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Profitability of Rice Production Among Small-Scale Rice Producers in Ghana

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Abstract

This study was designed to assess the profitability of rain-fed rice production among small-scale farmers and to analyze the determinants of the profitability of rice production in the Shama-Ahanta East District of Ghana. Using structured questionnaire, a multistage sampling procedure was used to collect primary data from 320 small-scale rice farmers from five communities in the District. Data were analyzed by means of non-parametric statistics, the farm budgeting technique and the normalized profit function model. A mean gross margin of GHC 895, a net of GHC 536 and a BCR of 1.56 show that rain-fed rice production is a profitable enterprise. Statistically significant ($p<0.05$) determinants of the profitability of rice production include age, per unit price of labor, per unit price of output, farm size, and access to agricultural extension services.

1. Introduction

Rice is a major staple food for more than 60 percent of the world's population, and its consumption worldwide has increased by almost 11% from 437,179mt to 484,592mt between 2008 and 2015 (United Stated Department of Agriculture (USDA), 2016). In Ghana, rice comes only after maize in terms of importance, and its consumption has continued to grow exponentially over the last two decades, with the current annual per capita consumption of 32 kg (Ministry of Food and Agriculture (MoFA), 2014). The contribution of rice in reducing food insecurity in Ghana can thus, never be underestimated. Despite the essential contribution of rice to the diet of many Ghanaians, production is done mainly by small-scale farmers who produce about 63% of total national output (MoFA, 2015). These farmers cultivate an average of about 1.3 ha and use rudimentary, low technologies and traditional methods in producing rice.

The use of traditional methods in rice production leads to low productivity which has created a gap between demand and supply, with demand outweighing the supply. Currently, rice production in Ghana meets 30% to 40% of national demand (Antwi, 2016), and the gap between demand and supply is closed through the importation of rice from other countries. Table 1 shows that imported rice accounts for about 56% of total national rice demand.

The continuous importation of rice increases government expenditure. In 2014, an average rice import bill of USD 450 Million was recorded by the government (Ministry of Food and Agriculture, 2015). The need to increase local production is thus, essential to improve food security in the country and also help to reduce government expenditure on rice importation. The past and the current government of Ghana have made several efforts to increase local rice productivity and reduce its importation into the country. This is evident by the implementation of productivity improvement interventions and policies

such as the block farm program and the fertilizer subsidy program to increase rice productivity (Ministry of Food and Agriculture, 2014).

Table 1. *Quantities of Rice Imported to Ghana to Supplement Local Production (2009-2014).*

Year	Total Local Production (Mt)	Total Import (Mt)	Total Demand (Mt)	% Imports
2009	235000	383945	618945	62.0
2010	295000	320143	615143	52.0
2011	278000	543446	821446	66.0
2012	332000	400316	732316	55.0
2013	393000	487523	880523	55.4
2014	434481	544080	978561	55.6

Productivity improvement could be achieved by increasing investment in rice production by using improved cultural practices and adopting modern technologies to rice production. This is pertinent as Ghana is endowed with fertile land for suitable for rice production, a favorable rainfall pattern and the availability of human capital (Angeluci *et al*, 2013). However, emphasis on farmers' level of resource use and increased returns to scale have not been adequate bearing in mind that most of the rice farmers operate on a small-scale basis and unable to take advantage of economies of scale. The condition is worsened by the fact that most of the farmers barely estimate the profitability of their farming enterprise.

Most of the empirical work in Ghana on rice have focused attention on productivity improvement with less attention given to profitability assessment of rice production in Ghana, particular among small-scale rice producers who produce the bulk of rice in the country. The objective of this study is to complement previous studies by empirically estimating the cost and returns to rice production and to identify and analyze the determinants of the profitability of rice production among small-scale farmers in Ghana.

