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Profit Efficiency Of Small – Scale Rice Farms In Patigi Local Government Area Of Kwara State, Nigeria

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Abstract: ***This study examined the profit efficiency of small-scale rice farms in Patigi Local Government Area of Kwara State, Nigeria. Data for the study came from structured questionnaire administered to 150 small scale rice farmers in the study area selected through a three-stage sampling technique. The Cobb-Douglas - Stochastic Frontier Profit Function, Descriptive statistics, and Gross margin analyses were used to analyse the data. Findings showed that 88.7% are males, married and have a mean age of 40 years. Only 33% of the respondents have access to credit facilities. The result of the gross margin analysis showed that average gross margin and Net return are #50,985.12, and #41,112.88 respectively. The return per Naira invested is #1.79 which implies that for every #1 spent. 0.79k is returned as profit. Result of the stochastic frontier profit efficiency showed that the mean profit efficiency is 77% showing that there is still room for improvement. The major constraints faced by the rice farmers are inadequate capital, high cost of labour, lack of credit etc. The study therefore recommends that the government formulates agricultural-improving policies that will solve the major constraints observed in the study to ensure profitable rice production in the study area.***

I. INTRODUCTION

A. BACKGROUND TO STUDY

Rice is the seed of the monocot plants *Oryza sativa* (Asian rice) or *Oryza glaberrima* (African rice). As a cereal grain, it is the most widely consumed staple food for a large part of the world's human population. It is the agricultural commodity with the third-highest worldwide production after maize and sugarcane (FAOSTAT, 2019). About 486.62 million metric tons of rice is consumed worldwide (Ogunsumi, 2021). It provides more than one fifth of the calories consumed worldwide by human Species, though relatively lower in protein compared to other cereals, it contains a better balance of amino acid (Oyewole *et al*., 2010).

Rice is crucial to the food security of many nations (Africa Rice, 2007) and rice consumption is increasing rapidly in Nigeria because of the shift in consumer preference towards rice, increasing population growth, increased income level and rapid urbanization (Kamai *et al*., 2020).

Nigeria is one of the largest producers of rice in the African continent, it is also the largest consumer with a consumption per capita of 32kg as well as one of the leading importers of rice in Africa (Ojo *et al*., 2020). In the past years, consumption has increased to 4.7%, almost four times the global `consumption growth, and reached 6.4 million tonnes in 2017 which accounts for 20% of Africa's consumption (Muhammed et al., 2019). In 2011, rice accounted for 10% of household food spending (Nwaobiola and Adesope 2013). Given the importance of rice as a staple food in Nigeria, boosting its production has been accorded high priority by the government in the past years. The federal government established research institutes and programmes which were geared towards increasing rice production and other crops to achieve food self-sufficiency. They also increased tariff on rice importation and subsequently banned its importation to widen the home market for the nation local rice (Kamai *et al*., 2020). However, there is still a strong demand for foreign rice by Nigerians despite the restrictions placed on the importation of rice. It is estimated that overall, there are five bags of imported rice for every bag of local rice sold in the market. Nigerians' preference for imported rice creates a market gap for nearly three million metric tons between rice demand and local supply (USDA, 2020).

Nigerians' preference for imported rice is an indication of poor state of the nation's agricultural and technologies

development, low production, inefficiency in the use of resources, disincentive from the macro-economic environment and production in the hand of small-scale farmers who use traditional technology (Federal Ministry of Agriculture, 2001). The ability of local farmers to achieve sustainable rice production which will compete favourably well with taste and other qualities of imported rice depends on their profit efficiency and the factors that would cause changes in the farms' level of profit. This study is thereby conducted to evaluate the profit efficiency among small scale rice farmers in the study area.

A. OBJECTIVES OF THE STUDY

The broad objective is to examine the profit efficiency of small-scale rice farms in Patigi local government area, Kwara state, Nigeria while the specific objectives are to:

- ✓ describe the socio-economic characteristics of small-scale rice farmers in Patigi local government area, Kwara State, Nigeria.
- ✓ evaluate the profit efficiency of small-scale rice farms.
- ✓ estimate the profitability of small-scale rice farms.
- ✓ identify the constraints faced by rice farmers in the study area.

