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Land Tenure Systems and Agricultural Productivity in Nigeria: A Case of Rice Production

Saheed O. Sanusi *, Musa J. Madaki , Hyelni S. David

Department of Agricultural Economics and Extension, Federal University Gashua, P.M.B 1005, Gashua. Yobe State, Nigeria

Authors' Contributions

S. O. Sanusi: Conceptualization of the study and development of the research plan, coordination of entire research activities, and preparation of the manuscript.

M. J. Madaki: Coordination and supervision of data collection process, development of the methodology for the research work, data entries, and coding.

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ABSTRACT

This study examined land tenure systems and rice productivity in Nigeria. Primary data were used for the study. Data were collected with the aid of a well-structured questionnaire. A four-stage sampling technique was used to select a total sample size of three hundred and forty-nine (349) rice farmers for the study. Data were analysed using descriptive statistics, total factor productivity, and the Stochastic production frontier model. The study revealed that a large portion of the land (over 94%) used for rice production was acquired through inheritance mode of land acquisition and communal type of land tenure system widely practised. The result of total factor productivity indicated that 62.18% of the rice farmers were at a sub-optimal productivity level. The results of the stochastic production frontier function revealed that seed ($P< 0.10$), and fertilizer application ($P<0.01$) were the significant factors influencing the technical efficiency of rice production in the study area. Based on the findings, the study recommends that the current land use act and policy should be amended to prevent concurrent grabbing of agricultural land for non-agricultural purposes to enhance the availability and accessibility of land for agriculture.

1. Introduction

Land is one of the vital assets throughout the world either in urban centres or rural environments' where lives and survival are based and built on the cultivation of land [1]. According to [2], smallholder farmers play key roles in achieving food security but unfortunately, they face limited access to land resources due to different socio-economic and land tenure factors. Land tenure is essential, the methods by which individuals or groups acquire, hold, transfer or transmit property rights in the land [3]. The term tenure means the sum of rights an individual, household or community may have concerning land or water or other resources for that matter. It is a mix or number of entitlements (rights and duties) concerning the use of land resources. It covers the rules under which those rights and duties are exercised and the time horizon or guarantee of continued claim to such entitlements. In simple terms, land tenure systems determine who can use what resources for how long and under what conditions. Land remains a limited resource and its distribution, as well as tenure structures, are key

* Corresponding author
E-mail address: sanusisaheed@yahoo.com
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issues in the nation's agricultural developmental strategy. The development of the rice sub-sector in Nigeria revolves, largely around the ownership and use of land resources, and the type of labour [4]. The land is the main factor for agricultural production and rural livelihoods, it is one of the principal challenges of implementing agricultural programs for improved productivity and resource utilization. Consequently, access to, and security of land rights are major concerns for policies and strategies aimed at increasing rice production. The land is, therefore, a very strategic socio-economic asset, particularly in poor societies where agricultural output is measured by control of, and access to land.

Land tenure systems affect agricultural productivity by influencing the efficient use of inputs and the adoption of modern technology. [5] opined that the land tenure system has generally been broadly described as rigid, creating obstacles in the way of agricultural development. Land as a factor of production and as a natural resource is critical in agricultural production. Its importance is expressed in terms of availability, accessibility, quantity and quality. In Nigerian agriculture, the accessibility and quality factors stand out as major determinants of productivity. The accessibility of most agricultural lands especially in the North-Central part of the country depends largely on the land tenure system and the extent of competition by non-agricultural land uses [6]. Farm size and productivity is one of the oldest issues in the academic arena for analysing the agrarian structure.

Rice (*Oryza sativa*) is an important traditional basic commodity contributing a significant proportion of the food requirements of Nigerians and it is cultivated in almost all the agro-ecological zone in Nigeria [7]. In recent years, rice production had been on the increase but not sufficient to meet the demand of the growing population According to [8] rainfed lowland and upland rice production have the potential to meet national demand. However, their average rice yield of 1.8 tons/ha fall short of the expected national average potential yield of 5.0tons/ha and 3.0tons/ha respectively [9]. The current average increase in yield of about 2.5-3.2 tons/ha for lowland rice is a tremendous growth but still below the optimal level of production. Hence, there is a gap in the optimum capacity of rice farmers in realizing the expected output. The research is therefore set to ascertain the validity of this claim.

