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Economic Analysis of Rice Processing by Women in Navrongo Municipality of Upper East Region of Ghana

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Abstract

The study economically analyses rice processing by women in the Navrongo Municipality in the Upper East Region of Ghana. The objectives were to determine the profitability of rice processing, estimate the efficiency of the value addition by the women and identify the factors influencing the profit. Primary data was collected from 65 randomly selected women rice processors using interview schedule. The study revealed that processing 93kg bag paddy rice valued averagely at GhȻ273.42 would yield output of 30 "alonkas" of milled rice, 1.02 "alonkas" broken milled rice and 0.34 bag husk which were sold at GhȻ364.92. The net-income from that one bag was GhȻ30.10. The study also indicated that, factors such as total income, educational level of women and total cost of processing significantly influenced the profit of women.

Keywords: Rice; Processing; Efficiency; Profitability.

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.1. Introduction

The agriculture sector in 2013 has seen an improvement over the 2012 records. Its growth rate of 2.3% in 2012 went up to 5.2% in 2013 yet its contribution to Gross Domestic Product (GDP) continues to decline with its share reducing from 23% in 2012 to 22% in 2013. The provision of employment in the agriculture sector helps in the alleviation poverty, enhances food security as well as improves the standard of living by increasing income level of the rural people. Currently is estimated that agriculture employs about 50% of total Ghana's population down from over 60% Ghanaians in the past. Statistical Service estimates in 2000 revealed that 56.2% women in Ghana live in the rural areas and depend on agriculture for their livelihood. It employs 68.3% of the women population in the sector [3]. It is a common practice to see the women in northern Ghana work from dawn to dust and in contrast with men have little time for their leisure. Rice (*Oryza sativa L.*) is a crop that is produced and processed by women in the rural areas of the Upper East Region for their livelihood. The cultivation is mainly on smaller holdings basis where about 90% of the farm holdings are less than 2ha in size [9]. Despite the growing interest of women in agriculture, women's access to and control over land can potentially lead to gender equality alongside addressing material deprivation [10]. The exclusion of women from access to and control over assets, whether land, technology or credit greatly lowers growth [1].

Besides rain fed upland rice that is mostly produced by the people in swampy areas, the production of irrigated paddy rice in the Navrongo Municipality occurs around the Tono irrigation project situated in the south-west of Navrongo town in the Upper East Region of Ghana. After production, the grain is normally processed by women and sold in and around towns in Navrongo and other parts of the country. Rice processing is a combination of several operations to convert paddy into well milled silky-white rice which has superior cooking quality attributes. There is a growing demand for the consumption of local rice in Ghana. According to MoFA, [8], the yearly per capita consumption of rice is increasing rapidly, from 17.5 kg in 1999-2001 to 22.4 kg in 2002-2004 and 24 kg in 2010-2011. This consumption demand is estimated to grow at an annual growth rate of 18.4 percent [7]. In 2011alone, Ghana total consumption of milled rice was 912,000MT, out of which 309,000MT was produced locally whilst 558000MT was imported [2]. The increase in demand is because rice was changed from being an elitist to staple food for many Ghanaians. Many people prepared rice because of its relative ease in terms of storage and preparation. The processing of rice by women in Navrongo is a well-known business but little work is done on the economics analysis to determine the profitability or otherwise of the industry. The investigation was carried out mainly to economically analyze the local rice processing activities of the women to determine its profitability in the Navrongo Municipality. The study specifically tries to:

1. Determine the profitability of rice processing by women in the Navrongo Municipality.
2. Estimate the efficiency of the value addition by the women in the rice processing.
3. Identify factors affecting the profitability rice processing business in the study area.

2. Materials and Method

The study employed the multistage stratified purposive sampling techniques. With this, a proportionate selection of four communities and thirteen (13) sub-communities whose main business is rice processing and

sixty five (65) women who process rice and sell in the Municipality were used in the study. Primary sources of data obtained using structure questionnaires were administered on the women. The input-output data were collected on each woman. The inputs included the total variable cost (the cost per 100kg bag of paddy rice, cost of fire wood, labour, milling, water, and transportation) and total fixed cost (depreciated cost for basins, drums, 'alonka', sacks etc). The output on the other hand included Information on quantity of milled rice, broken rice and rice husk. Also obtained were household characteristics such as age, family size, marital status, educational level. The services of students from ecological agriculture department of the Bolgatanga polytechnic who were natives in the Municipality were employed to facilitate in the data collection.

