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Full Length Research Paper

Analysis of property rights and productive efficiencies among smallholder rice farmers in South western Nigeria

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This study examined the property rights and productive efficiencies of small scale rice farmers in Oyo State, South western Nigeria. The study employed the Stochastic Frontier Analysis and the Tobit model using the smallholders' various agricultural inputs and capital stock as exogenous to rice productivity. The results reveal that farm size has the greatest impact on productivity for both native and non-native rice farmers with majority of them having no formal education. The results further show that native farmers have property rights while non-native farmers do not. The study concludes that rice production be managed by young and better-educated farmers who will be able to adopt the new and improved technologies in rice production. There should be provision of institutional credit to farmers on timely basis and with easy access to such credit facilities. This measure could in a way allow rice farmers access input like fertilizer, pesticides and herbicides and even modern implements so as to encourage expansion of their initial land area allocated to rice production. Government policy formulation on land tenure that will be advantageous to both the native and non-native farmers is critical.

Key words: Property rights, technical efficiency, smallholder rice framers, South western Nigeria.

INTRODUCTION

Agricultural production and land conditions are affected by land management practices, including both private decisions made by farm households and collective decision made by groups of farmers and communities. For example, farm households make decisions about land use (whether cropland or grazing land), the crop types to plant, the amount of labour to use, and the types and amount of inputs, investments, and agronomic practices to use to conserve soil and water, improve soil fertility, reduce pest losses and so on (Feder et al., 1990).

Significant improvements in agricultural productivity are crucial to addressing the worsening conditions of poverty and food security in sub-Saharan African (Omiti et al., 2000). In Nigeria, improvement in land productivity is vital to enhance and sustain the welfare of the largely agrarian population. The traditional land use and land management practices that used to sustain the welfare of human population under low population pressure with little or no technical know-how is no longer able to support the growing population. Due to increasing population

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density and degradation of natural resource base, declining per capita food production results in deteriorating human welfare conditions.

Improvements in agricultural productivity in Nigeria will require a more efficient use of rural resources, especially land, labour and capital, since these resources are the major inputs in the agricultural production in the country. Improvements in the performance of agriculture will, therefore, depend considerably on how well the constraint of the functioning of markets for these key factors of production is addressed.

Increasing population results in land scarcity and when alternative employment opportunities outside agriculture are limited, may eventually lead to landlessness. Under this situation, well functioning land markets may result in welfare gain by allocating the land resource to more efficient users and by permitting land consolidation to achieve economies of size.

Out of all the food commodities produced and consumed in Nigeria, rice is of great importance as it has remained a major source of calorie for households (World Bank, 1991). It is widely accepted and consumed in one form or another by households across all ethnic, religious, and geo-political zones in the country. Other food crops being produced and consumed in Nigeria are: maize, millet, sorghum, cowpea, groundnuts, cassava and yam. Rice production in the country has not met the actual demand. Between 1995 and 1999, about ₦34.4 billion had been spent on rice importation. This involved the use of hard foreign exchange and this is quite a drain on the country's finances.

To prevent the depletion of Nigeria's foreign exchange earnings through massive food importation bills and achieve a satisfactory level of self-sufficiency in domestic food crop production, there is need to improve factor productivity with proper land management decisions. The low level of productivity in food crop production is a reflection of the low level of technical efficiency in the food crop sub-sector. An approach at solving the problem of low productivity in rice-based food crop production is to investigate the efficiencies of resource use in this food crop production.

Nigeria has the potential to be self-sufficient in rice production, both for food and industrial raw material needs and for export. However, a number of constraints have been identified as limiting factors to rice production efforts by farmers. These include problems with research; pests and diseases management, soil fertility management, unavailability of simple and cheap farm implements, access to institutional and infrastructural support credits facilities; and inadequate input delivery, marketing channels, irrigation facilities and extension services. Addressing at least most of the problems is a good first step towards attaining the target of rice self-sufficiency (Bamire et al., 2005). This study is planned to examine land distribution (property rights), land management decisions and efficiency of rice growing farmers in Oyo State, Nigeria. The study examined the influence of rice farmers' socio-economic characteristics, land management practices on the profitability of rice based production system. The limited capacity of the Nigeria rice sector to meet the domestic demand has raised a number of pertinent questions both in policy aide and among researchers. For example, the issue of the factors explaining why domestic rice production has been lagging behind the demand for the commodity in Nigeria has been occupying a center stage for some time now. Central to this explanation is the issue of efficiency of the rice farmers in the use of resources. Land is one of the most important resources needed. This study will make use of the findings to provide critical insights to the needful in this discussion.

The result of this study will provide the basis for the evolution of property right, land management practices and productivity of the rice farmers and it will ensure the sustainability of rice production.

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

Concept of efficiency

Efficiency in production is a way to ensure that firms produce in the best and most profitable way. In every sector of the economy where production takes place, efficiency is of paramount importance in order to safe-guard against wastage of resources. According to Rodriguez et al. (2004), efficiency refers to the global relationship between all outputs and inputs in a production process. We have different types of efficiency, but for the purpose of this work, only four will be described.