An efficient system of land tenure and land rights contributes to the general economic development by assisting agriculture in contributing to industrial development through the production of food, capital, raw materials, labour, foreign exchange and expanded market. Consequently, the system of land tenure in any place to a large extent determines the pattern of agriculture that prevails in that society. It has the potential to determine the allocation of resources, systems of conserving land and the general productivity of the farm. [5] reported that the land rights system determines the type of farming systems, decisions regarding the investment of factors of production such as capital, labour and management as well as the productivity of such farming systems. Even though land tenure is believed to strongly impact agricultural production in rural areas of Nigeria, relatively little is known about the types and mode of land acquisition, how and the extent of the impact and in what specific areas of agricultural activities the impact is evident, particularly in Federal Capital Territory, Nigeria. The gap that existed between the dual mix of the land tenure system and the effect on rice productivity in the Federal Capital Territory necessitated the need for research of this nature to fill the identified vacuum. Furthermore, much of the little that is known about the effect of land tenure on agricultural production in Northern Nigeria is merely speculative and not sufficiently substantiated or clarified by empirical evidence. Hence, the need for a study such as this in Federal Capital Territory, Nigeria.

From time immemorial till the present period, there has been a great concern that the process of land tenure system and land ownership practices for agricultural purposes and other uses in Sub-Sahara Africa subdued productivity, resource use and investments in agriculture [10]. The concern that land tenure disrupts free ownership and control of land resources are rarely backed with empirical evidence. Quantitative evidence to support the argument that there exists an inverse relationship between land tenure practices and productivity are scanty and weak [11-12]. To some extent, the weak evidence reflects the fact that either it is because it is difficult to measure the effect of land tenure on productivity or there is not enough empirical research that has been carried out in this area of human endeavour. Hence the need for research to be conducted on this subject area to fill the identified gap in the literature. Therefore, the broad objective of the study was to examine the land tenure system and productivity of rice farmers in the Federal Capital Territory, Nigeria. The specific objectives were to:

(a) identify the types of the land tenure system and mode of land acquisitions by rice farmers;
(b) determine the productivity index of rice farmers; and
(c) examine the factors influencing the technical efficiency of rice production.

2. Theoretical Framework

Nigeria has about 84 million hectares of arable land that spreads across all the ecological zones and only about 5 million hectares is suitable for rice cultivation [13]. [14] suggested that a much smaller area is available for cultivation leaving little room for agricultural expansion as a result of which great difficulties are going to be faced in producing enough food to sustain future populations, and the impact of tenure on land use and productivity is critical. The customary principle of communal land tenure is seen as setting limits on strategies that could be used to promote agricultural production or as warping the effects of the various strategies in use [15]. It is argued that this principle encourages fragmentation of holdings and land immobility which prevents progressive farmers from consolidating fragmented parcels or expanding their holding. The argument advanced by the critics of customary tenure emphasized the utility of private over communal (public) land-ownership, and the starting assumption appears to be that only private tenure can quickly adjust to the rigid social and economic change brought about by modernizing agriculture.

Jialing and Jian [16] stressed that the dominant source of output growth in Chinese agriculture from 1978 to 1984 was the change from collective - team large farms to individual household-based farming (despite the often-small size of household plots). Private plots usually are highly productive and account for significant national agricultural output; Individualized tenure facilitates the establishment of commercial agriculture; the communal tenure system under customary arrangement breeds uncertainty and insecurity of tenure [15].

[17] affirmed that ownership insecurity causes low farm productivity due to a lack of investment incentives and limited access to credit; Tenant farmers have generally been found to be neglected in the allocation of credits and are subjected to insecurity as an additional source of risk to farmers. Therefore, its impact on productivity depends on the ability of farmers to bear additional risk. Corroborating this view, [15] stated that the right an individual exercise over his portion of communal land usually terminates at the end of the cropping season.