2.1 Gross Processing Analysis

This is a method employed to estimate the cost and return for processing rice per bag. The method was used by [4] and [5]. The gross processing is defined:

$$NPI = GPI - TC \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad \text{(i)}$$

$$NPI = GR(Q_{MR} \times P_A + Q_{RB} \times P_B + Q_{RH} \times P_H - TC(TFC + TVC) \quad \ldots \quad \text{(ii)}$$

Where:

NFI =Net Processing Income

GPI = Gross Processing Income

TC = Total Cost

GR = Gross Revenue (from milled rice and rice bran)

Q_{MR} = Quantity of milled rice (number of 'alonkas')

P_A = Price per an alonka or bowl of milled rice

Q_{RB} =Quantity of broken rice from milling paddy

P_B = Price of broken rice from milling

Q_{RH} = Quantity of rice husk per 93kg bag paddy rice

P_H = Price of rice husk per 93kg bag paddy rice

TVC = Total Variable Cost includes costs of paddy rice, fire wood, packaging, labour, milling, water and transportation.

GR = Gross Revenue or Gross Receipts is the total output multiplied by the price per bowl (an alonka) of rice

TFC= Total Fixed Cost include cost of depreciation on fixed assets used in the parboiling, processing and marketing of processed rice. These include basins, drums, alonkas, sacks, drying polythene etc. the straight line depreciation method was used, that is;

$$D = \frac{(PV - SV)}{L} \quad \text{……..} \quad \text{(iii)}$$

Where;

D = depreciated value of the asset

PV = is the asset's present value (ie. its expected future replacement cost at the time of analysis)

SV = is its expected salvage or residual value at the end of its useful life

L = is its expected total years of life.

Rice processing and marketing is said to be profitable if the GPI is greater that total cost of paddy, processing and marketing

2.2 Determination of Efficiency and Value Added

Value added is a process of increasing the economic value of a commodity. It involves the cost of purchasing transformed paddy or milled rice less cost of paddy or milled rice in its untransformed form. Transformation involves parboiling which is defined as the hydrothermal treatment of paddy rice before milling. The merit of the parboiling process comes from the gelatinization of rice starch and hardening of rice kernel that reduces breakages during milling. It involves first soaking the rice in cold or lukewarm water to increase its moisture content. The rice is then steamed to attain partial gelatinization. The next is drying of the paddy to save the moisture content for storage and milling. Husking is carried out to remove the bran from brown kernel.

It is expressed as:

$$VA = C_{PT} - C_{PU} \quad \text{……..} \quad \text{(iv)}$$

Where:

VA= Value Added

C_{PT} =Cost of purchasing transformed paddy/milled rice

C_{PU} = Cost of paddy/milled rice in its untransformed form

Efficiency is a measure of the ratio of output (Y) per unit input(X). Following this, a measure of efficiency was used to estimate the most efficient services provided along the value chain in the Navrongo municipality.

$$Efficiency = \frac{valueadded}{\cos t} \times 100 \quad \text{(v)}$$

Processing = parboiling + milling operations

2.3 Factors Affecting the Profit of Women Rice Processors

Model specification

To investigate the relationship between profit and socio-economic factors affecting profit, a multiple regression analysis using the Ordinary Least Square (OLS) was employed. The OLS is expressed as:

$$Y = \beta_0 + \beta_i X_i + e_i \quad \text{(vi)}$$

Where Y is the dependent variable which represents profit obtained by women from rice processing, β_0 is the intercepts, β_i is regression coefficients, and e_i is the stochastic error term. The empirical model was given as:

$$prfit = (inc, age, edu, fmlys, tc, e_i)$$

Where:

$prfit$ = profit of women from processed rice (Gh₵)

inc = income (Gh₵)

age = age of respondent (number of years)

edu = educational level of respondent (number of years spent in school)

