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Land Access and Tenure Impacts on Technical Efficiency of Rice Farmers in Ondo State, Nigeria

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ABSTRACT

Background and Objective: Land policy measures need to regulate land tenure and access for a couple of agricultural development actions. This study examined the relationship between land access, tenure system and technical efficiency among rice farmers in Ondo State, Nigeria. **Materials and Methods:** Only 90 respondents were selected due to low population of rice farmers. Data collection was based on the structured questionnaire and the data were analyzed with descriptive statistics and stochastic frontier analysis (SFA). **Results:** The major results revealed that communal land tenure and inherited land are prevalent land ownerships among farmers. The technical efficiency of the rice farmers ranged from 0.01 to 0.90, with a mean technical efficiency of 0.615. It was found that rice output increases with labour and farm size but decreases with fertilizer use. Also, technical efficiency decreases with native farmers, land tenure and rented and inherited land access. **Conclusion:** The study concludes that the patterns of land access and tenure should be reformed to enhance the potential of rice productivity and revitalize the present bad economic system in Nigeria. It was recommended that the bondage placed on land via tenure patterns that are retarding technical efficiency in Nigerian agriculture be liberated.

KEYWORDS

Land tenure, land access, technical efficiency, rice farmers, Nigeria, farm inputs

INTRODUCTION

Nigeria's land ownership system makes it more difficult for potential farmers to access viable lands. The land tenure system has, among other issues, influenced the location of the farm and its size. Land tenure is the key to agricultural change and development in Nigeria. Specifically, Olagunju *et al.*[1] proved that land ownership reduces risk and variability and increases projected output, additionally, various individual level factors impact the effect of land ownership in different ways. Across sub-Saharan Africa, land ownership, land tenures and farm inputs are obstacles to increased agricultural production. Land tenure gives people, a single entity or groups, the right over a piece of land and its resources such as water, pasture, given relationship with, agreement and the legal right to hold such land. It is a system by which the land is owned by people, which could be formal, communal, customary, or sacred land tenure typologies. Land tenure, in other words, is the proper definition of ownership and property rights in rural and urban settlements. Land access is referred to as the opportunity to acquire and use land or the state of having acquired holding over farmland[2].

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Generally, the relationship between access to land through land registration and land tenure system and agricultural productivity go hand in hand to determine the pattern of agrarian land use as well as agricultural performance. A close scenario of the nexus between these terms was pinpointed by Singirankabo and Ertsen[3] in their study which reported land access through land registration influences agricultural productivity in developing countries greatly by raising the motivations for investing in farming, decreasing the frequency of land disputes, while increasing the legal ownership of land, this subsequently leads to investments in fixed inputs such as machines that ultimately improve productivity. This helps farming households to gradually move from subsistence farming to large scale farming and indirectly affecting food security at the national level through food availability, consequently the food prices.

A lot of empirical studies identified the potential of land on agriculture, as being the single most important factor of farm production. Therefore, for adequate planning and agricultural development, land acquisition through correct land ownership, access to land and sustainability of the access are crucial. Land for farming and agribusiness provides a means of livelihood to farmers as a productive asset, also through the sale of their produce. In addition, entitlement to land rights may even break intergenerational transmission of poverty. Sequel to this, the researchers are very curious and motivated to test how both land access and tenure drive farm technical efficiency in some important food crops including rice supply.

Efficiency measurement is crucial for productivity and economic growth. Mzyece and Ng'ombe[4] opined that farmers can improve their returns by knowing how to raise their productivity through efficiency measurement. Many researchers recognize the potential of efficiency to foster production because it helps farmers combine their resources in the best way to achieve production. Enhancing farm-level productivity by improving production efficiency is also considered imperative by Saka *et al*.[5] . Agricultural efficiency is essential because it enhances productivity, which is the primary interest of any economy, according to Raufu *et al*.[6] . Productivity can be achieved through technological innovations and the efficiency of such production technologies. The efficiency with which farmers use available resources and improved technology is essential in agricultural production, as suggested by Rahji[7]. Efficient resource mobilization and use help to account for productivity increases. Azadi *et al*.[8] reported various factors contributing to farmers' inability to make decisions that can increase their output in practice. These factors include inadequate knowledge, institutional bottlenecks, market limitations, volatility, diverse objectives and differences in quality of resources, which if overcome by farmers can lead to significant output increases as well as improvement in farming conditions.