2. Methods and Procedures

The study was conducted in five (5) communities out of the thirteen (13) communities in the Shama-Ahanta East District which is located on 5.037°N and 1.656°W. The five communities are Beposo, Dompim, Kobinanokrom, Kwadwokrom, and Ohiamadwen. The District has a population of 81,966 with a population growth of 3.2% (Ghana Statistical Service, 2010). Rice is the main crop produced by farmers in these selected communities and is produced on small scale basis. The District is characterized by an average rainfall of about 1800mm per annum, which is conducive for rice production. The District continues to increase its rice output and currently contributes about 52% of the Western Region annual rice output (MoFA, 2015).

A multistage sampling method was adopted to select respondents for the study. For the first stage, a purposive sampling procedure was used to select the District due to the relatively high level of rice production. For the second stage, a simple random sampling procedure was used to select the five communities, from which 320 rice farmers were randomly selected and used as respondents for the study.

Data were analyzed by means of non-parametric statistics, the farm budgeting technique and the normalized profit function model. Following Hoque and Haque (2014), the profitability of rice production was measured by the Benefit Cost Ratio (BCR). Both net returns and costs of production were calculated at the farm gate price levels and did not include transportation and transaction costs. This is because paddy rice in Ghana is usually sold on the farms by farmers to middlemen.

The farm budget model is stated as;

$$NFI = GFI - (VC + FC) \quad (1)$$

$$BCR = \frac{Net\ Farm\ Income\ (NFI)}{Total\ Cost\ (TC)} \quad (2)$$

Where: NFI is the Net Farm Income

GFI is the Gross Farm Income.

VC represents the Variable Costs.

FC represents the Fixed Cost

TC is the Total Cost (VC+FC)

The BCR was computed for each of the five communities since factors of production and prices differed from one community to the other.

Following Nwike and Ugwumba (2015), the profit function analysis was used to estimate the effects of prices of inputs, output, and socioeconomic determinants of the maximum variable profit. The parameter estimation was done using the heteroskedastic-consistent covariance matrix (HCCM) because the null hypothesis for the White's test was rejected at 5% with a statistic of 39.45 (p=0.0002). The empirical model is specified as:

$$\prod = \alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_{9+} \beta_{10}X_{10} + \beta_{11}X_{11} + \varepsilon_i \quad (3)$$

Where $\prod$ is the maximum variable profit.

X_1 = Age of respondent (years).

X_2 = Gender of respondent (male=1, female=0).

X_3 = Educational level of the respondent (years).

X_4 = Household size of the respondent (number).

X_5 = Rice farm size (hectare).

X_6 = per unit price of land (GH¢).

X_7 = per unit price of fertilizer (GH¢)

X_8 = per unit price of agrochemicals (GH¢).

X_9 = per unit price of labor (GH¢).

X_{10} = per unit price of output (GH¢).

X_{11} = Respondent access to agricultural extension services (access=1, otherwise=0)

α, β_1…..β_{11} are parameters to be estimated
ε_i is the stochastic error term.

3. Results and Discussion

Characteristics of Respondents

The results in Table 2 shows the summary characteristics of the respondents. Regarding age, the results show that rice farmers in the study area are relatively young with a mean age of 44 years. Considering gender, majority of the rice farmers are males (73%) and 27% being females. The low level of female participation in rice production could be attributed to poor to access agricultural resources including land by female farmers in the study area. The results show a low level of education (2.1 years) in the study area, which suggests that primary level education is the commonly attained level of education in the study area. This result further strengthens the 2010 Population and Housing Census which showed that less than 20 percent of farmers aged 15 years and older have formal education (Ghana Statistical Service, 2010). The results further indicate the relatively high household size of 5.6 people which is higher than the national average household size of 4.5 people (Ghana Statistical Service, 2010).