B. SIGNIFICANCE OF THE STUDY

The study will evaluate the profit efficiency of the small - scale rice farms and identify social economic factors which may influence this. The outcome will identify the profit level and show if the farms are performing on the profit frontier or otherwise. Farms performing on the frontier implies maximum profit (profit efficiency) will be achieved. However, new technologies which will involve more expenditure and interventions on the part of the government will have to be introduced and adopted by rice farmers to bridge the gaps between the national demand and production in terms of quantity and quality of rice. But if otherwise, the performance will be below the frontier and the profit will be below expectation implying profit inefficiency. If this happens it means the rice gaps in quantity and quality can be drastically reduced by mere adjustments of some social economic factors at farm level. The outcome of the study will therefore, reveal how and steps to be taken by the policy makers to improve the quantity and quality of rice production which will meet the needs of consumers in the country. This will not only improve rural income but will also reduce rural-urban migration and ensure food security in Nigeria.

II. CONCEPTUAL FRAMEWORK

The term efficiency indicates an economic state in which every resource is optimally allocated to serve each person in the best way while minimizing wastes and inefficiency. Efficiency signifies a peak level of performance that uses the least quantity of inputs to achieve the highest quantity of output. It requires reducing the number of unnecessary resources used to produce a given level of output (Caroline & Michael, 2020). The concept of efficiency expresses a specific form of rationality, used in attempts to control a changing situation by bringing it into conformity with a vision of how the world works. Efficiency became an important technological value during the nineteenth and twentieth centuries, as part of the construction of modern industrial society (Seidu, 2009). Generally, efficiency analysis in agricultural production is associated with the possibility of farms producing a certain level of output from a given bundle of resources or certain level of output at least cost (Girei *et al.*, 2013 and Girei *et al.*, 2014).

There are two types of efficiency; Production efficiency and profit efficiency. Productive efficiency can be measured as technical, allocative or economic efficiency (Farell, 1957). Profit efficiency is the ability of a farm to achieve highest possible profit given the prices of variable inputs and levels of fixed factors on the farm.

This study would measure the profit efficiency level of small-scale rice farming in Patigi local government, Kwara State. The state is one of the major rice producing state and one of the beneficiaries of several governments' intervention programmes in rice farming in Nigeria.

The concept of small-scale farm according to Odemenem & Obinne (2010) has no universally accepted definition. The term "small" may refer to number of workers, capital invested or amount of land worked. Although land size is the major criterion commonly used in Nigeria Agriculture. However, generally small- scale farmers are characterized by marginalization, in terms of information, technology, resources, assets and capital but there is a degree of variation to which each of these applies. The Food and Agricultural Organization (FAO, 2016) adopted a two-hectare threshold as a broad measure of a small farm. Majority of small - scale farmers live in rural areas (IFAD, 2011). Small - scale farming systems are very diverse, and contribute considerably to global agricultural output of a variety of crops (IAASTD, 2009). Small - scale farmers produce the bulk of food in developing countries, and in many instances their contribution is growing (IAASTD, 2009). For this study small scale farmers would be regarded as farmers utilizing one to ten acres of land for rice production.

A. THEORETICAL FRAMEWORK

The theoretical framework of profit efficiency stands on the theory of production. Measuring profit efficiency therefore, entails an understanding of the decision-making behaviour of the producer. The theory of production comprehensively examines the principles which guides the farmers in their inputs and output decision with the intent of realizing their profit maximization, output maximization, cost minimization and satisfaction maximization objectives. The theory involves some of the most basic principles of economics which entails the relationship between the farm outputs and the productive factors used in producing them as well as the relationship between the prices of farm output and the productive factors. The farm's task is to decide the best combination of factors of production that can produce the desired output at least cost. This is best carried out with the production function and the relationship is mathematically written as;

$$y = f(x_1, x_2, \ldots\ldots, x_n; k_1, k_2 \ldots\ldots, k_p)$$

Where, y denotes the quantity of output and the farm is assumed to use *n* variable factors of production like labour, agrochemical and seed. The farm is also assumed to use *p* fixed factors such as land, equipment and vehicles. The entire formula expresses the amount of output that results when specific quantities of factors are used (Robert, 2021). The production relationship defines a production unit or farm-firm which makes use of input mix in obtaining a given output.