$fmlys$ = family size of the respondent (number of persons)

tc = total cost in processing rice (Gh₵)

e_i = stochastic error term

Two functional forms of the above were tried viz, semi-log and double-log. The explicit forms of the functional forms were as follows:

Semi-logarithm

$$prfit = b_0 + \log b_1 inc + b_2 \log age + b_3 \log edu + b_4 \log fmlys + b_5 \log tc + e_i \quad \text{..... (vii)}$$

Double-logarithm

$$\log prfit = b_0 + \log b_1 inc + b_2 \log age + b_3 \log edu + b_4 \log fmlys + b_5 \log tc + e_i \quad \text{..... (viii)}$$

The model was estimated using the ordinary least squares method

3. Results and Discussion

3.1 The Activities of Rice Processing in the Study Area

Parboiling is the main activity in the rice processing involving the hydrothermal treatment of paddy before milling. The process required soak paddy in cold or lukewarm water to increase the moisture content. It is then steamed to achieve gelatinization before it is dried to save the moisture content for storage and milling. Husking and milling follow concurrently in a rice machine to remove the bran from the brown kernel.

The most common varieties of rice processed included both the 'traditional' rice called Oryza glaberrima (brown rice), and Oryza sativa (white rice). The study revealed that various landraces of oryza sativa in the area included rita 8, rita 9, habija, 90 days, perfume etc. The prices for the processed rice depended on how 'wholly' or 'broken' the grains were as well as the colour appearance. The white grains were preferred.

3.2 Profitability of Rice Processing By Women

The analysis of the results in the table 1 below shows that a 93kg bag of paddy rice valued averagely at Gh₵ 273.42 would yield an average quantity of 30 alonkas (bowls) of milled rice had a market value of Gh₵ 345.00 at Gh₵ 11.50 per an alonka. Besides, other revenue accrued to the rice processor includes, 1.02 'alonka' of broken rice valued at Gh₵ 9.74 and 0.34 bag of rice husk at a cost of Gh₵ 10.18. The overall total revenue from processing 93kg bag paddy rice stood at Gh₵ 364.92.

The study also revealed a sum total cost of Gh₵ 334.82 which came from the cost of paddy rice Gh₵ 273.42 (81.66%), firewood Gh₵ 15.35(4.58%), water Gh₵ 3.50 (1.04%), transportation Gh₵ 7.70 (2.29%), milling Gh₵ 7.00 (2.09%), labour Gh₵ 6.92 (2.06%) and other cost such as drying, winnowing and marketing Gh₵ 19.62 (5.86%). The total fixed cost included the depreciation on the fixed assets such as basins, drums, alonkas (bowls used for measuring to sell). The study therefore showed a profit of Gh₵ 30.10 from processing a 93kg bag of paddy rice in the study area.

Table 1: Descriptive Statistics of Cost and Returns in Rice Processing in the Study Area $1.00 = GhȻ3.89

Cost/Returns	Unit	Quantity	Cost Per Unit	Total Cost	Percentage
i.Paddy rice (bag)	Kg	93	2.94	273.42	81.66
ii.Firewood	Bundle	34.11	0.45	15.35	4.58
iii.Water	Litre	104	0.0336	3.50	1.04
iv.Transportation	GhȻ	93	0.0883	7.70	2.29
v.Milling	GhȻ	93	0.075	7.00	2.09
vi.Labour	Man day	1.28	5.41	6.92	2.06
vii. Other cost(drying, winnowing, and marketing)	-	-	-	19.62	5.86
A.Total Varible Cost(TVC)				333.49	99.58
B.Total Fixed Cost (TFC)					
Depreciation of Fixed Assets	GHȻ	-	-	1.33	0.02
C. Total Cost (TVC+TFC)	**GHȻ**	**-**	**-**	**334.82**	**100**
D. Revenue					
i. Revenue from milled rice	Alonka (bowl)	30	11.50	345.00	94.54
ii. Revenue from broken milled rice	Alonka (bowl)	1.02	9.55	9.74	2.67
iii. Revenue from husk	Bag	0.34	29.94	10.18	2.78
F. Gross Revenue(D_i + D_{ii}+ D_{iii})	**GHȻ**	**-**	**-**	**364.92**	**100**
Profit(F-C)	GHȻ	-	-	30.10	-