Table 2. *Characteristics of respondents.*

Socioeconomic Characteristics	Mean	Standard Deviation
Age (years)	44.81	17.45
Gender (category)	0.73	0.45
Educational level (years)	2.10	1.67
Household size (number)	5.60	1.75
Farm size (ha)	0.96	0.71
Price of land (GH¢)	45.62	2.33
Price of fertilizer (GH¢)	75.88	2.07
Price of Agrochemical (GH¢)	33.54	1.72
Price of labor (GH¢)	50.75	3.42
Price of output (GH¢)	470.46	1.42
Extension Access	0.13	0.34
Profit (GH¢)	526.68	47.20

Source: Computation from Field Survey

The real average output prices in the study area were found to be GH¢47.5 per 50kg and are relatively lower than the national average of GH¢53.1 (Statistics, Research and Information Directorate, 2015). The relatively lower average output price could be ascribed to the absence of adequate storage facilities in the study area which pushes farmers to sell their produce straightaway after harvest, mainly to middlemen. Access to agricultural extension service, which is essential to enhancing rice productivity and profitability has been found to be low. This could be ascribed to the low number of agricultural extension agents in the country. According to the Ministry of Food and Agriculture (2015), the current extension-farmer ratio in Ghana stands at 1:1500, hence many farmers are not able to access extension services. The results further show a relatively low profit (GH¢527) from producing a hectare of rice as compared to the national average of GH¢586 reported by the Ministry of Food and Agriculture.

4. Production Cost and Profitability of Rice Production

Production costs and net returns from rice production is dependent on input use level, cultural practices adopted, environmental factors and prevailing prices of inputs and output. Thus the production cost, gross and net income, as well as benefit-cost ratio, were calculated for each of the five communities. The average values are also indicated in Table 3.

Table 3. *Cost and Returns (GH¢/Ha) of paddy rice production in the 5 communities.*

Cost/Benefit Items/ha	Study Areas					
	Beposo	Dompim	Kobinanokrom	Kwadwokrom	Ohiamadwen	Average
Cost Items (GHC)						
Land Preparation	25.39	22.31	25.01	23.75	22.23	23.74
Fertilizer	78.96	74.91	78.13	73.97	78.18	76.83
Seed	50.12	47.89	46.35	48.06	45.23	47.53
Transplanting	25.36	21.14	23.78	24.17	22.87	23.46
Bird Scaring	18.12	15.96	16.89	15.86	17.34	16.84
Harvesting	30.34	27.87	26.84	28.06	30.12	28.65
Jute Sacks	12.23	15.11	13.13	14.13	15.32	13.98
Weedicide	32.10	31.12	33.21	34.43	35.13	33.20
Hiring of Land	42.12	45.01	44.94	42.44	48.01	44.50
Total Cost of Production (GHC)	366.98	351.33	359.32	353.54	361.64	358.56
Yield (ton)	1.23	1.21	1.14	0.97	1.04	1.12
Gross Income (GHC)	963.67	897.89	924.78	798.96	890.93	895.25
Net Returns (GHC)	596.69	546.56	565.46	445.42	529.29	536.68
BCR	1.63	1.56	1.57	1.26	1.46	1.50

Source: Computation from Field Survey

The results in Table 3 shows that rain-fed paddy rice production is profitable since positive net incomes were recorded, however, the profit levels vary among the five communities. The highest profit was recorded by rice farmers in Beposo (GH¢597) while rice farmers in Kwadwokrom recorded the lowest profit per hectare (GH¢445) among the five communities. Beposo community also recorded the highest BCR among the five communities, stressing the

importance of storage facilities in ensuring high profit among rice farmers.

Determinants of Profitability of Rice Production

The results of the multiple regression analysis to determine the factors which influence the profitability of rice production in the study area are presented in Table 4.