According to the literature, increased output per input unit can be obtained through increased scale or specialization, efficiency and technological change. Rice, *Oryza sativa*, Asia or *Oryza glaberrima*, as in Africa, continues to be a staple and indispensable food intake by the masses due to its palatability and comfort cooking, compared to all other grain crops. In a report by Soto-Góme and Pérez-Rodríguez[9], rice is one of the 3 important grains consumed for human nutrition, after maize and wheat. The economic importance of rice can be supported by the growth of the agricultural sector as an internationally tradable commodity and food security pillar. There is a supply gap in rice production in Nigeria since rice consumption in Nigeria is higher than domestic production and rice farming is mostly done by smallholder farmers most of whom cultivate less than 1 ha[10], thereby encouraging importation at the expense of local production to meet demand.

Governments have tried to halt rice importation in Nigeria to boost local rice production. Nigeria's rice statistics suggest enormous potential to raise productivity and improve the efficiency level of rice production.

Recurrent studies on the nexus between the land tenure system and agricultural production are necessary and they should keep growing until farm households overcome the challenges of land tenure occurring in their societies. The stagnation of research on farmland redistribution, reform and reclamation accounts

for a more significant impairment in agricultural development in this country. This is noticeable in the shortfall in food supply that the masses are experiencing. There is no doubt that secure land access is a basis for agricultural food systems. Nonetheless, the systems by which people in the country hold the land must be revisited to promote land allocation and enhance farming activities. The land tenure issue directly influences food availability at the household level in agrarian society by controlling access to resource endowments and indirectly affecting food security at the national level through food availability and, consequently, food prices.

In essence, the land ownership structure in our local societies may call for more investigations into the intertwined allocation of agricultural land, the land tenure system and hence, farm efficiency. Naturally, farmers are not emotionally attached to land they use for cultivation if they do not have the security of ownership of such land, by extension they do not develop the land and will not maximise the use of inputs productively. To this end, the study generally analyzes the relationship between land tenure typologies and farm technical efficiency among rice farmers in the Ondo State of Nigeria. Specifically, it identifies the various land tenure/access types, measures the technical efficiency of rice farmers and examines the effect of land tenure and access on the technical efficiency of rice farmers in the study area.

MATERIALS AND METHODS

Study area: The study was carried out in Ondo State, Nigeria between March 2022 and August 2023. The state was created on February 3rd, 1976 and is located in the southwestern part of the country, consisting of 18 local Government areas grouped under the (6) agricultural zones of the Ondo State Agricultural Development Programme (OSADEP), which are Akure-Owo Zone, Ikare Zone and Okitipupa Zone. Ondo State includes a mangrove swamp forest near the Bight of Benin, a tropical rain forest in the centre and a wooded savannah on the gentle slope of the Yoruba Hills in the north. The people's primary work is farming. The state covers a total land area of 15,500 km^2. It shares borders with Ekiti State to the north, Kogi State to the northeast, Edo State to the east, Delta State to the southeast, Ogun State to the southwest and Osun State to the northwest. The average annual temperature is 25.9°C with high humidity. The annual rainfall is 1546 mm. The climate is tropical; in winter, there is much less rainfall than in summer. Its agroecological condition permits the cultivation of agriculture for economic gain. Rice crops thrive in Ondo State more than in other states in Southwest Nigeria, although the production is still less than the demand of people in the region.

Sampling technique: The population for this study consisted of the food crop farmers major in rice production in Ondo State. Thus, purposive sampling was used to select the rice farmers across the whole state to reach a large audience. The list of registered rice farmers gives a figure of about 120 people as the population frame across the region. Using Yamane[11] approach to determine the equivalent sample size, that is:

$$n = \frac{N}{1+N\,(e)^2} \quad (1)$$

Where:

N = Population size = 120

e = Precision required for sampling error

$$n = \frac{120}{1+120\,(0.05)^2} = 92.308 \text{ rice farmers}$$

About 92 rice farmers were sampled, representing all rice farmers in the Ondo State, Nigeria. A structured questionnaire was employed to collect data from primary sources. Input-output data for rice farming, land tenure system, farm-level characteristics and some socio-economic factors represented the information

collected from the sampled respondents. However, only 90 respondents were focused on this study due to inconsistent information provided by the other respondents.