An important assumption that guides production efficiency is that farms operate on, rather than within the production possibility frontier (PPF) available to them. In other words it is generally accepted that production takes place in the rational zone of production stages because that is the zone where maximum profit (output) can be obtained. According to Asrat (2019), A rational producer, producing a single output from a number of inputs, $x = x_1 \ldots\ldots x_n$, that are purchased at given input prices, $w = w_1 \ldots w_n$ and operating on a production frontier will be deemed to be efficient. But if the producer is using a combination of inputs in such a way that it fails to maximize output or can use less inputs to attain the same output, then the producer is not economically efficient.

Profit maximization is generally governed by three rules. First, that the marginal value product (MVP) of each factor must be equal to its price, Second, that factors must be combined in the least cost factor combination, and third, that products must be combined in the highest profit product combination. All these explain the technical ability of farmers to practice good skills or knowledge in the manner in which inputs can be combined. According to Farrell (1957) Technical efficiency is the maximum attainable level of output for a given level of production input, given the best technologies available to the farmer. Allocative efficiency describes the adjustment of inputs and outputs to reflect relative prices, the technology of production already having be chosen. These adjustments are the marginal consideration for profit maximization, which states that MVP should equal marginal factor cost (MFC) for any single variable input, and that MVP per unit of an input should be equal across different outputs (the principle of equ-marginal returns). Economic efficiency is the situation of both technical and allocative efficiency.

B. ANALYTICAL FRAMEWORK

The measurement of agricultural efficiency has always been of interest to agricultural economists. Every rational and commercially-oriented farm firm aims at profit maximization; even the non-commercial farmer's intention of producing is to obtain the maximum achievable output from the available resources (Ojo *et al*., 2020). The available literature provide evidence to show that both the primal (production function) and dual approaches (the use of profit and cost functions) are used to analyse farm efficiency. In microeconomic theory, the production or profit frontier explains the maximum output resulting from a set of production inputs and technology. While some inputs are decided by farmers, some are exogenously generated by fixed technology provided to farmers. This would add some constraints and/or advantages to the production performance of farmers (Mayen, Balagtas, & Alexander, 2010). According to Amos, (2017), the profit function approach combines the concepts of technical and allocative efficiency in the profit relationship and any error in the production decision is assumed to be translated into lower profits or revenue for the farmer. If the farm fails to operate on the profit frontier, it is considered to be profit inefficient, otherwise it is profit efficient and is able to earn the maximum allowable profit from the available and given resources. Since the rate at which inputs are transformed into agricultural outputs varies among crops, soil types, land area, capital, agro-inputs, technologies, climatic conditions (rainfall and temperature levels) and labour, it also contributes to how feasible the production will generate profit at the end.

Recent studies of efficiency have used the stochastic frontier approach (involving the use of stochastic production fronter, stochastic profit frontier and stochastic cost frontier models. And the approaches have produced varying results and conclusions, partly because of differences in study locations, sample size, production practices and model specification. The stochastic frontier approach has gained popularity in farm specific efficiency studies. In the frontier approach, the profit function is estimated as the most efficient set of points in cost-output space so that deviations from this frontier are used as measure of inefficiency. An economically efficient input-output combination would be on both the production frontier function and the expansion path (Xu and Jeffery, 1994)