According to Farrell (1957), one can describe technical and allocative efficiencies of a firm. The latter is referred to as price efficiency in Farrell's seminar article. From the output perspective, technical efficiency measures the potential increase in output, keeping the inputs constant. Allocative efficiency, from the output perspective is simply the revenue-maximizing problem. Technical efficiency, from the input perspective measures the ability of the firms to produce a given output using the firm's ability to allocate the input bundle in the cost minimizing way. Technical efficiency itself can be further decomposed into two components: Scale Efficiency and Pure Technical Efficiency. The former relates to the most efficient scale of operation in the sense of maximizing average productivity. Pure technical efficiency, however, is obtained when separating the scale effect from the technical efficiency. In a more sublime form, allocative efficiency can be defined as the ability of a firm to equate marginal value product and marginal cost. In other words, a firm is allocatively inefficient if it does not utilize the inputs in optimal proportions, given the observed input prices, and hence does not produce at minimum possible cost (Coelli et al., 2002; Abay et al., 2004). Accordingly, the differences in the technical efficiency of the various crop and animal enterprises might be due to any of the four factors which include:

i) Differentials in the management capabilities of the various farm operators.
ii) The employment of different levels of technology based on the type, nature and quality of the inputs used.
iii) Differentials in the environmental factors like the edaphic factors (soil texture, structure and nutrient quality) and climatic factors (rainfall, solar radiation and evaporation).
iv) Differentials in the existence of the non-economic and non-technical factors such as achieving the highest level of farm output.

A combination of measures of technical and allocative efficiencies yields a measure of economic efficiency. The output and input perspective will coincide when measuring technical efficiency under Constant Return to Scale (CRS). The allocative and economic measure, however, are completely different in nature and are not likely to coincide for other reasons than by chance.

It was pointed out in Alverez and Arias (2004) that various degrees of inefficiency in production seem to be the rule rather than the exception. About the issue of relationship between efficiency and farm size is a parameter which has revealed a significant influence on efficiency. For example, Bravo-Ureta and Rieger (1991) found a significant positive relationship between technical efficiency and farm size in the sample of New England dairy farms. However, the relationship between economic efficiency and allocative efficiency and farm size was found to be significantly negative. Berkes et al. (1989), who estimated technical, allocative and economic efficiencies on a sample of Ecuadorian dairy farm, also found a positive relationship between size and technical efficiency.

Review of empirical studies on property right

Feder and Feeny (1991) argued that certain institutional arrangements for land rights have evolved in order to reduce uncertainty and increase efficiency in both land and credit markets where land is often used as collateral. They constructed a simple model of investment, production and land price determination which assumes that the objectives of farmers are to maximize their utility by allocating their initial endowment and borrowed funds to three uses: current consumption, land acquisition and investment in physical capital. The model links the supply of credit directly to the value of landholdings and inversely to the probability of land loss from their economic analysis. Feder and Feeny *op cit* concluded that titled land results in the following social benefits, which outweigh the cost of establishing and enforcing titling systems: (1) reduced risk of expropriation; (2) better access to credit; (3) significant higher market value of land (as compared to squatter's land); (4) larger volume of investment; (5) higher likelihood of land improvement; (6) more intensive use of variable inputs; and (7) higher output per unit of land. Bamire et al. (2005) analyzed the optimization and sustainability of agricultural productivity that is required in the appropriate management of the land resources base. In the paper, they examined the influence of farmers' socio-characteristics and land management practices on the profitability or production systems in Osun State. The results showed that rice farming is on small scale. Land management practices such as inorganic fertilizer, bush fallowing, shifting cultivation, crop rotation and crop rotation/inorganic fertilizer mix were identified. Inorganic fertilizer is most predominant crop rice-base production system which will contribute to food security and poverty reduction if land management is appropriately used and other information from research findings.

In the study of technology dissemination to rice farmers cultivating in land valleys in Nigeria, Fashola et al. (2004) discovered that the "Sawah" rice production technology system (Sawah package) which is an adapted rice production technology system in Asia consists of level field surrounded by bund with inlet and outlet connecting irrigation and drainage canals, row transplanting of improved variety and fertilizer application. Similarly, the area covered by the technology increased from 0.5 ha in 2001 to 20 ha in 2005. The project has embarked on the process of mass adoption for the whole country with its tillers used in the land preparation. Bamire and Fabiyi (2002) examined property rights and their changing pattern constituting one of the principal factors that influence the adoption of land improvement techniques among farm operators. The paper examined the economic implication of property rights status on farmers' adoption and use of fertilizer technology in two ecologies of Osun State of Nigeria. They concluded that the use of fertilizer affects farm returns in different properly rights region. Increased technology will aid its adoption and use of improved land quality.

Quy-Toan and Lakshmi (2002) examined the impact of land reform in Vietnam which gave households the power to exchange, transfer, lease, inherit and mortgage their land use rights. They expected the change to increase incentives as well as ability to undertake long term investments on the part of households. The results of the study indicated that the additional land rights led to significant increase in irrigation investment. These effects are stronger in areas which felt the impact of the land reform earlier. Tenure insecurity is defined as the perceived probability or likelihood of losing ownership of a part of one's entire land without his/her consent (Sjaastad and Bromley 1997). The strength of this perception may have a bearing on how farmers manage their land and this in turn has an effect on agricultural production and sustenance of the people who directly depend on it. It has been argued that tenure insecurity discourages the incentives for it as one may not be able to collect the expected flow of benefits of one's efforts if there looms a threat of losing the land in the future. It is also possible that land tenure encouragements that assign land rights to the community or to landlords, rather than to the actual land users, may discourage long term investment in land improvement (Hayami and Otsuka, 1993). Through investments, farm households improve their productivity, leading to increase agricultural output and increase income and wealth level. By providing incentives for exerting non observable extra efforts and for use of purchased inputs, tenure security may also have an impact on productivity and farm output, even in the short-run.