3. Methodology

3.1. The Study Area

The study was conducted in the Federal Capital Territory (FCT). The FCT was purposively chosen because it is a major rice belt and hub in the North Central part of Nigeria. FCT was created in 1976, while the city was built throughout the 1980s. It officially became Nigeria's capital on December 12, 1991, replacing the role of the previous capital, Lagos. FCT is located at the heart of Nigeria, approximately between latitudes $8^0$25'N and 9^0 20'N and longitude $6^0$39' and $7^0$45' East of the Greenwich meridian [18]. It lies just above the hot humid lowlands of the Niger - Benue trough and it is bounded on the north by Kaduna State, on the west by Niger State, on the east and southeast by Plateau State and on the southwest by Kogi state. It covers a landmass of about 8,000 sq. km, out of which 274,000 hectares are available for agricultural activities, 270,000 hectares under forest reserves, and 250,000 hectares earmarked for the Federal Capital Cities developments, and the remaining 6,000 hectares account for rocks, hills and rivers [19]. The vegetation of the FCT is normally classified as park savannah, with scattered trees, pockets of guinea, woodland and derived savannah. The FCT has two main seasons, rainy (April to October) and dry (November to March). The average annual temperature varies between 20°C (68°F) and 33°C (91.5oF) with relative humidity, in the dry season, of between 20 and 30 per cent. The average annual rainfall range is in the order of 1,100 mm to 1,600 mm, with an annual average of 82 rainy days [20-21]. [22] put FCT at 3,564,126 people. The FCT is divided into six area councils namely, Abaji, Abuja Municipal, Bwari, Gwagwalada, Kuje, and Kwali. Table 1 shows the sampling matrix and sample size of smallholder rice farmers in the study areas.

3.2. Sampling Techniques and Sample Size

Federal Capital Territory was purposively selected because of the presence of rice farmers in the villages. Multi-stage sampling method was used for selecting the respondents. In the first stage, four (4) Area Councils were randomly selected using the raffle-draw ballot-box method. In the second stage, four (4) wards were randomly selected each in Abaji, Bwari, Gwagwalada, and Kwali Area Councils respectively using the raffle-draw ballot-box method. In the third stage, two (2) villages were randomly selected using the raffle-draw ballot-box method from each of the 16 sampled wards making a total of 32 villages. Fourth and the final stage, from equation (1) a proportionate–random sampling was used to select a total sample size of three hundred and forty-nine (349) smallholder rice farmers from the total sample frame of 2723 rice farmers [20]. The sampling matrix used is stated in Table 1. The study used [23] for estimating the sample size as equation (1).

$$\mathrm{n} = \frac{N}{1+N(e^2)} = 349 \quad (1)$$

Where n is the sample size (units), *N* is the sample frame/population size (units), and e is the level of precision (5%).

3.3. Method of Data Collection

Primary data were used for this study. Primary data were collected from rice farmers in the study area. Trained enumerators from Agricultural Development Project (ADP) were employed for data collection using a well-structured questionnaire. The questionnaires were sectioned appropriately to cover all the specific objectives stated such as types of land tenure systems, mode of land acquisitions by rice farmers, and production inputs used by the farmers.

3.4. Method of Data Analysis

Descriptive statistics involve the use of mean, frequency and percentages. It was used to identify the land tenure system and mode of land acquisitions as stated in specific objective one (a). To achieve specific objective two (b), that is, to determine the productivity index of rice farmers; Total Factor Productivity (TFP) is understood as the measure of technical efficiency of total inputs. TFP model following [24] was used. The TFP approach adopted is given as:

$$TFP = \frac{Y}{TVC} \quad (2)$$

$$TFP = \frac{Y}{\sum P_i X_i} \quad (3)$$

Where Y is the output (kg), TVC is the total variable cost (₦), P_i is the unit price of the i^{th} variable input (₦), and
X_i is the quantity of i^{th} variable input (kg). Total fixed cost is constant as it is fixed.

Table 1 Sampling Matrix and Sample Size of Smallholder Rice Farmers in the Study Areas.

S/N	Area Councils	Wards	Villages	Number of Farmers	Proportion	Sample Size
1	Abaji	Yaba	Adagba	76	0.028	10
			Kona-Mada	94	0.035	12
		Ebaji	Ebagi	90	0.033	12
			Ebaji-Kasa	86	0.032	11
		Pandaji	Dabala	78	0.029	10
			Bago	83	0.030	11
		Gurdi	Gurdi-Sama	90	0.033	12
			Gurdi	87	0.032	11
2	Kwali	Kilankwa	Kilankwa 1	86	0.032	11
			Kilankwa 2	93	0.034	12
		Yangoji	Forgbe	90	0.033	12
			Yangoji	78	0.029	10
		Ashara	Sadaba	76	0.028	10
			Ashara	92	0.034	12
		Wako	Wako 1	81	0.030	10
			Wako 2	92	0.034	12
3	Gwagwalada	Paiko	Paiko-Kore	80	0.029	10
			Paiko	83	0.030	11
		Ibwa	Ibwa 1	88	0.032	11
			Ibwa 2	86	0.032	11
		Gwako	Gwako	85	0.031	11
			Gwako-Kasa	86	0.032	11
		Tunga Maji	Anagada	77	0.028	10
			Tunga Maje	93	0.034	12
4	Bwari	Barapa	Barapa	88	0.032	11
			Barapa-Kasa	79	0.029	10
		Bazango Bwari	Bazango	90	0.033	12
			Byazhi	86	0.032	11
		Bunko	Bunko 1	83	0.030	11
			Bunko 2	87	0.032	11
		Galuwyi	Galuwyi	83	0.030	11
			Galuwyi-Gairi	77	0.028	10
Total	4	16	32	2,723	1	348.7