Although several functional forms can be used to specify the stochastic frontier, desirable forms are those linear in parameters because they easily facilitate the calculation of efficiency or inefficiency. Nevertheless, forms that are multiplicative in input and error terms are excellent candidates for stochastic frontier (Kirkkey et al., 1951). Aigner et al (1977) and Meeusen & Van den Broeck (1977) proposed Cobb-douglas stochastic profit frontier function for measuring profit efficiency. The use of this tool has gained prominence in econometric and applied economics (Amos. 2017) is also used for profit analysis in this study

a. THE STOCHASTIC PROFIT FRONTIER MODEL

Stochastic frontier model is one the parametric or econometric methods commonly used in the measurement of firm level efficiency with the use of maximum likelihood estimate. It imposes a functional form on the profit function, allows for inefficiency and makes assumptions on the distribution of the one-sided error term. The model separates the deviations of the realized gross profits from the frontier profit into pure noise and inefficiencies effects. Following the theory of the stochastic profit function as proposed by Aigner *et al*., (1977) and Meeusen & Van den Broeck (1977), the stochastic profit function of farmer i is expressed as:

$$\pi = f(p_i, w_i, a_i)\exp(v_i - u_i) \quad (1)$$

While the frontier profit function is given by

$$\pi^* = f(p_i, w_i, a_i)\exp(v_i) \quad (2)$$

The $v_i s$ represent the idiosyncratic components which are independent and identically distributed random errors with mean zero and variance σ_v^2. The presence of v_i is due to random factors that are usually beyond the control of the

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farmer such as climatic conditions and measurement errors. The $u_i s$ are non-negative random variables that are associated with factors typical of individual farmers which prevents them from attaining the maximum profit specified by the frontier (Battese, 1992). The non-negative random variable is responsible for the profit inefficiency and has values that lie between 0 and 1. The u_i has a non-negative half-normal distribution. For the profit function, u_i and v_i are assumed to behave in a way consistent with the concept of stochastic frontier functions. The profit efficiency (PE) of farmer *i* is defined as the factor by which the level of profit for the farmer is less than its frontier profit (Battese, 1992). Given the stochastic profit frontier model as expressed by equation (1), the PE is calculated from equation (3)

$$PE_i = \frac{\pi_i}{\pi_i^*} = \frac{f(p_i, w_i, a_i)\exp(v_i - u_i)}{f(p_i, w_i, a_i)\exp(v_i)} = \exp(-u_i) \quad (3)$$

In measuring efficiency based on the stochastic profit frontier, two key assumptions are made which results in two types of the function. Depending on whether market forces are taken into account or not, the standard and the alternative profit functions can generally be recognized (Saysay et al., 2016). The Cobb-Douglas functional form of the stochastic production frontier will be employed to estimate the profit efficiency of rice farmers in the study area.

It is specified as

$$In\ \pi = \beta_0 + \beta_1 InZ + \beta_2 InP_1 + \beta_3 InP_2 + \beta_4 InP_3 + \beta_5 InP_4 + (V_i + U_i)$$

III. METHODOLOGY

The study was conducted in Patigi local government area, Kwara State, Nigeria. The state is located between latitudes 7^0 45'N and 9^0 30'N and longitude 2^0 30'E and 6^0 25'E with a total land area of 3,682,500 hectares, a population of about 2,365,353 people in 2006 and an average density of eighty-eight persons per square kilometre (NPC, 2006; KWADP 2011). It has 247,975 farm families with majority living in rural areas (KWADP 2011). It is bounded in the North by Niger State, to the South by Oyo, Osun and Ekiti states, to the East by Kogi state and to the west by Benin Republic. It comprises of 16 Administrative Local Government Areas, divided into four agricultural zones by the Kwara State Agricultural Development Project (KWADP) in consonance with ecological characteristics, cultural practices and project administrative. The zones are: zone A; Baruten and Kaima LGAs; Zone B; Edu and Patigi LGAs; Zone C; Asa, Ilorin East, Ilorin South, Ilorin West and Moro LGAs and Zone D; Ekiti, Ifelodun, Irepodun, Offa, Oyun, Isin and Oke Ero LGAs.). Patigi local government area has a high propensity to rice production. It has a total land area of 2,743kmsq and a population of 110,852 (NPC, 2010). The vegetation of the study area is derived savannah with a great expanse of arable land. It features two distinct seasons which are the rainy season and the dry season. Rainfall is between 800cm and 1500 cm per annum (Oyeniyi 2017) It has an average temperature of 30 degrees centigrade and the soil is sandy-loamy and easy to farm.

