Rice Processing in Wukari Local Government Area

The major reason for engaging in rice processing enterprise by the processors of Wukari Local Government Area is to make profit. The amount spent on the purchase of inputs and the amount generated at the end of production cycle is used to determine the returns obtained by the processors.

Cost of Inputs Incurred during Rice Processing in the study area

The cost of purchase of paddy accounts for ₦507,503.10 which represents about 89% of the total variable cost and it accounts for the highest percentage of variable cost incurred while processing. This implies that paddy is the most important input required for carrying out rice processing activity in the study area. The cost of transportation during the processing period accounts for ₦1,150.78 which represents 0.20% of the total variable cost. This implies that since majority of the rice processors operate on a small-scale level, their outputs do not need special transportation facilities. Also, the large-scale rice processors have the ability to spread cost over their large volume of output, thus, reducing the cost of transportation.

The cost incurred on polishing for all farmers is ₦27,847.53 and it accounts for 4.89% of the total variable cost. Pre-milling cost is incurred while carrying out Parboiling activities which involves Soaking, Steaming, Drying, Spreading and Cleaning of the paddy. The total cost incurred for pre-milling for all processors is ₦9,418.44 and it accounts for about 2% of the total variable cost. The total cost incurred on firewood for all farmers was ₦5,572.50 per processing cycle and it accounted for 1.00% of the total variable cost. Large scale processors purchase their firewood from firewood dealers and suppliers

The total costs incurred on destoning, grading, water, winnowing and husking are ₦4,967.19, ₦4,246.91, ₦3,869.94, ₦3,028.01 and ₦2,241.81 and these account for 0.87%, 0.75%, 0.68%, 0.53 and 0.32% respectively.

Gross Margin

Table 1 revealed that rice processors earned a gross margin of ₦112,915.90 per processing cycle implying that rice processing is profitable in Wukari Local Government Area of Taraba state. The Gross Margin represents the difference between the total returns and the total variable cost.

The return per naira invested was estimated to be ₦0.22, which implies that for every ₦1 expended, the processor is expected to earn ₦0.22 returns. This indicates that rice processing is a profitable enterprise in the study area. This result conforms with the findings obtained by Bose *et al.* (2020)., in a study carried out to consider the cost and returns of small-scale paddy rice processing and marketing in Dass local government area, Bauchi state which posited that for every naira invested, the processor realized a return of ₦0.27. A similar result was obtained by Ango *et al.* (2018), which revealed that the processors realized ₦0.27 for every naira invested.

Table 1: Gross margin of rice processors

Table 11: Gross Margin of Rice processors				
	Item		Cost	Percentage
A	Variable Cost			
	Firewood	1 bundle	5,572.50	1.00
	Water	400 litres	3,869.94	0.68
	Paddy Rice	8 bags	507,503.10	89.06
	Pre-milling		9,418.44	1.65
	Husking		2,241.81	0.32
	Grading		4,246.91	0.75
	Polishing		27,847.53	4.89
	Destoning		4,967.19	0.87
	Winnowing		3,028.01	0.53
	Transport		1,150.78	0.20
	Total Variable Cost		569,846.23	
B	Total Revenue		695,082.81	
C	Gross Margin (GM) = TR-TVC		125,236.58	
D	Return per naira invested (GM/TVC)		0.22	

Source: Field Survey (2025)

Socioeconomic Factors Influencing Rice Processing in the Study area

The social attributes of processors and how it affects their level of productivity and profitability is examined to determine which factor is favorable for increased production of processed rice in the study area. Table 2 explains how these factors relate to the output level.

The results of the socioeconomic factors influencing rice processing in Wukari Local Government Area revealed that the number of significant variables were four, and significant F statistics variable which is significant at 1%. The dependent variable was the total output of finished rice in kilogramme of rice processed per individual respondents. Four regression models were tried, namely; linear, semi-log, exponential and double log. Among all models, the semi-log form was the best fit and was adopted regard to sign of the coefficients and number of significant variables in agreement with a priori expectations. The F-Value was high (143.129) and significant at 1% level indicating best fit of the model adopted. The R^2 for the Semi-log model (0.92) indicated that the explanatory variables investigated highly accounted for about 92% of variations or changes in the dependent variables.