Source: Field Survey (2020).

From cost theory:

$$AVC = \frac{TVC}{Y} \quad (4)$$

Where, AVC is the average variable cost in Naira (₦). Therefore, the transpose of AVC will be TFP as:

$$TFP = \frac{Y}{TVC} = \frac{1}{AVC} \quad (5)$$

As such, TFP is the inverse of the AVC. The partial productivity estimate is the marginal product (MP) given as equation (6).

$$MP = \frac{\Delta TFP}{\Delta X} \quad (6)$$

Note: At the time of undertaking this study, 1 dollar ($1) = 500 hundred naira (₦500).

The stochastic production frontier model following [25] is stated thus:

$$Q_i = f(X_i\beta) + \varepsilon_i \quad (7)$$

Where, Q_i is the output of $_i^{th}$ farmer (kg), Xi is the vector of actual quantity used, β is the vector of the parameter to be estimated, ε_i is the composite error term denoted by [25]; and $\varepsilon_i = V_i - U_i$, where V_i is the decomposed error term measuring technical efficiency of the farmer, and U_i is the inefficiency component of the error term.

The stochastic production frontier Model is stated explicitly as equation (8).

$$L_nQ = \beta_0 + \beta_1 L_n X_1 + \beta_2 L_n X_2 + \beta_3 L_n X_3 + \beta_4 L_n X_4 + \beta_5 L_n X_5 + V_i - U_i \quad (8)$$

Where Q is the output (total quantity of rice harvested in kg), X_1 is the farm size (Ha), X_2 is the labour input (Mandays), X_3 is the fertilizer input (kg), X_4 is the agrochemical input (litres), and X_5 is the seed input (kg); V_i is the decomposed error term measuring technical efficiency of the farmer, while U_i is the inefficiency component of the error term.

The inefficiency component of the Stochastic Production Frontier Model is stated as equation (9).

$$U_i = \propto_0 + \propto_1 Z_1 + \propto_2 Z_2 + \propto_3 Z_3 + \propto_4 Z_4 + \propto_5 Z_5 + \propto_6 Z_6 + \propto_7 Z_7 + \propto_8 Z_8 + \propto_9 Z_9 \quad (9)$$

Where, U_i is the inefficiency component, Z_1 is the contact with the extension agent (number of contact/month), Z_2 is the access to credit (Naira), Z_3 is the sex of the farmers (1, Male; 0, Otherwise), Z_4 is the educational level of farmers (number of years in school), Z_5 is the farming experience (years), Z_6 is the member of cooperative society (1, member; 0, otherwise). Z_7 is the land tenure system (1, individual; 2, communal; 3, government), Z_8 is the mode of land acquisition (1, inheritance; 2, lease; 3, purchase), and Z_9 is the labour utilized (1, hired; 2, family; 3, communal); whereas, α_0 is the constant term, and $\alpha_1 - \alpha_6$ is the regression coefficients.

The stochastic production frontier model, equation (7), was used to achieve specific objective three (c), which is, to evaluate the factors influencing the technical efficiency of rice production.

4. Results and Discussion

4.1. Mode of Land Acquisitions by Rice Farmers and Types of Land Tenure Systems

Mode of land acquisitions by rice farmers: The mode of land acquisition is presented in Table 2. Inheritance is the highest mode of farmland acquisition as indicated by 94.56 % response. Inheritance refers to the customary transfer of land to children on the death of the landholder. Inheritance ranks first and it is followed by purchase (3.44 %). The title acquired under inheritance is permanent and heritable. The holder of such a title exercises full management rights over his/her holdings. The finding is in line with [26] that concluded that inheritance is the principal mode of land acquisition in the Northern part of Nigeria. However, the finding differs from [27] who reported that purchase was the major means of acquiring land in South-Eastern Nigeria. Farmers who own land tends to have an edge over farmers renting lands.