Figure 1: Map of the Kwara state showing Patigi LGA and others

The population of the study include all the small-scale rice farmers in Patigi local government area. The sample size was calculated using the Slovin's (1960) formular,

$$n = \frac{N}{1 + Ne^2}$$

Where n = Sample size, N = Population size, e = margin error, 1= constant value

A three-stage random sampling technique was used to select the representative rice farming households in the study. After the purposeful selection of Patigi local government Area being the highest producer of rice in the state, random selection of 5 villages out of the list of rice farming villages/settlements followed. The third stage involved random selection of 30 rice farming households per settlement to make a total of 150 rice farming household for this study from data for the study was collected with the aid of structured questionnaire and interview schedule. The collected data was analysed using descriptive statistics, Gross margin analysis and stochastic profit frontier model

✓ DESCRIPTIVE STATISTICS

Including frequency tables, percentages, averages and standard deviation were used to examine the Socio-economic profile of the respondents and to identify the constraint of small-scale rice farmers.

✓ GROSS MARGIN ANALYSIS

Gross margin analysis was used to determine the profitability of rice production and return on capital investment.

The formular for gross margin analysis is given as GM =TR-TVC.

Where GM= gross margin, TR = total revenue, TVC = total variable cost.

✓ STOCHASTIC PROFIT FRONTIER MODEL

The Cobb-Douglas functional form of the stochastic production frontier was employed to estimate the profit efficiency of rice farmers in the study area.

It is specified as

$$In\ \pi = \beta_0 + \beta_1 InZ + \beta_2 InP_1 + \beta_3 InP_2 + \beta_4 InP_3 + \beta_5 InP_4 + (V_I + U_I) \ \ldots\ldots (1)$$

Where: In= the natural logarithm, π = Total profit, Z = Farm size (acre), P_1 = Price of labour (man-days/Naira), P_2 = Price of Seed (Naira/acre), P_3 = Price of pesticide (Naira/acre), P_4 = Price of fertilizer (Naira/acre), β_0 = Intercept, β = Parameters to be estimated

V_1 = Error term not under the control of farmers, U_1 = Inefficiency model

The determinant of technical efficiency was modelled in terms of socio economic factors of the farmers to identify which of the factors affect the profit efficiency of the rice farmers. The determinants of the technical inefficiency (U_i) were modelled and defined by:

$$U_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + \delta Z_6 + \delta_7 Z_7 + \delta_8 Z_8 + \delta_9 Z_9 + e \ldots . (2)$$

Where:

$\delta_0 - \delta_9 =$ Parameters to be estimated

Z_1 = Age of farmers (years)

Z_2 = Household size (number of household member)

Z_3 = Farming experience (years)

Z_4 = Level of Education (years in school)

Z_5 = Gender (1 for male, 0 for female)

Z_6 = Access to credit (1 for access, 0 for otherwise)

Z_7 = Membership of farmers association (1 for membership, 0 for otherwise)

Z_8 = Access to extension agent (number of contact with extension agent)