Emphasis on how spatial and temporal characteristics of technologies have implications for the relevance of tenure insecurity and the need for collective action has been made. Tenure insecurity is likely to be of less importance if costs and benefits accrue in the short run than if the benefits accrue over a longer time period. We may therefore expect tenure insecurity to have more impact in decisions like tree planting, building of conservation structures or irrigation, than purchase of fertilizer, seeds and other inputs providing short term returns. Gavian and Fafchamps (1996) found that existing empirical studies have failed to establish strong links between land rights investment and agricultural productivity on African croplands. It has been asserted that rights (use rights or transfer rights) were not significantly related to yields in Ghana, Kenya and Rwanda. They also found no relationship between total costs of non-labour inputs and rights in Ghana while there was a positive correlation between the incidence of some types of land improvement and land rights in Rwanda. Use of credit was also not significantly related to land rights. They concluded that lack of access to credit, insufficient human capital and labour shortages adversely affected investment decisions more than insecurity of tenure. Barrows and Roth (1990) found no link between land title and or land rights and land improvements in Kenya. Gavian and Fafchamps *op cit* found that tenure insecurity might incite farmers to divert scarce manure resources to move secure fields whenever they can, as they preferred to use manure on own fields rather than borrowed fields.

Fuss et al. (1999), in a study of tenure security and gender difference in tree planting in Zimbabwe, found that women were less likely to plant trees due to the fact that they have less security of duration at tenure. Gavian and Ehui (1999) found in a study in Ethiopia that informally contracted lands appeared to be farmed 10-16% less efficiently but that such lands actually received more, rather than less inputs. This attributed the gap in factor productivity to differences in input quality or lack of skills in applying inputs.

METHODS

Analytical framework

Property rights are classified based on the bundles of rights comprising the rights of use, investment, exclusion and transfer with or without permission of the village head, the head of the house, community organization or external links. In line with this, building an index that measures the degree of practical exercise of use and regulation rights on the different plots of land exploited is a necessary condition. The index is built by the use of Borda rule (Platteau, 1993). For the purpose of this study, the components of property rights considered are: (a) farm size; (b) the percentage of the farmland with the rights to perennial crop; (c) the percentage of the land purchased or inherited, that offer most transferable rights; (d) the freedom in the choice of crops to grow; (e) the independence in farming decisions/sowing, weeding, fertilizing, etc; (f) the rights to use the crops on the land; (g) the management of the harvests in the household; and (h) the management of farm income.

Criteria (d) to (h) specified in the above paragraph are more ordinal than numerical. For that reason, the different plots are sorted in ascending order according to each criterion and the ranks are summed up for each farm. The farm whose total score is the highest is the one with highest property rights. Borda rule applies as function of property of rights given by:

$$PBR_i = \sum_{j=1}^{8} R_{ij} \qquad (1)$$

where

PBR_i = gross indicator of the bundle of properly rights held by farm i,

R_{ij} = rank granted according to criterion j to farm i.

This indicator is normalized between 0 and 100 using the following transformation:

$$PRN_i = \left(\frac{m_p(i) - \min[m_p(i)]}{\max[m_p(i)] - \min[m_p(i)]} \right) * 100 \qquad (2)$$

$m_p(i)$ is the sum of the ranks corresponding to the farm i,

PRN_i is the normalized indicator of the bundle of properly rights for the farm.

The higher the indicator PRN_i, the heavier the bundle of properly rights associated with the farm i.

Given that the indicator of property rights is normalized between 0 and 100, Tobit model is used to identify the determinants of bundle of property rights owned by each farmer. The explanatory variables used are: socio-economic variables, distance of farm plots from homestead, farm income, expenditure on purchased farm inputs and association membership, while the dependent variable is the normalized indicator of bundle of property rights. The Tobit Model, originally developed by Tobin (1958) is expressed as follows:

$$Y^* = X\beta + \varepsilon$$

Where β is a vector of unknown coefficients, X is a vector of independent variables, and ε is an error term that is assumed to be independently distributed with mean zero and a variance of σ^2. Y* is a latent variable that is unobservable. If data for the dependent variable is above the limiting factor, zero in this case, Y is observed as a continuous variable. If Y is the limiting factor, it is held at zero. This relationship is presented mathematically in the following two notations:

$Y = Y^*$ if $Y^* > Y_0$
$Y = 0$ if $Y^* < Y_0$

where Y_0 is the limiting factor.
These two notations represent a censored distribution of the data. The Tobit model can be used to estimate the expected value of Y_i as a function of a set of explanatory variables (X) weighted by the probability that $Y_i > 0$.
Tobin (1958) and Maddala (1983) show that the expected intensity of adopting E (Y) is
$E(Y) = X\beta F(z) + \sigma f(z)$ and $z = X\beta/\sigma$
Where F(z) is the cumulative normal distribution of z, f(z) is the value of the derivation of the normal curve at given point (unit normal density), z is the Z score for the area under the normal curve, and σ is the standard error of the error term. The coefficients for variables in the model (βs) do not represent marginal effects directly, but the sign of coefficient will give the researcher information as to the direction of the effect.