The result shows that education and experience were positive and significant at 1% level of significance, age was positive and significant at 5% level of significance, while household size was also positive and significant at 10% level of significance. However, gender and marital status had a negative relationship with the level of output and were not significant factors affecting rice processing at conventional level in the study area.

Education was positive and significant at 1% level with a coefficient of 0.258. This implies that an educated rice processor will have the opportunity of producing an additional 0.258 kilogram of processed rice than his uneducated counterpart. This is as a result of the fact that an educated individual has higher chances of easily understanding the activities involved and are easily open to innovations which will help increase their productivity.

Experience was seen to have a positive relationship with the level of output at a significance level of 1% and a coefficient of 0.761. This means that an increase in the number of years of

experience will give an additional 0.761 kilogram of processed rice. This is because experience comes with expertise and an experienced processor is likely to make lesser mistakes that may result into losses than an unexperienced processor.

Age was positive and significant at 5% level with a coefficient of 0.132. This depicts that for any additional age of respondents; there will be additional 0.132 kilogram of processed rice. This means, increase in age will increase output of finished rice because age grows with experience and practices which will enhance specialization and efficiency.

Household size has a positive relationship with the level of output and is significant at 10% level and has a coefficient of 0.138. This means that an additional member joining the household will result into obtaining additional 0.138 kilogram of processed rice. This implies that larger household have the opportunity of involving the members in taking part in the processing activities, thus increasing efficiency and reducing cost. The amount saved can be used to purchase more inputs to ensure higher level of output.

This result is in conformity with the findings of Damola (2010) which stated that household size and experience were important factors influencing the output of rice processing. Uhuegbulem *et al.* (2020) also obtained a similar result which posited that experience, household size, education were significant factors, however the coefficients of age and gender were not significant. A study carried out by Ango *et al.* (2018) however gives a disagreeing result which stated that household size has a negative relationship with the level of output but also significant at 10% level of significance is the only significant socioeconomic factor affecting rice processing activities.

Table 2: Socioeconomic factors influencing rice processing

Items	Coefficient	Std. Error	t-value
Constant	-1442.634	544.618	-2.649
Age	12.621	6.166	2.047**
Gender	-65.974	256.542	-0.257
Education	403.045	114.311	3.526***
Household Size	54.462	28.238	1.929*
Marital Status	-169.214	272.116	-0.622
Experience	194.917	22.329	8.729***
F-Value	143.129***		
R-Square (R ²)	0.922 (92.2%)		

Source: Field survey (2025) ***Significant at 1% level, ** at 5% level, * at 10% level

Input Factors Influencing Rice Processing in the Study area

Various inputs are necessary to carry out rice processing. The impacts of each input and the level at which it reduces or increases the level of output is thoroughly examined to identify which inputs will ensure more profit than the other.

The regression result of the functional forms estimated shows that the coefficient in the Semi-log model was the best as it was observed from the f-values as well as the appropriateness of their signs with relation to a *priori* expectations and the coefficient of multiple determination R². The R² for the Semi-log model (0.863) indicated that the explanatory variables investigated highly accounted for about 86% of variations or changes in the dependent variables.

The regression coefficient of Paddy rice is found to be statistically significant at 1% level of significance which implies that there is positive relationship existing between paddy rice and the output of rice processors. Invariably, as the quantity of paddy rice increases, the productivity of rice processors in the increases. This implies that for every increase in the kg of paddy rice,

there will an additional increase of 0.3kg in the output. The result disagrees with the study of that revealed that paddy is not a significant factor affecting rice processing output in Niger state.