δ_0 = Intercept/constant

e = Error term

IV. RESULT AND DISCUSSION

Variables		Frequency	Percentage	Mean	Minimum	Maximum	Stand Dev	Studies with Similar results
Gender of respondent	Male Female	133 17	88.7 11.3					
Marital Status	Married Single Divorced Widowed	132 13 2 3	88 8.7 1.2 2.0					Olooto et al 2018
Age of respondents	18 – 27 28 – 37 38 47 48 -57 Above 58	13 50 49 24 14	8.7 33.3 32.7 16.0 9.3	40	25	66	9.83624	Ngegba *et al.*, (2016),
Educational level of Respondents	No edn Pry edn Sec. edn Ter. Edn Adult edn	57 29 40 10 4	44.7 19.3 26.7 26.7 6.7 2.7				1.108	Mohammed-Lawal *et al.*, (2009).
Household size of Respondents	1-5 6-1 11-15 16-20	26 83 32 09	17.3 55.3 21.3 6.0	9	1	18	0.778	Yusuf & Adenegan, (2009).
Access to credit	Yes No	50 100	33.3 66.7					
Yrs of Experience	1-12 13-24 25 and above	96 35 19	64.0 23.3 12.67	2.67	1	6	0.473	Muhhamed etal 2009
Farmer	Yes	64	42.7					Ogunniyi
s' Assn	No	86	57.3					(2011)
Extension contacts	0 1-2 3-4	85 49 16	56.7 32.6 10.7	1.57	1	2	0.496	Seidu, 2009
Farm size (acre)	1-5 6-10	101 49	67.3 32.67	3.5	0.25	10	2.48	Tsue *et al.*, (2012)

Source: Field analysis, 2021

Table 4.1: Socio-economic Characteristics of the respondents. (n = 150)

A. PROFIT EFFICIENCY OF SMALL - SCALE RICE FARMING IN THE STUDY AREA

The result of the profit efficiency Table 11 shows the Maximum Likelihood Estimates of stochastic frontier profit function. The estimated value of gamma (γ), which is the ratio of the variance of farm -specific profit efficiency (u), to the total variance (σ^2) of profit is 0.899 is significantly different from zero. This ascertains the fact that a higher level of inefficiencies exists in rice production in the study area. The result can be interpreted to mean that the differences between actual (observed) and frontier profit level are dominated by inefficiency in the factor mix considering their prices. The results suggest that about 90% of the variation in profit level among the farms is due to the differences in farmers' practices and that only 10% of the variation in the level of profit among rice farms is due to random shocks outside the farmers' control. According to Apezteguia and Garate, 1997, and Seidu Al- Hassan 2008 random shocks include; - weather, floods, bush fires and diseases

The coefficient of farm size with a positive value of 0.143 is significant at 5% level of significance. This implies that a 1% increase in cultivated farm land will improve the profit of the rice farms by 14%. The finding is in line with Ngaga et al., 2010 findings. Aside from land size and seed other variables including prices of labour, pesticide and fertilizer have negative coefficients with significant relationship with profit level. Their significant relationship imply that they are determinants of profit among rice farms. The negative relationship implies inverse relationship with profit efficiency. Indicating that, the lower the prices of labour, pesticide and fertilizer the larger the farm profit. The implication of this finding is that rice farmers in the study area are spending too much on labour, pesticide and fertilizer which have a reduction effect on profit and preventing them from been on profit efficiency frontier. Result of the analysis therefore show that reducing the cost of the production variables by 1% will increase farm profit by the magnitude of the coefficients attached to each price. For instance,1% reduction in the prices of labour, pesticide and fertilizer will increase farm profit level by 42%, 24% and 15% respectively.

B. DETERMINANTS OF PROFIT INEFFICIENCY

To evaluate the effects of on farm, farmer socioeconomic and demographic factors on profit efficiency, age, credit availability, education, extension contact household size, farmer experience and membership of association were considered. The results are summarised in Table 11. The relationship between the profit inefficiency and the farm, and farmer characteristics is considered under the inefficiency effect in the maximum likelihood analysis. Rice production is

a strenuous exercise which is gender sensitive and requires adequate labour at certain critical levels of growth. In line with this assertion, the inefficiency results show that the estimated coefficients of household size, farming experience and gender were negative and statistically significant at 1%, 10% and 5% respectively. This result implies that the more the number of the available experienced male farmers the lower the profit inefficiency and consequently the higher will be the profit efficiency. The result is in agreement with Abiyong et al., (2019). His findings showed that gender and farmer experience have negative relationship with profit inefficiency

However, age, level of education, annual income and access to credit and membership of farmers associations contributed positively to profit inefficiency. Ngaga et al., 2010 discovered that, farm specific variables that explained inefficiency in his study were higher level of education and farming experience. Asrat 2019, also found group membership and farming experience having positive relationship with inefficiency.