To estimate the productive efficiencies, the stochastic frontier production function approach is used to compute the technical efficiency of resources. This is a widely used methodology in empirical studies to assess technical efficiency achievements in farm production (Coelli et al., 1998; Kumbhakar and Lovell, 2000). The frontier production function shows the maximum amount of output obtainable from given quantities of inputs representing maximum efficiency (Hallam and Machado, 1996). Technical inefficiency is measured from this frontier level. The stochastic frontier production function specification enables the separation of output shortfalls due to technical inefficiency from those caused by random disturbances. The general statistical model of the stochastic frontier production function (Jondrow et al., 1982; Kumbhakar and Lovell, 2000) that is applied for the analysis is:

$$\ln Y_i = a + \beta^* X_i + v_i - u_i,\ i = 1, 2, 3, \ldots N \qquad (3)$$

Where

$\ln Y_i$ is the natural logarithm of the output for observation i,
β stands for the vector of parameters to be estimated,
Xi stands for the vector of input variables (in logs) for the ith observation,
v_i stands for the disturbance term with a symmetric distribution,
u_i stands for the disturbance term with a half-normal distribution (one sided error term) measuring the technical inefficiency component independently distributed of the vi's.
i stands for observation unit, in this case a plot.

The technical inefficiency terms, u measures the shortfall of output from its maximum possible value given by stochastic frontier (Jondrow et al., 1982). These are expressed as:

$$U_i = Zi\delta_0 + w_i,\ I = 1, 2, 3, \ldots, n \qquad (4)$$

Where Z stands for the vector of factors that influence the technical inefficiency,
δ stands for the vector of unknown parameters of the plot specific inefficiency variable, and w is a random disturbance term obtained by truncations of the normal distribution with means zero and variance σ^2.
The technical efficiency of production of the i^{th} firm is computed as:

$$TE_j = \exp(-\mu_i) = \exp(-Zi\delta - w_i) \qquad (5)$$

The Maximum Likelihood estimates of the model parameters are computed using the statistical package Frontier version 4.1 which assumes a Cobb-Douglas production technology (Coelli, 1996).

Study area, sampling and data

The study was carried out in Ogbomoso zone of Oyo State Agricultural Development Programmes (ADPs). The ADP zone enjoys tropical climate influenced by the major wind current, the southwest trade wind, which are, hot and dry. These wind currents give rise to two major seasons: the rainy season occurs between March and October when the area is under the influence of the moisture laden south west trade wind which blow inland form the Atlantic ocean. The dry season starts in November lasting till March with the accompanying Northwest dust laden harmattan wind from the Sahara desert between December and January. The monthly rainfall varies from season to season. For instance, the average rainfall of about 192.2 mm is often recorded during the month of July while rainfall in December or January is as low as 1.5 mm.

Average monthly temperature for the zone in general varies between 24 to 30°C with average maximum monthly temperature ranging between 27 and 35°C with minimum between 18 and 23°C. The hottest months of the year are February and March during which the average mean temperature is usually 30°C and the months are August and September during which mean temperature is about 22°C. Relative humidity of the zone is usually higher during the raining season between April and September. The mean daily relative humidity varies between 40% and 90%.

All the rice farmers in Ogbomoso Agricultural zone in Oyo State constituted the target population of the study. Multistage sampling technique was adopted in the study. The first stage involved purposive selection of two Local Government Areas (LGAs) noted for rice cultivation in Oyo State. The second stage involved simple random selection of six towns/villages from the list of rice grown villages/towns obtained from the information unit of each LGA, making a total of twelve towns from the state. From each of the selected villages, a proportional random sampling of the respondents was carried out based on the lists of all registered rice farmers to make a total of 180 respondents for the study distributed equally among native and non-natives rice farmers.

RESULTS AND DISCUSSION

This section discusses the findings on analysis of socio-economic profiles and characteristics of native and non-native rice farmers in the study area. It also discusses econometric and inferential results of the analyses. We first describe the profiles of the sampled respondents in Table 1.