Analytical techniques: Descriptive statistics and the stochastic frontier approach (SFA) were used in analyzing the data. The stochastic frontier approach (SFA) has been used for a long period to estimate the efficiency level of many agricultural enterprises globally, even in regions with distinct production systems and agroclimatic zones. It is the most popular technique used to measure production efficiency, as earlier noted by Sultana *et al.*[12], Zewdie *et al.*[13], Aboaba[14], Charnes *et al.*[15], Aigner *et al.*[16], Meeusen and van den Broeck[17] and others. According to Mailena *et al.*[18], stochastic frontier analysis (SFA) is based on the standard production function approach, which relates the quantity of output of a given farm yi to the quantity of inputs used xi relative to the production technology. The function builds hypothesized efficiency determinants into the inefficiency error component to identify focal points for action to bring efficiency to higher levels. The specification of stochastic production frontier analysis in most cases followed the Cob-Douglas production function, which is stated as follows:

$$\ln Y_i = \beta_o + \beta_1 \ln X_1 + \ldots \beta_n \ln X_n + V_i - U_i \quad (2)$$

Where:

ln = Natural logarithm
Y = Rice output (kg)
X_1 = Family labour (man-days)
X_2 = Labour used
X_3 = Farm size (ha)
X_4 = Seed (improved) kg
X_5 = Seed (local) kg
X_6 = Fertilizer (kg)
X_7 = Pesticide (kg)
X_8 = Land cultivated
v_i = Normally distributed random error
β_i's = Parameters estimated
ln's = Natural logarithm
u_i = Technical inefficiency term

In addition, the factors affecting the efficiency of the rice farmers are usually determined using the inefficiency model stated below:

$$U_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_2 Z_2 + \ldots \delta_n Z_n \quad (3)$$

Where:

U_i = Inefficiency model
δ_1-δ_n = Coefficients of independent variables
δ_0 = Constant term
Z_1-Z_n = Explanatory variables
Z_1 = Native of village (Yes = 0, No = 1)
Z_2 = Communal freehold (Yes = 0, No = 1)
Z_3 = Years of education (Years)
Z_4 = Household size (Numbers)
Z_5 = Rented (Yes = 0, No = 1)
Z_6 = Inheritance (Yes = 0, No = 1)
Z_7 = Lease (Yes = 0, No = 1)

RESULTS AND DISCUSSION

Socio-economic characteristics of the farmers: The descriptive analysis of the socio-economic characteristics of the rice farmers was tabulated and discussed here. According to Table 1, rice farmers were dominated by males, accounting for 64.44%, while females accounted for 35.56%. This finding suggests that males can take more risks and face uncertainty associated with rice production than their female counterparts in the Ondo State. It was also observed that 30% of the respondents were 41-50 years of age, 26.67% of them were 60 years and more, 22.22% were 51-60 years of age, 22.22% of the respondents were 31-40 years of age and 11.11% of the farmers were less or 30years of age. This shows that the more significant percentage of the respondents falls between 20 and 50 years of age, which implies that the farmers are still strong enough to work well on their farms and the products from the farms will be high. The study revealed that majority of rice farmers comprising 67.78% consisted of a family size of between 6 to 10 members while 32.22% of them constituted 5 people or less in their family with an average household size of 8 people. Agriculture in Nigeria is labour intensive and also subsistence, household labour is used for most farming activities with little or no mechanization, hence it is important to consider the size of farming households. Since household labour constitute the most human effort to farming activities, families with larger household size tend to have more labour input and benefit more using unpaid labour.

The result shows that 82.22%, representing 74 farmers, have a household size of 10 or less, while 16 farmers have a family size above 10, representing 17.78%. The marital status of the farmers shows that

Table 1: Distribution of socio-economic characteristics of the sampled rice farmers

Variables	Frequency	Percentage	Mean
Sex			
Male	58	64.44	
Female	32	35.56	
Age			
31-40	19	11.11	51.8 years
41-50	27	30.00	
51-60	20	22.22	
≥60	24	26.67	
Marital status			
Married	57	63.33	
Not married	33	36.66	
Households size			
≤5	29	32.22	8 people
6-10	61	67.78	
Educational status			
Primary	17	55.56	
Secondary	14	60.83	
Tertiary	19	8.75	
No formal education	40	44.46	
Primary occupation			
Not full time	25	27.78	
Full time	65	72.22	
Farming experience	90	100.0	2.2 years
Farm size			
≤5	65	72.22	4.62 ha
6-10	19	21.11	
≥10	6	6.67	
Farmers association			
Not member of association	10	11.11	
Member of association	80	88.89	
Extension contacts			
Access	77	85.56	
Non access	13	14.44	