Table 2 Mode of Land Acquisition by Rice Farmers in the Study Area.

Mode of Land Acquisition	Frequency	Percentage
Inheritance	330	94.56
Lease	7	2.10
Purchase	12	3.44
Total	349	100

Source: Field Survey (2020).

Types of land tenure system: The land tenure system is presented in Table 3. From the results, a greater percentage (97.71%) of the sampled rice farmers rely on communal arrangements for the land they use for cultivation. However, 2% of sampled rice farmers had their farmland, while 0.29% of the farmland was owned by the government. This implies that the farmers had restrictions and could not engage in farm practices suitable to them especially cultivating permanent crops. This finding agrees with the findings of [28].

4.2. Total Factor Productivity of Rice Production in the Study Area

The result of the total factor productivity in Table 4 shows that most (62.18 %) of the smallholder rice farmers had a TFP index of less than one which means that the productivity is sub-optimal. Also, 19.2 % of the respondents had a TFP index greater than 1.10 which is in the super-optimal range, while 18.62% had a TFP index within the optimal range of 1.00 and 1.09. This implies that most of the respondents performed less than the optimal level, meaning that there is low utilization of production factors among the smallholder rice farmers. The result agreed with [29]. However, the finding was contrary to that of [30] who posited that the average total factors were at an optimal level among arable crop farmers.

4.3. Factors Influencing Technical Efficiency of Rice Production in the Study Area

The result for the stochastic production frontier function for rice farmers showing the maximum likelihood estimates and inefficiency components are presented in Table 5. The Gamma value for the production function was 50.12%. This result is consistent with the theory that postulated that the gamma (γ) value should be greater than zero. That is, it should be statistically different from zero [31]. The result implies that 50.12% of the variations in the yield of the rice farmers are due to farmer inefficiency rather than random variability. Therefore, since the factors are within the control of the farmers, reducing the effect of the gamma(γ) will greatly enhance the technical efficiency of the farmers and thereby improve potential yields of rice production. Hence, the values represent the total output made on the frontier production function attributed to technical efficiency [25]. The average technical efficiency of 0.75 implies that rice farmers can obtain 75% of the output from the mixtures of inputs used.

The estimated coefficient of seed was positive and statistically significant at a 10% level of probability. The estimated coefficient of seed is 0.3186l. The positive coefficient implied that seeds input contributed significantly to the technical efficiency of rice production. This implies that a unit increase in seed by one per cent increases the output of rice by 31.86%. This is in line with [32-33] that poised that there is a positive relationship between seeds and farmers' efficiency in the production process. Seed is very important in production as it determines to a large extent the kind of output obtained. Hence, farmers need to be mindful of the quality, seed rate and variety of seed used to obtain the increased output. The output will be low in the absence of good quality and improved seeds even if other inputs are in abundance [32]. Similarly, fertilizer is negative and statistically significant at a 1% level of probability. The negative sign implies that the factors had an indirect effect on rice production. The implication of the coefficient of fertilizer which was -0.2809 is that if the fertilizer increases by one per cent, it could decrease output by 28.09%. Fertilizer is a major input for improving the performance of output per hectare of cultivated crops. Farmers in this instance had excessively applied fertilizer on their rice farms. The result aligns with the research findings of [34-36].

Table 3 Types of Land Tenure Systems in the Study Area.

Land Tenure Systems	Frequency	Percentage
Communal	341	97.71
Individual	7	2.00
Government	1	0.29
Total	349	100

Source: Field Survey (2020).

Table 4 TFP Index of Smallholder Rice Farmers in the Study Area.

TFP Index	Frequency	Percentage
Sub-Optimal (< 1.00)	217	62.18
Optimal (1.00–1.09)	65	18.62
Super-Optimal (≥ 1.10)	67	19.2
Total	349	100
Mean	0.52	
Minimum	0.001	
Maximum	5.17	
Standard Deviation	0.91	

Source: Field Survey (2020).