Profile of the respondents

Majority of the native respondents (about 43%) had their age range equal to or less than 40 years while about 37% of their non-native counterparts were in the same age range. However, only about 11% and 8% of native and non-native rice farmers respectively had their age range equal to or greater than 61 years. Overall, the average age of the rice farmers in the study area was 44.43. The implication of the overall average age for the farmers is that rice farming is dominated by youth in the study area. This is expected to have a significant effect on their productivity and this is in line with the study of Battese and Coelli (1995), that older farmers were less efficient. Majority of the native respondents (72%) were married while more (76%) of the non-native respondents were married. This is in line with Idowu (1990), that this group (that is, married) can be considered as those who have established themselves in farming while the unmarried respondents who incidentally are young, can be considered as the new entrant into farming activities. Majority of the native respondents (about 52%) had their household size less than or equal to 4 compared with 52% majority of the non-native farmers that had between 5 and 7 members in the household. However, about 1% and 43% of the native and non-native rice farmers respectively had their household size range equal to or greater than 8. Overall, the average household size of the rice farmers in the study area was 6 people. The implication of the overall average household size for the farmers is that large household size is maintained to ensure adequate supply of family labour for rice production activities. This is in line with Awudu and Richard (2001) that large families appeared to be more efficient than small families. Majority of native farmers had between 2 and 4 years of farming experience compared to about 41% majority of the non-native that had between 5 and 7 years of rice farming experience. Overall, the average farming experience of the rice farmers in the study area was about 5 years. The implication of the overall average farming experience for the farmers is that an average non-native farmer has high farming experience. This is consistent with Pierre (2005), that the length of experience in farming is probably an indicator of a person's commitment to agriculture and also is in line with Awudu and Richard (2001), that farming experience contributes to production. Results for the analysis on educational levels of respondents show that 33% of the native farmers had no formal education compared with 68% of the non-native farmers. About 1% of the native compared to 32% of non-native completed primary school education, 24% of the native farmers compared to nothing in non-native had secondary school certificate. None of the non-native farmers had NCE and University education, while about 29% of the native farmers had university education and NCE/ND certificates. This indicates that majority of the native farmers are educated at least with secondary school level and this

Table 1. Characteristics of respondents.

Characteristics	Native	Non Native	Characteristics	Native	Non Native
Age range (years)	**Percentage**	**Percentage**	**Number of extension**	**Percentage**	**Percentage**
≤ 40	42.67	37.33	1-2	97.3	82.7
41-50	25.33	28.00	3-4	2.7	17.3
51-60	21.33	26.67	Total	100.0	100.0
≥ 61	10.67	8.00			
Total	100.00	100.00	**Labour (man-day)**		
			10-30	6.7	20.0
Marital status			31-60	55.9	80.0
Single	28 .0	24.0	61-100	37.4	-
Married	72.0	76.0	Total	100.0	100.0
Total	100.0	100.0			
			Rice output (kg)		
Household size			200-300	32.0	-
≤4	52.1	5.3	301-400	48.0	-
5-7	46.7	52.0	401-500	20.0	-
≥8	1.3	42.7	>500	-	100
Total	100.0	100.0	Total	100	100
Farming experience			**Production practice**		
2-4	56.0	34.0	Rain fed upland	48.0	72.0
5-7	36.0	41.3	Low land rice	54.0	25.3
≤30	08.0	24.0	Irrigation rice	-	2.7
Total	100.0	100.0	Total	100	100
Education level			**Varieties of rice**		
Non formal	33.3	68.0	Local rice	96.0	100.0
Primary	1.3	32.0	Improved rice	4.0	4.0
Secondary	24.0	0	Total	-	-
NCE/ND	29.3	0			
University	29.3	0	**Transfer right**		
Total	100.0	100.0	To register land	94.7	-
			To loan out	-	-
Farm size (hectare)			To rent out	92.0	-
1-5	40.0	18.6	To mortgage	1.3	-
6-10	60.0	66.7	To pledge	-	-
>10	0.0	14.7	To bequeath	89.3	-
Total	100.0	100.0	To give	5.3	-
			To sell	4.0	-
Land acquisition			Total		-
Family land	85.3	-			
Rented land	-	66.3			
Leased land	-	94.3			
Purchased land	17.3	-			
Gift land	1.3	-			
Borrowed land	6.7	-			
Pledge land	-	-			
Community land	90.7	-			
Government land	-	-			
Share cropping	-	-			
Total	-	-			

corroborates the findings of Fuss et al. (1999), that average schooling in the village (external benefit of school) improves technical efficiency. Education helps in the learning process and also helps in adoption of new technologies as rightly observed by Clark and Akinbode (1968).

Further results show that 40% of native farmers had farm sizes between 1 and 5 ha as compared to about 19% of the non-native. It further revealed that 60 of the native farmers have between 6 and 1 ha, while about 67% of the non-native farmers fell within that range as well. Non-native farmers had above 10 ha as compared to about 15% of the non-native. Overall, the average farm size of the rice farmers in the study area was 5.4 ha. The implication of this is that native rice farmers are small scale farmers, which is in line with Olayide (1980) who classified farm size, into small, medium and lame farm size based on hectarage.

On land acquisition patterns, about 85% majority of the native rice farmers used family land compared to about 94% of the non-native that used leased land for their rice operations. About 91% of the native rice farmers compared to none of the non-native farmers used community land, about 66% of the non-native farmers used rented land for rice cultivation. This implies that majority of native rice farmers used free land for rice cultivation, while the non-native farmers rented the land they are using for the rice production. It was discovered that only the native rice farmers have the transfer right of the land. The table of results (Table 1) revealed that about 95% of native rice farmers have right to register their land, 92% of them can rent out their land, about 89% of them can also bequeath the land while only 4% and 5% of them can sell their land and can give it to their people for farming operation. This is an indication that only the native rice farmers have the transfer right of the land in the study area. On production practices, results show that 48% of the native rice farmers compared to 72% of the non-native practised rainfed upland production system while none of the native rice farmers used irrigation for rice production compared to about 3% (minority) of non-native farmers that used irrigation for their rice operations. Ninety-six percent of the native farmers as compared to 100% of the non-native farmers planted local rice, 4% minority of the native farmers compared to 4% minority of the non native farmers planted improved rice in the study area. This implies that technology of improved rice is still lacking for both the native and the non-native rice farmers in the study area. Majority of the native rice farmers produced 301-400 kg compared to 100%, majority of the non-native farmers produced over 500 kg. This implies that the non-native farmers are the major producers of rice in the study area. This means that even if lack of individual title to land does lead to tenure insecurity, it does not necessarily follow that reduced insecurity would result in higher agricultural productions or investments in agriculture.