VARIABLES	COEFFICIENT	STANDARD ERROR
Constant	-9.281	0.434
Farm size	0.145**	0.078
Price of labour	-0.426***	0.046
Price of seed	-0.018	0.053
Price of pesticides	- 0.246***	0.032
Price of fertilizer	- 0.156**	0.069
Inefficiency model		
Constant	1.168	0.646
Age	0.732***	0.095
Household size	-0.003***	0.024
Farming experience	-0.086*	0.081
Level of education	0.573**	0.256
Annual income	0.134	0.176
Gender	-0.059**	0.189
Access to credit	0.161*	0.086
U Membership of association	0.764**	0.355
Diagnostic statistics		
$\gamma = \sigma^2_u / \sigma^2$	0.89913***	
$\sigma = (\sigma_v^2 + \sigma_u^2)$	0.71335**	
R squared	0.85	
N	150	

**, **, *** p-value indicates significant at 10, 5 and 1% level respectively*

Source: Field analysis, 2021

Table 4.2: Maximum Likelihood Estimates for profit efficiency/inefficiency of Rice Farms

Efficiency level	Frequency	Percentage
<0.30	7	4.667
0.31-0.40	13	8.667
0.41-0.50	29	19.333
0.51-0.60	41	27.333
0.61-0.70	17	11.333
0.71-0.80	12	8
0.81-0.90	11	7.333
>0.90	20	13.333
Total	150	100
Mean =0.77		
Minimum=0.18		
Maximum=0.97		

Source: Field analysis, 2021

Table 4.3: Frequency distribution of profit efficiency

Table 4.3 depicts the frequency distribution of the profit efficiency model. The profit efficiency of the rice farming in the study area was estimated using the stochastic production frontier. The result revealed that about 33% of the farmers attained efficiency level of 50% while about 67% attained the efficiency level of more than 50%. The mean profit efficiency is 77% with a minimum profit efficiency of about 18% and maximum profit efficiency of 97%. The rice farms exhibited varied profit efficiencies ranging from 18% to 97%. The mean profit efficiency of 0.77 shows that the farmers will be able to increase profit further by 23% by adopting improved technology and techniques to attain the profit efficiency of one.

C. PROFITABILITY OF SMALL SCALE - RICE FARMING IN THE STUDY AREA

The result of the profitability of small - scale rice production per acre in the study area gave a average variable cost of #41,674.88 and the average fixed cost of #98,72.24. The gross margin which was calculated by subtracting the total variable cost from the total revenue gave a value of #50,985.12. Since the gross margin is positive, it implies that small scale rice farming in the study area is profitable and lucrative

Furthermore, the return per naira invested is #1.79 which implies that for every #1 invested in rice production, a return of 79 kobo was generated. This result greatly coincides with the result of Okoye *et al*., (2009) in his study of determinants of labour productivity on small-holder cocoyam farms in Anambra State, Nigeria where it was observed that cocoyam production is profitable with returns of #1.80 to every #1.00 spent.

ITEM	AMOUNT (#/acre)
A. Revenue	92660
B. Variable cost	
i. Cost of seed (kg)	8054.48
ii. Cost of herbicide (litres)	3273.4
iii. Cost insecticide (litres)	2320
iv. Cost of fertilizer (kg)	6531
v. Cost of labour (Mandays)	21496
Total	41674.88
C. Fixed cost	
i. Land	5357.94
ii. Spraying pump	3714.3
iii. Cutlass and hoe	800
Total	9872.24
D. Total cost (TFC+TVC)	51547.12
E. Gross margin(TR-TVC)	50985.12
F. Net return (TR-TC)	41112.88
G. Return per Naira Invested (TR/TC)	1.79

Source: Field analysis, 2021

Table 4.4: Average Cost and Return of rice production

D. CONSTRAINTS FACED BY RICE FARMERS

The major constraint hindering rice production in the study area is inadequate capital with a mean of 3.80. This was closely followed by high cost of labour with a mean score of

3.10, lack of credit and high cost of input with a mean age of 3.01. Pest and diseases ranked next with a mean of 2.93, poor weather condition with a mean of 2.77 and distance to market with a mean of 2.48.