Number of Drums is found to be significant at 1% and this implies that there is a positive relationship between the number of drums used for parboiling process and the resulting output. The quantity of rice increases with an increase in the number of drums used for steaming. An additional drum used to soak and steam paddy rice will increase the output by additional 1.3kg. A study carried out by Muochebe *et al.* (2020) revealed that while parboiling, the paddy at the base of the drum might be partially cooked and those at the top might be improperly parboiled. The use of additional drums might help reduce the effect.

Firewood is seen to be significant at 1% showing that the relationship between the bundles of firewood used and the level of output is positive. This means that an additional bundle of firewood added to the level of input. The result implies that every additional bundle of firewood used up during the production process will add an additional 22kg to the output. This study conforms with a survey carried out by Usman *et al.* on the comparative economic analysis of rice parboiling systems in Niger state, Nigeria which shows that firewood is a factor that is significant at 1% level although, there is a negative relationship between the level of output and the quantity of firewood used.

The coefficient of water used for the production process showed a positive relationship with the output, that is, additional litre of water used during production will increase the output by about 23kg. This implies that water is an important factor in the production process and it contributes greatly to the productivity of the rice mills.

The amount of fuel used up during processing has a positive relationship with the level of output produced. This is due to the fact most activities in rice processing are carried out using machines and they are fueled to ensure the smooth running of the operation. According to the study, an additional litre of fuel used up during processing will increase the level of output by about 0.4kg.

The result shows that quantity of paddy rice, number of drums used, quantity of firewood used, litres of water used and the litres of fuel used all have positive relationship with the level of productivity and are significantly related at 1% level. This means that increasing the level of these inputs used will increase the level of processed rice that will be obtained.

Table 3: Input factors influencing rice processing

Items	Coefficient	Std. Error	t-value
Constant	5.928	0.178	33.357***
Paddy Rice	4.745	0.895	4.247***
Drums	0.579	0.219	2.640***
Fire Wood	1.159	0.163	7.111***
Labour	0.004	0.004	1.114
Water	0.006	0.001	7.724***
Fuel	0.078	0.015	5.287***
F-Value	76.545***		
R-Square (R ²)	0.863 (86.3%)		

Source: Field Survey (2025) ***Significant at 1% level

Constraints of Rice Processing in the Study

In the course of carrying out rice processing activities, various problems are encountered by the rice processors. Some of the problems identified in the study area and their order of gravity

are explained. Unpredictable weather (particularly during rainy season), pests and poor marketing ranked first, second and third, respectively as challenges to rice processing in the study area.

Table 4: Constraints faced by rice processors in the study area

Items	Scale	Rank
Unpredictable Weather	2.68	1 st
Pests	2.64	2 nd
Poor Marketing	2.61	3 rd
High Level of Impurities	2.55	4 th
Lack of Storage Facilities	2.43	5 th
Labour Intensive	2.36	6 th
High Level of Broken Grains	2.20	7 th
Offensive Odour	1.90	8 th
Spoilage	1.88	9 th
Time Consuming	1.86	10 th
High Level of Contamination	1.62	11 th

Source: Field survey (2025)

CONCLUSION AND RECOMMENDATIONS

It is concluded that most inputs and socioeconomic characteristics had either positive influence on paddy rice processing. Also, based on the findings of this study, it can be conclusively said that rice processing is a profitable enterprise in Wukari Local Government of Taraba State with a return of ₦0.22 on every naira invested in the enterprise at the prevailing input and output price as at the time of this study. The result further revealed that profitability can be increased if input usage will be adjusted to increase their efficiency and productivity.

Based on the findings of this study, the following recommendations were made:

- Government should provide mechanical driers to rice processors at subsidized rate to ensure that processing activities can be carried out irrespective of the time of the day or season of the year.
- Government through soft loan to small and medium scale should consider encouraging local rice processors so as to boost their business by accessing milling machines that can be used to process rice.
- The processors should be enlightened about how to increase efficiency by reducing cost and increasing the level of output.

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