In this study, labour was measured in terms of adult man-day as eight-hour day. Considering the number of people performing each farm operation and the duration of time used for the operation, the man-day equivalent of both families and hired labour were calculated out. Operations performed by women were taken to be 0.75 of the man-day equivalent and those by children to be 0.50. Table 1 revealed that about 56% majority of the native farmers compared to about 80% majority of the non-native used between 31-60 man-day, about 7% (native) compared to 20% (non-native) used 10-30 man-day of labour. The variation in the quantity of labour used may be due to use of machinery.

Ninety seven percent of native farmers had between 1 and 2 extension visits compared to about 83% of non-native farmers. However, about 3% native compared to about 17% non-native farmers had between 3-4 times extension visits in a year. This implies that both farmers have access to extension services in the study area which will surely aid their production.

Results of statistical and econometric analyses

Here, results of three important analyses are described and discussed. First, a t-test was conducted on the variables included in the stochastic Frontier Function analysis. This is to check and ascertain the differences in the mean values of these variables for the native and non-native farmers. Also, the results of the stochastic Frontier Function analysis are described and discussed, and thereafter a Tobit analysis was carried out to determine the factors that are responsible for the differences or otherwise in the technical efficiencies of both the native and non-native farmers.

Two sets of variables were included in the Stochastic Frontier Function analysis. They included the variables that represent the inputs used in the production activities. These are farm size, labour use, seed use, fertilizer use, herbicide use, pesticide use and implement depreciation. The variables also included the inefficiency variables and these are age, farming experience, education and extension visits. Results (from Table 2) indicate that out of the seven variables included, about 43% (3 out of 7) showed significant mean (at 10% level of significance) differences for the native and non-native farmers. These variables are fertilizer use, herbicide use and pesticide use. This means that the native and non-native farmers are different in their use of these inputs. However, only in the use of fertilizer do we observe a positive significant difference. Herbicide and pesticide use showed negative significant differences. On the four inefficiency variables included, 75% (3 out of 4) showed significant mean differences between the native and non-native farmers. These are farming experience, education and extension visits. Farming

Table 2. Characteristics of variable included in the Stochastic Frontier (Test of mean differences).

Variable	Native	Non-native	Total sample	Difference
Farm size	5.45 (0.13)	5.34 (0.15)	5.40 (0.10)	-0.11 (0.20)
Labour use	54.31 (2.09)	78.03 (40.51)	66.17 (20.24)	23.72 (40.56)
Seed use	2.25 (0.14)	2.25 (0.14)	2.25 (0.10)	0 (0.20)
Fertilizer use	0.94 (0.12)	40.67 (11.92)	20.80 (6.16)	39.73 (11.92)*
Herbicide use	1.97 (0.30)	0.99 (0.14)	1.48 (0.17)	-0.99 (0.33)*
Pesticide use	1.97 (0.30)	0.99 (0.14)	1.48 (0.17)	-0.99 (0.33)*
Implement depreciation	2328 (94.07)	2328 (94.07)	2328 (66.29)	0 (133.03)
Age	44.19 (1.50)	44.67 (1.36)	44.43 (1.01)	0.48 (2.03)
Farm experience	3.77 (0.20)	5.73 (0.30)	4.75 (0.020)	1.96 (0.36)*
Education	7.0 (0.68)	1.92 (0.33)	4.46 (0.43)	-5.08 (0.76)*
Extension visits	0.81 (0.09)	0.17 (0.04)	0.49 (0.66)	-0.64 (0.099)*

* = Significant at 10% level.

Table 3. Maximum likelihood estimate for the parameters of the Stochastic Frontier Production Function for native farmers.

Variable	Coefficient	T-value
Production function		
Constraint	0.2838	94.574
Farm size	0.5822	13.370***
Labour	0.4238	0.8674
Seed	0.6535	1.764
Fertilizer	0.1153	8.9107***
Herbicides	0.1828	16.1217***
Pesticides	0.3381	0.5699
Implement depreciation	0.1115	0.1018
Inefficiency model		
Constraint	0.1482	4.9907
Age	-0.4644	-0.8136
Years of farming experience	0.5506	5.1278***
Years of education	0.7054	0.5178
Number of extension visit	0.1084	5.2176***
Variance parameter		
Sigma squared	0.5098	5.0827***
Gamma	0.2498	0.2022
Log likelihood function	1.9826	

Source: Field survey (2009).
*** = Significant at 1%; ** = Significant at 5%; * = Significant at 10%.

experience showed positive significant difference while education and extension visits showed negative significant mean differences. This also means that the native and non-native farmers are different in the factors that affect their efficiency.