Constraint	Very Severe	Severe	Mildly severe	Neutral	Mean	Std dev.	Rank
High cost of labour	40 (26.7)	87(58.0)	21(14.0)	2(1.3)	3.10	0.673	2nd
Inadequate capital	124 (82.7)	22(14.7)	4 (2.7)	0 (0)	3.80	0.463	1st
Lack of credit	44(29.3)	65(43.3)	40(26.7)	1(0.7)	3.01	0.768	3rd
Pest and diseases	48(32.0)	53(35.3)	40(26.7)	9(6.0)	2.93	0.910	5th
Poor weather condition	39(26.0)	45(30.0)	59(39.3)	7(4.7)	2.77	0.891	6th
High cost of input	40(28.0)	71(47.3)	34(22.7)	3(2.0)	3.01	0.768	3rd
Distance to markets	29(19.3)	42(28.0)	51(34.0)	28(18.7)	2.48	1.008	7th

Source: Field analysis, 2021

Table 4.5: Constraints faced by rice farmers

V. SUMMARY

This study examined the profit efficiency of small- scale rice farms in patigi local government area of Kwara state, Nigeria. Specifically, the study described the socio-economic characteristics of small - scale rice farmers, evaluated the profit efficiency and the profitability of small - scale rice farming and identified the constraints militating against the achievement of maximum profit efficiency in the study area.

Gross margin was used to determine the profitability of rice production and it was also used to analyse return to capital investment, Descriptive statistics including frequency tables, percentages, averages and standard deviation was used to examine the Socio economic profile of the respondents and to identify the constraint on a likert scale of small scale rice farming and the Cobb-Douglas functional form of the stochastic production frontier was employed to estimate the profit efficiency of rice farming in the study area.

The result shows that majority of the rice farmers (88.7%) in the study area are male, have mean age of 39. Married with large family ($\ddot{x} = 9$) about 55% of the farmers have one form of education or the other. The result of profit efficiency shows that profit efficiency of the study area ranged between 0.18 and 0.97 with the mean of 0.77. Further analysis reveals rice venture in the study area is profitable. The result shows that net return to rice farm in the study area is #41112.88 while returns on every #1 invested is #1.79 which implies 79kobo gain on every #1 invested in rice production. Lastly, the major constraints to rice production as expressed by the respondents include; inadequate capital, pest and diseases, lack of credit, high cost of labour, high cost of input poor weather condition and distance to markets. These coincidentally were the same as the factors found increasing profit inefficiency in the study area through the maximum likelihood analysis.

A. CONCLUSIONS

The study reveals that rice farming in the study area is profitable judging by the estimated return on capital – 79 kobo on every #1.00 spent. However, the analysis of the profit efficiency shows that farms are not making maximum profit. An average rice farm is making 77% of what it ought to have been making. The farms are operating below the frontier function. On the premises of the inefficiency result and the constraints specified by the farmers themselves, rice farmers do not have access to credit facility and at the same time face high cost of factors of production. They are therefore, spending more to achieve very little, and in economic term, the more the cost the less the profit. This explains the reason why rice farmers are not encouraged to adopt improved technology that will improve the quantity and quality of rice to meet the needs of numerous consumers. The implication of the mean profit efficiency of 77% is that there is room for improvement. It means that maximum profit can be attained and quantity and quality of rice can be drastically increased to reduce the gap in the national demand and supply by simply reducing the cost of factors of production. This will make the farmers to adopt the best practices that will take them to frontier level the most efficient level in production.

B. RECOMMENDATIONS

Findings show that rice farmers paid exorbitantly on labour and other factors of production. It is therefore, recommended that rice farmers in the study area be given access to labour saving technology. In addition, it was discovered that only 55% of the rice farmers have one form of education or the other, most of them learn rice cultivation through experience. For efficient use of resources rice farmers in the state need to be trained on the use and adoption of improved technologies capable of increasing the quantity, quality and profitability of the rice farm.

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