Table 4. *Determinants of Profitability of Rain-fed Rice Production.*

Variables	Estimate	t-Value	p-value
Intercept	24.599	3.19	0
Age	0.584	3.92	0.036**
Age2	-265	2.94	0.042**
Gender	9.368	0.87	0.118
Education	1.356	0.68	0.497
Household size	-1.076	-0.7	0.409
Farm size	9.926	2.13	0.004***
price of land	-1.259	-1.15	0.251
price of fertilizer	-0.269	-0.21	0.62
price of weedicide	-0.514	-0.36	0.404
price of labor	-2.215	-3.12	0.027**
output price	5.604	3.18	0.024**

R^2 - 0.76 *, **, *** - significant at 10%, 5% and 1% respectively
Adjusted R^2 = 0.72
F-statistic – 10.28 (p=0.002)
Durbin Watson statistic - 1.88

The multiple regression results presented in Table 4 shows that the selected socioeconomic factors together explains 76% of the total variation in the profitability of rain-fed rice production. The corresponding F-value was found to be highly significant at 1% significance level of probability (p=0.002). Factors including age, household size, per unit price of labor, per unit output price and access to agricultural extension services, were found to be significant at various significance levels.

The coefficient of age was found to be significant and positively related to the profitability of rain-fed rice production up to an optimum age of 69 years where rice profitability begins to negatively relate to age. This result suggests that older farmers gain more profit than younger farmers from rain-fed rice production up to the optimum age. One argument that can be put forth for this relationship is that older farmers are likely to have more experience in rice production due to long years of producing. In addition, older farmers are assumed and have more experience in dealing with middlemen to get reasonable prices for their produce. This result agrees with the results of Antwi (2016) who found a significant and positive relationship between age of farmers and productivity of rice in Ghana.

The coefficient of farm size was found to be significant and positively related to rice profitability. This suggests that as farm size increases, rice farmers' productivity and net farm income also increase. This finding corroborates the findings of Ohaka *et al* (2013) who found that farm size has a positive and significant effect on farmers output and net income among rice farmers in the Imo State of Nigeria. Haque and Hoque (2014) also found a positive relationship between farm size and profitability of rice production among rice farmers in Bangladesh.

As expected, the unit price of labor was found to be significant and negatively related to the profitability of rain-fed rice production. This finding implies that farmers who manage labor use to improve the marginal productivity of labor might have higher profit. This finding is in consonance with the finding of Nwike and Ugwumba (2015), who found a significant negative relationship between labor and rice seed production in Anambra State in Nigeria.

The coefficient of the unit price of output was found to be significant at 5% significance and positively related to rain-fed rice profitability. This finding meets *a priori* expectation and suggests that higher output price could lead to higher profitability of rice production. Antwi (2016) found that increase in unit output price of rice increases incomes from rice farming, which in turns increases investment and thereby increasing productivity levels among rice farmers.

As expected, access to Agricultural Extension services was found to be significant and positively related to the profitability of rain- fed rice production. This result was expected because access to extension service improves agricultural information availability to farmers and thus improve their productivity levels, particularly where farmers are mostly illiterates. Extension Agents show farmers new and improved practices of rice production and provide advice to farmers on how to solve production problems such as pest infestation and the correct application of inputs. This result agrees with the findings of Haq (2011) who found a positive and significant effects of extension service in improving farm productivity among rice farmers in Bangladesh. This is also similar to the findings of Usman and Baker (2013) in their study on rice farmers in Nigeria and argued that farmer access to extension services reduces production inefficiencies and yield losses which are necessary for increased profitability.

5. Conclusion and Recommendations

The study sought to examine the profitability of rain-fed rice production in Ghana. Results of the study have revealed that rain-fed production of rice among small-scale farmers is a profitable enterprise. Determinants of rain-fed rice production among small-scale farmers in Ghana include age of household head, farm size, per unit price of labor, per unit price of output and access to agricultural extension services, were found to be significant factors which influence the profitability of rain-fed rice production. This study provides a baseline for future research which could look at determinants such as environmental, political and cultural factors that influence the profitability of rain-fed rice production among small scale rice farmers in Ghana.

Agricultural extension services are essential to profitability improvement among rice farmers in Ghana. Policies to improve better linkages between extension and farmers need to be established. This could be achieved by training existing extension agents on new and improved methods and technologies in rice production and recruiting new agents to improve the current extension to farmer ratio to enhance the

transfer of knowledge and proper management of available resources to for improved profitability of rice farming.

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