Two functional forms of stochastic production frontier model were fitted (Linear and Cobb Douglas functional forms), but only the Cobb Douglas type provided the best fit (Table 3) based on the explicit detail of the technical efficiency of the native and non-native rice farmers as well as the number of significant variables in the model. More so, Kalirajan and Flinn (1983) alluded to the fact that Cobb Douglas type has certain advantages over the other functional forms. The coefficients of variables are very important in discussing the result of the analysis of the data. Among the native rice farmers in the study area, the variables that were significant included farm size (significant at 1%), fertilizer quantity used (significant at 1%) and herbicides quantity used (significant at 1%), while the other variables like labour, seed, pesticides and implement depreciation were all not significant at all known levels of significance. By implication, the above findings revealed that the major productive inputs that have a great impact on rice production of the native rice farmers were farm size, fertilizer used and herbicides quantity used. Farm size had the highest coefficient, with a value of 0.5822 which is positive in the preferred model (MLE) and by implication the farm size used existed as the most important input that had a great effect on rice output among the native rice farmers. Therefore for every unit increase in land, there is less than proportionate increase in rice output. In the maximum likelihood estimate model, all the significant variables carry positive signs. The economic implication of the sign is that any increase in the quantity of farm size, fertilizer quantity used and herbicides quantity used would lead to an increase in rice output of the native farmers. Negative coefficient on a variable might indicate an excessive utilization of such variable. In economic terms, any attempt to increase the quantities of such variables will be tantamount to raising the level of rice output of the native rice farmers in the study area.

Table 4. Maximum likelihood estimate for the parameters of the Stochastic Frontier Production Function for the non-native farmers.

Variable	Coefficient	T- value
Production function		
Constraint	0.2592	15.3616
Farm size	-0.2557	-0.6219
Labour	0.2209	1.6805*
Seed	0.6587	1.6337*
Fertilizer quantity used	-0.6052	-0.1337
Herbicides quantity used	-0.7206	-0.4920
Pesticides quantity used	0.6583	2.7254***
Implement depreciation	0.7497	0.1337
Inefficiency model		
Constraint	0.7708	0.1035
Age	-0.4059	-9.9869
Years of farming experience	0.9323	0.9920
Years of education	0.2972	7.9139***
Number of extension visit	0.1366	0.1191
Variance parameter		
Sigma squared	0.5725	5.5354***
Gamma	0.9103	6.6040***
Log likelihood function	60.1716	

Source: Field survey (2009).
*** = Significant at 1%; ** = Significant at 5%; * = Significant 10%.

Among the non-native rice farmers (Table 4), the significant variables include labour (significant at 10%), seed (significant at 10%) and pesticides quantity used (significant at 10%), while other variables, that is, farm size, fertilizer and herbicides used were not significant at all known levels of significance. The implication of the above findings is that the productive input that exert great impact on rice output of the non-native rice farmers are labour, seed quantity planted and pesticides quantity. Among the above three major inputs, seed planted has the highest coefficient with a value of 0.6587 and therefore, it existed as the most limiting factor that greatly determine what rice output would be like among the non-native rice farmers. In the maximum likelihood estimate of farm size, fertilizer quantity used and herbicides quantity used had a negative sign but was not significant. The implication is that any increases in those variables would greatly reduce the returns to be realized from the sales of rice output among the non-native, so an extra cost incurred on those inputs does not translate into better returns.

The estimated parameters of the inefficiency model in the stochastic frontier model of the native and non-native rice farmers are also presented in Tables 3 and 4. The analysis of the inefficiency model shown in the tables showed that signs and significance of the estimated coefficients in the inefficiency model have important policy implication on the technical efficiency (TE) of the native and non-native rice farmers.

Among the native rice farmers, the coefficient of farming experience, numbers of extension visit were significant of 1% and positive, while coefficient of age was negative, although not significant, even at 10% level of significance. The above findings revealed that years of farming experience and number of extension visits tend to increase the level of technical inefficiency of the native rice farmers. The above findings are not in conformity with “a priori” expectation and were incongruent to the findings of Ajibefun and Daramola (1999), Ojo (2003) and Seyoum et al. (1998). The reason for years of farming experience and number of extension visit contributing to the inefficiency level of native farmers may include inefficient and inadequate family labour input, lack of proper supervision of their farms due to other profitable off-farm activities as well as trivialization of proven rice production information on personal ground.

Among the non-native farmers, only coefficient of years of education is significant at 1% and positive against “a priori” expectation. The findings revealed that years of education had a positive relationship with their technical inefficiency level and this means that the higher the educational level of the non-native farmers, the lesser their technical efficiency will be.

The estimated sigma square (σ^2) for each of the native and non-native rice farmers was 0.5098 (significant at 1%) and 0.5725 (significant at 1%). The values are very large and significantly different from zero which indicates a good fit of the model and the correctness of the specified distributional assumptions.

The estimated gamma (γ) parameters of the native and non-native farmers are 0.25 and 0.91. The above results suggest that about 25% of the variation in rice output among the native rice farmers and 91% variation in rice output among the non-native rice farmers in the study area are due to the differences in their technical inefficiencies. The result is consistent with the finding of Dawson and Lingard (1989), Ajibefun and Aderinola (2004) and Yao and Liu (1998).

Property right depends on a number of factors which are beneficiary related factors and these are considered to have significant effects on the property right using Tobit analysis. The variables used in the model are age, gender, household size, farm size, year of education, distance of farm plots from homestead, non-farm income, farm income, total cost of fertilizer, total cost of herbicides, total cost of pesticides and association membership respectively. The dependent variable used in this study is defined as the gross normalized indicator of the bundle of property rights.