Source: Analysis of Field Data, 2015

3.3 Multiple regressions on factors influencing profit by rice processors

Semi-Log

The table below depicts the summary of the results obtained from both the semi-log and double –log of the multiple regressions. On the semi-log, the coefficient of determination R^2 was 0.94 meaning that 94% of the variation in the profit obtained from rice procession was explained by the identified factors in the model. The F-statistic was observed to be significant at 1%, which means that all the explanatory variables jointly had impact

on the profit. As indicated in the results, income, educational level and total cost were found to be significant. Income was significant at 1% with a positive sign which means that, keeping other factors constant, as the income of the women processor increase, their profit goes up. Again, total cost was found to be significant at 1% with a negative sign which means that, keeping other factors constant, as the total cost increases, the profit realized decreases. Educational level was also significant at 5% with a negative sign contrary to the findings of [6] which shows that the literate women perhaps did not engage in the rice processing as a full-time business in the study area. They perhaps had other engagements like 'white colour' jobs and petty trading among others.

Double-Log

As shown in table 2, the double-log coefficient of determination R^2 was 61 meaning that 61% of the variation in the profit obtained from rice processing was explained by the variables in the model. The F-statistic obtained was significant at 1%, which means that all the explanatory variables jointly influenced the profit of the women. As indicated in the results, income and total cost were found to be significant. Income was significant at 1% with a positive sign which means that, holding other factors constant, as the income of the women processor increase, their profit increase. Again, total cost was found to be significant at 1% with a negative sign which means that as the total cost increases, the profit falls. This confirms the findings by Ibitoye *et al,* (2014).

Table 2: Multiple Regression Analysis of Factors Influencing Rice Processing

Variable	Semi-Log	Double-Log
Income	1395(26.27)***	7.125(6.65)***
Age	-31.58(-0.71)	0.557(0.66)
Educational level	32.54(2.06)**	-0.561(-1.79)
Family size	-0.05(-0.00)	-0.089(0.21)
Total cost	-1164.67(-21.35)***	-5.59(-5.36)***
Constant	-1536(-9.25)	-9.139(-2.78)
R^2	0.94	0.61
Adjusted R^2	0.93	0.56
F-Value	186***	13.46***

Figures in parenthesis are t-ratio, ***=significant at 1%, **=significant at 5%, *=significant at 10% levels. Source: Analysis of Field Data, 2015

3.4 Determination of Efficiency and Value Addition

Following equation 4, the valued added (V_A) from the processing of rice is equal to cost of transformed rice (C_{PT}) minus cost of untransformed rice (C_{PU}). However, the value of the transformed rice can be obtained by adding the value of the clean rice, GhȻ345.00 to the broken rice, GhȻ9.74 to arrive at GhȻ354.74. Again, the value of the untransformed rice (C_{PU}) is GhȻ273.42. The value added for processing the rice is therefore given as:

GhȻ354.74- GhȻ273.42 = GhȻ81.32

Therefore, the percentage of processing efficiency is 132.4% as shown below as:

$$\frac{81.32}{61.42} \times 100 = 132.4\%$$

4. Conclusions and Recommendations

Rice processing in the Navrongo Municipality of the Upper East Region of Ghana was found to be profitable. The study revealed that processing a 93kg paddy/untransformed rice yields a profit of GhȻ 30.10 after the sales of the milled rice and the husk. The factors that were found to be significant and influenced the profit were total income accrued from the sale of the milled rice, the educational level of the women, as well as the total cost involved in the rice processing.

In order improve the economic empowerment of the women; the study recommends that organizations (both governmental and non-governmental) need to direct their resources towards expanding the rice processing business in the municipality. Educational level played a significant role in improving profits of women rice processors, it is recommended that, women should be given refresher training to enhance their skills in rice processing. The study also discovered that, women used 'alonka' or bowl as the units of measurement which is not only cheating to the women but quite an outmoded way of measuring rice grains. It is therefore recommended that the women should use kilogramme (kg) to ensure uniformity in measurement.

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