Source: Field survey, 2022

the majority (63.33%) were married, (14.44%) were single and divorced respectively, (5.56%) were separated and (2.22%) were widowed. Since most of the farmers were married, more labour (spouse and children) was available to work productively on the farm. Also, the level of education of the farmers gives a good indication that economic activities can be improved upon given that more than half (55.56%) of the farmers had above primary education, with less than half (44.46%) having no formal education. Education has been known to influence the adoption of innovation by farmers. In addition, most (72.22%) of the respondents are full-time farmers, while (27.78%) are into non-farming as their primary occupation. It indicated that most respondents chose farming as their primary occupation. Also, rice farmers are distributed based on their experience in farming, it was found that all of them had 5 years or less of experience while the mean years of farming experience was 2.2 years. It implied that rice has not been highly propagated in many regions in this country. It is also served as an evidence for the low rice production in Nigeria. In terms of farmland size, about (72%) of the farmers cultivate 5 ha or less, 21.11% owned farm sizes ranging between 6 to 10 ha while a few of them (6.67%) cultivated on a farm size of 10 ha or more. The average farm size was 4.62 ha; which indicated that rice farming is dominated by smallholders. The distribution of membership of the association shows that 10% of the farmers do not belong to any association, while (88.89%) belong to an association. This implies that belonging to an association affords the farmers some benefits that cause improvement in production and therefore emphasizes the importance of cooperative association among rural farmers. The extension contract demonstrates a tremendous positive impact on farming practices. The majority (85.56%) of the respondents had access to extension agents, while about (14.44%) of the respondents did not have access to extension agents.

Forms/types of land tenure: Access to land is governed through land tenure systems. Land tenure is the relationship, whether legally or customarily defined, among people, as individuals or groups, with respect to land. Distribution of respondents according to land tenure typologies was discussed as depicted in Table 2. The study identified that most (67.78%) of respondents have communal land tenure, 12.22% have freehold land tenure, 11.11% have government (formal) land tenure and 8.89% of respondents have private land tenure. This result signified that the communal pattern of land tenure dominated among others in the study area. This finding was in conformity with Ogunwusi *et al.*[19] where results show that land ownership by absolute interest accounted for about (65%) of the farmers in Osun State.

Modes of farmland access among the respondents: Table 3 shows the various means by which the respondents accessed their farmlands. It signified that most farmers corresponding (54.44%) depended on inherited farmland to produce food crops, while the rest (23.33, 12.22, 5.56 and 3.33%) of them were able to access cropland through rented, purchased, shared cropping, a government source and the likes. This finding implied that ownership by inheritance remains the major mode of securing farmland in the study area. Tsue *et al.*[20] showed that land tenure system in the study area was predominantly (47.5%) through inheritance. Singirankabo and Ertsen[3] and Bamire[21] also found that farmland acquisition through inheritance was predominant in the dry savannas of Northern Nigeria.

Determinants of efficiency among the rice farmers: The maximum likelihood estimation of the frontier function shows that labour used and the total size of the land is significant at 1% and positively related to rice output in the efficiency model. The positive relationship between rice output and these inputs has economic implications, which could mean more rice production as more inputs are used by the farmers. The positive and significant relationship between labour used and rice output implies that as more labour is employed, there is assurance of high rice production output in the area, this was similar to Ogunwusi *et al.*[19]. The estimated positive coefficient for the total size of land, which is a significant factor at the 1% level, implies that an increase in farm size could also lead to an increase in rice productivity. According to Aboaba[14] and Ogunwusi *et al.*[19] farm size and labour are necessary factors to be increased to have increased farm output in Nigeria. On the other hand, fertilizer usage is negatively associated with rice output and significant variable at 10% level.