Tobit regression estimates for native rice farmers

Table 5. Tobit regression for the native rice farmers.

Variable	Coefficient	Standard error	t- value
Constant	0.4343	0.1176	3.691
Age	0.9850	0.1110	0.889
Gender	-0.8042	0.4778	-1.683*
Household	0.1493	0.1630	0.916
Farm size	-0.7075	0.9692	-0.730
Year of education	-0.4153	0.2340	-1.775*
Distance	0.5710	0.9906	0.576
Non farm income	0.6705	0.6468	1.637*
Farm income	0.7612	0.221	0.343
Total cost of fertilizer	-0.3997	0.2076	-1.991*
Total cost of herbicides	0.1386	0.6963	1.925*
Total cost of pesticides	0.1386	0.2403	2.113**
Association Membership	0.7720	0.3786	2.568***

Source: Field survey (2009).
*** = Significant at 1%; ** = Significant at 5%; * = Significant 10%.

rice farmers showed that coefficient of gender, year of education, non farm income, total cost of fertilizer, total cost of herbicide were significant at 0.01 level, while total cost of pesticides and association membership were significant at 0.05 and 0.10 levels, respectively. The coefficient of age, household size, farm size, distance of the farmer, and farm income was not significant.

The estimated coefficient of gender, year of education and total cost of fertilizer was negative and statistically significant at 10% level indicating that the likelihood of property right is enhanced as the number of years of education and total cost of fertilizer decreases. Table 6 of the non-native rice farmers show that farm size coefficient was significant at 1% level, whereas total cost of pesticide and distance of farm plots from homestead were significant at 1% level while non farm income and association of membership were significant at 5% level of significance. All the significant variables carry a positive sign which implies a positive relationship with property right of the non native rice farmers in the study area.

SUMMARY OF THE MAJOR FINDINGS

The study broadly examined the property rights, management and efficiency of rice farmers in Oyo State, Nigeria. The study used cross sectional data from the farm business survey conducted on a sample of 180 from Oyo State. The study employed the following tools in order to analyze the data collected from the field: descriptive statistics (mainly percentages) were used to describe the socio-economic profiles of rice farmers. Econometric analytical models such as stochastic frontier production function analysis and Tobit model were used to analyze the technical efficiency and determinants of bundle of property rights respectively for both categories of farmers. Among the native rice farmers, the variables that were significant in influencing the rice output (Table 3) included farm size, quantity of fertilizer used and quantity of herbicides used which were all significant at 1% levels. Results further show that farm size has the highest coefficient which existed as the most important input that greatly impacted on the rice production in the study area. Among the non-native rice farmers (Table 4), the significant variables include labour and seed which were significant at 10%, as well as the quantity of pesticides used which was significant at 1% level.

The Tobit regression of the native rice farmers shows that gender, year of education, non farm income, total cost of fertilizer, total cost of herbicides, total cost of pesticides and association membership have an impact on property right while the Tobit regression of the non-native farmers shows that farm size, distance of farm, net farm income, total cost of pesticides and association membership has an impact on their property rights.

Conclusion

This study has empirically studied the property right, land management and efficiency of rice farmers in Oyo State, Nigeria. The following conclusions are drawn based on the major findings of the study. The larger percentage of the sampled rice farmers were at their productive age, and had no formal education. Majority of the sampled farmers have a considerable family size, while the variation in the family size may be due to interest of the individual farmers to bear more children in order to use them for family labour, thereby reducing the cost of production. It is considered that native farmers used their family land while non-native farmers used leased land mainly for their farming operations; the native farmers also have transfer right on their land while non-native farmers have no transfer right at all.

It is concluded that non native rice farmers produced rice than the native farmers, which shows that the technology of rice farming is still lacking for the native farmers.

POLICY IMPLICATION AND RECOMMENDATIONS

The policy implications and recommendations of this study based on the major findings include:

- There should be provision of institutional credit to

Table 6. Tobit regression for the non-native rice farmers.

Variable	Coefficient	Standard error	t- value
Constant	0.7159	0.4822	2.485
Age	0.9430	0.5128	0.184
Gender	0.2150	0.170	1.258
Household	-0.3846	0.3443	-1.117
Farm size	0.1159	0.125	2.921***
Year of education	0.5458	0.1476	0.037
Distance	0.1440	0.78886	1.826*
Non farm income	0.1270	0.3520	2.361**
Farm income	-0.2723	0.6909	0.844
Total cost of fertilizer	-0.107	0.8985	-1.193
Total cost of herbicides	-0.2968	0.4809	-0.617
Total cost of pesticides	0.1803	0.1687	1.713*
Association membership	0.1809	0.1687	2.107**

Source: Field survey (2009).
*** = Significant at 1%; ** = Significant at 5%; * = Significant 10%.

farmers on timely basis and with easy access to such credit facilities. This measure will allow rice farmers to purchase input like fertilizer, pesticides and herbicides and even modern implement so as to encourage expansion of their initial land area allocated to rice production.
- Government should try and formulate a policy on land tenure that will favour both the native and non-native farmers so as to encourage non-native farmers to have good access to farmland at a low rate.
- Government should possess large hectares of land for agriculture which could be given to native or non-native farmers so as to promote agricultural production without tribal consideration.

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