Table 5 Maximum Likelihood Estimates of Stochastic Production Frontier Function for the Rice Farmers

Variables	Coefficient	Std. Err,	t-ratio
Farm Size	0.158527	0.235292	0.67
Labour Input	-0.52558	0.322612	-1.63
Fertilizer	-0.28094***	0.065376	-4.3
Agrochemicals	0.192247	0.17347	1.11
Seed Input	0.3186*	0.167276	1.9
Constant	-0.37915	3.793474	-0.1
	Inefficiency Component		
Extension Contacts	-0.74766	0.918657	-0.81
Access to Credit	-0.44847	1.711237	-0.26
Sex	-2.75452**	1.2339	-2.23
Level of Education	-0.52105	0.367236	-1.42
Farming Experience	-0.07036*	0.043318	-1.66
Land Tenure System	0.730972	2.39928	0.72
Mode of Land Acquisition	-0.205416***	0.350196	-3.44
Labour Utilized	-0.35116*	0.213176	-1.65
Member of Cooperative Society	1.03889	1.54550	0.67
Constant	1.870889	1.653285	1.13
Chi-Square	57.90***		
Lambda	1.005		
Mean Technical Efficiency	0.75		
Log Likelihood	-687.0619		
Total Number of Observations	349		
Gamma	50.12%		

Source: Computed Field Data (2020).

For the inefficiency effect components presented in Table 4, the result indicated that farming experience ($P<0.10$), sex ($P<0.05$) and labour utilization ($P<0.10$) were negative and statistically significant. The signs of the coefficients of these variables have important policy implications as a positive sign implies a negative effect on technical efficiency and vice versa. Therefore, the implication of sex being negative and statistically significant at a 5% level of probability implies that as sex disparity increases, technical inefficiency declines thereby increasing the production efficiency. That is, male farmers had the likelihood of lowering technical inefficiency. The result is in line with the findings of [37] that asserted that male farmers were more technically efficient than their female counterparts cultivating the same crop. Also, farm experience is negative and significant at a 10% level of probability which indicates that as farm experience increases, technical inefficiency decreases. Hence, experience in farming activities enhance better performance, improve knowledge and ability to make good farm decisions that will lead to efficiency and profitable enterprise. This finding is supported by several authors [38-40] that concluded that farmers with more experience would be more efficient. Labour utilization on the other hand is negative and statistically significant at a 10% probability level. Labour is significant probably because virtually all farming activities are carried out using human labour among small scale farming households in developing countries like Nigeria where mechanization is rarely deployed [31]. The coefficient of labour utilization was -0.35116. The result of the coefficient implies that a unit increase in labour utilization will likely lead to a 35.11% decrease in technical inefficiencies in rice production in the study area. The results are in line with several studies that confirmed the importance of labour in farming activities. Such studies are [41-44].

The estimated coefficient of land acquisition is 0.2054 and it was statistically significant at a 1% probability level. The result implies that a unit increase in land acquisition by one unit will decrease the technical inefficiency of the farmer's output by 20.54%. The findings confirm the results of [45] in the analysis of rice production in Enugu State, Nigeria.

5. Conclusion

The study investigated land tenure system and its effects on rice productivity in Nigeria. The study revealed that communal and inheritance are the established forms of land tenure and mode of land acquisition respectively in the study area. These identified means of land control constitute constraints and negatively influence the productivity of the rice farmers particularly as it reduces their ability to possess full ownership and control in the use of the farmland. The stochastic production frontier function for rice farmers shows that fertilizer

(P<0.01), seed input (P<0.10), land acquisition (P<0.01), and labour utilized (P<0.01) were statistically significant. Therefore, the study concluded that land tenure and acquisition play a significant role in the determination of rice production and agricultural productivity.

6. Recommendations

Based on the results of analysis from this study, the following recommendations were made:

(a) Land use act and policy that is currently in use should be amended. This is necessary to enhance the availability and accessibility of land to individuals, groups and institutions for rice production and agricultural purposes. The amendment is also important to mitigate the preponderance of the inheritance mode of land acquisition and the communal tenure system.

(b) Farmers should be trained by agricultural extension officers on the appropriate utilization of production factors such as fertilizer, seeds, land and agrochemicals to increase their technical efficiency and output.

Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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ORCID

S. O. Sanusi https://orcid.org/0000-0002-0531-643X
M. J. Madaki https://orcid.org/0000-0003-4983-0980
H. S. David https://orcid.org/0000-0003-2071-8821

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