Table 2: Distribution of the rice farmers by land tenure typologies

Land tenure typologies	Frequency	Percentage
Private	8	8.89
Communal	61	67.78
Government	10	11.11
Freehold	11	12.22
Total	90	100.00

Source: Field survey, 2022

Table 3: Distribution of respondents according to the mode of farmland access

Mode of farmland access	Frequency	Percentage (n = 90)
Inherited	49	54.44
Purchased	11	12.22
Rented	21	23.33
Shared cropping	5	5.56
Government appreciate land	3	3.33

Source: Field survey, 2022

Table 4: Maximum likelihood estimation of the stochastic frontier model

Variables	Coefficients	Standard error	t-value
Constant	8.453	0.751	11.25
Labour wage	-0.028	0.018	-1.56
Labour used	0.289**	0.111	2.61
Farm size	0.346**	0.655	5.27
Seed (improved)	0	0.002	0.25
Seed (local)	0	0	-0.26
Fertilizer used	-0.000*	0	-1.86
Pesticide	0	0	0.39
Land cultivated	-0.106	0.069	-1.54
Inefficiency			
Constant	-3.467	1.445	-2.40
Native farmers	0.998*	0.553	1.71
Communal	0.898*	0.489	1.83
Freehold	0.64	0.479	1.33
Farming experience	0.258	0.275	0.94
Household size	-0.059	0.077	-0.78
Rent	2.492**	0.709	3.51
Inheritance	1.426**	0.568	2.51
Lease	0.766	1.333	0.57

Source: Field survey, 2022, *Significant at 10% and **Significant at 5%

The sources of inefficiency were examined simultaneously and the results, as specified by the maximum likelihood parameter estimates, are presented in Table 4. It was discovered that native farmers and communal land tenure are both significant at the 10% level, while rent and inheritance from land increased technical efficiency (positive relationship) with a significance level of 1% within the system. From the efficiency model, it is important to explain farmers' observed level of technical efficiency using the signs of the variables. Farmers' production capacity increased with a negative coefficient, indicating that negative coefficients reduce technical inefficiency. While farmer's propensity to increase in efficiency and reduce productive efficiency is shown by a positive coefficient variable. This result implies that farmers who owned land by communal land tenure, inheritance and rent were less efficient. According to prior work done by Mailena *et al.*[18] and Ogunwusi *et al.*[19] land ownership had a positive relationship with technical inefficiency.

Distribution of respondents by technical efficiency for rice production: The result in Table 5 revealed that the predicted technical efficiency ranged between 0.057 and 0.937 with a mean technical efficiency of 0.615. About 72.15% of farmers attained technical efficiency levels ranging between 0.50 to 0.90, 23.31% operated at a range of technical efficiency of 0.10 to 0.50 and 3.33% operated at an efficiency level

Table 5: Distribution of respondents by technical efficiency

Technical efficiency score	Frequency	Percentage
<0.10	3	3.33
0.10-0.50	21	23.31
0.50-0.90	64	72.15
>0.90	02	1.11
Total	90	100
Mean	0.615	
Minimum	0.057	
Maximum	0.937	

Source: Field survey, 2022

of <0.10 while the rest of them comprising (1.11%) had efficiency scores >0.9 or equal to 1. Efficiency cannot exceed 1 and the gap between this and the average levels of technical efficiency attained is 0.385. It signified that for rice production to be on the frontier, the farmers must improve their efficiency levels.

CONCLUSION AND RECOMMENDATIONS

The study concludes that land tenure particularly communal land tenure has negative impact on the technical efficiency of rice production. The result showed that communal land tenure and other modes of accessing cropland like rent, inheritance, or native farmers increased the inefficiency level in rice production. Also, this study suggests that the patterns of land access and ownership should be reformed to enhance the potential of farm productivity. Given the foregoing, it is recommended that stakeholders, especially the government and the agricultural sector should provide support to farmers by subsidizing agricultural inputs such as improved seed, land acquisition and making herbicides and fertilizer affordable for farmers. This will improve productive capacities and increase efficiency levels among rice farmers significantly. A land redistribution policy that will increase farmers' farm size will boost rice production. In addition, policies that will encourage the expansion of existing farmlands that are not currently under cultivation should be formulated. Overall, land policy measures need to regulate land tenure and access in Nigeria for a couple of agricultural development actions.

SIGNIFICANCE STATEMENT

Securing land access and tenure is of paramount important for agricultural planning and development. It is in most cases substantially encourages the establishment of farms of any kind because it often boosts the rural or farm households' morale towards agricultural practices, even for the newer farmers. Hence, facilitates high investments in agricultural land and makes farming activities more convenient to perform and manage. In a farm settlement, for instance, the land tenure system formed one of the determinants of agricultural productivity growth and other natural resource management. This study was tailored towards securing land access and tenure to gear up agricultural productivity especially the efficiency of rice farmers. Improving the efficiency of rice production will contribute to its local supply as well as revitalize the present bad economic system in Nigeria.

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