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Research Article

UTILIZATION OF IMPROVED RICE PRODUCTION TECHNOLOGIES AMONG RICE FARMERS IN EKITI STATE, NIGERIA

AREMU PA[1]*, ADEWALE JG[2], OLANIYI OA[2]

[1]National Cereal Research Institute, Badeggi, Niger State, Nigeria. [2]Department of Agricultural Extension and Rural Development, Ladoke Akintola University of Technology, Ogbomoso, Oyo, Nigeria. Email: aremumola@yahoo.com

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ABSTRACT

The global demand for rice continues to rise due to population growth and changing dietary preferences. Improved rice production technologies offer significant potential to enhance yield, ensure food security, and support sustainable agricultural practices. This study explores the utilization of improved rice production technologies among rice farmers in Ekiti State, Nigeria. A multistage sampling procedure was employed to select 133 rice farmers for the study. Data were collected using a structured interview schedule. Descriptive statistics, frequency counts, percentages, means, and Weighted Mean Scores were used to describe the study's objectives. In addition, Pearson Product-Moment Correlation was used to test the study's hypothesis. The findings revealed that the mean age of rice farmers was 44 years, while the mean household size was 4 people, and the grand mean number of years spent in formal schools was 4.1 years. The mean year of experience in rice farming was 5.2 years, while the mean size of rice farm cultivated was 2.9 ha, and the mean annual income was ₦595,420. Knapsack sprayer, rice farming inputs, and improved rice varieties were the types of improved rice production technologies utilized by the rice farmers on every occasion, while poor access roads and other infrastructure, lack of transport facilities, high cost of farm inputs, excessive weeds, and infestations of pests and diseases were the most strenuous and tough constraints encountered in rice farming. A significant relationship was found between rice farmers age (r=0.310, p=0.000), household size (r=0.409, p=0.000), number of years of spent schooling (r=0.131, p=0.034), years of experience in rice farming (r=0.505, p=0.000), size of rice farm (r=0.470, p=0.000), and annual income (r=0.142, p=0.000) and utilization of improved rice production technologies among rice farmers. The study concluded that the successful utilization of improved rice production technologies holds the key to addressing the pressing challenges of food security and agricultural sustainability. It was recommended that there should be the implementation of comprehensive training programmes to educate the farmers on the benefits and practices associated with the utilization of improved rice production technologies.

Keywords: Utilization, Improved rice production technologies, Rice farmers, Rice farming.

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INTRODUCTION

Agriculture remains a fundamental component of the Nigerian economy, employing about two-thirds of the nation's workforce. The National Bureau of Statistics (NBS) reported that the agricultural sector contributed 41 trillion naira, representing 23.7% of the total nominal Gross Domestic Product to Nigeria's economy in 2021 (Ripples Nigeria, 2022). Over 70% of Nigerians are engaged in the agriculture sector, mainly at a subsistence level (Food and Agriculture Organization [FAO], 2022). The country is rich with abundant human and natural resources, quality soil, and favorable climatic conditions for agricultural activities. Nigeria, with a population of over 200 million people and a landmass of 923,768 km2, has a total of over 79 million ha of cultivable land (FAO, 2022). A breakdown of the arable land reveals that about 4.6 million hectares are suitable for rice cultivation, of which 1.8 million ha (39%) is currently utilized for rice production (Demont, 2013). Rice (Oryza sativa) is a staple food for more than 60% of the world population (Chikezie et al., 2020). Rice is a cereal crop and a staple food that is consumed globally by 50% of every household (Akinniran and Faleye, 2020). Rice belongs to the seed of the grass species O. sativa or Oryza glaberrima and of the grass family Gramineae, a large monocotyledonous family of some 600 genera and around 10,000 species (Ajala and Gana, 2015). Rice is not only meant for consumption, but also a source of income generation and an employer of labor for the poor. In rice-producing areas, rice production employs more than 80% of the inhabitants in various activities along the production/ distribution chain from cultivation to consumption (Ajoma et al., 2016). Rice is cultivated in almost all agro-ecological zones of the country, as it is part of one major cereal crop produced by Nigeemploysria farmers. In terms of comparative advantage, Ajah and Ajah (2014) identified that rice can be grown in flooded and non-flooded soils because it has both lowland and upland varieties that can adapt to different agro-climatic and soil conditions. FAO (2013) observed that the demand and supply gap in rice production is widening annually, thereby resulting in a huge import bill for the nation. According to Ammani (2013), Nigeria is the second-highest importer of rice and spends over 356 billion naira on the importation of the commodity annually. Nigeria's food importation is growing at an alarming and unsustainable rate of 11% yearly, and it has continued to fuel domestic inflation resulting from the use of scarce foreign currency to import rice. Uduma et al. (2016) noted that the inability of local supply to meet consumers' demand (consumption) has given rise to the high importation of rice in Nigeria. There has been a phenomenal rise in rice importation in Nigeria, estimated at 300 thousand tons annually in recent times, which on average is valued at 300 million naira per annum. They stressed that aside from the huge cost to the Nigerian economy, rice imports expose the country to international market shocks with their associated risk implications on food security. This growing dependence on rice imports is a major concern of Nigeria's government, and since the early 1980s, numerous programs have been implemented to encourage domestic rice production, mostly done by smallholder farmers. Smallholder farmers operate at the subsistence level due to a lack of funds to support their farming activities. They contribute greatly to the Nigerian agricultural sector and deserve every support to boost their rate of production, supply raw materials to agro- allied industries, and ensure food security. Improved rice technologies are methods and practices that affect rice production. Improved technologies are seen as a way of boosting farmers' income in most of the developing countries because they result in increased farm yield and income (Margaret and Samuel, 2015). Unfortunately, the majority of smallholder farmers rely on traditional methods of production, and this has reduced their level of productivity. Akinsuyi (2011) opined that 80% of rice production is from smallholder farmers who are the major suppliers of food to Nigerians. These farmers generally obtain very low crop yields due to the use of local varieties. Most of the rice is grown under rain-fed conditions, and irrigation is not frequently used; little or no fertilizer application, and pest control is not adequate (Muzari et al., 2012). Many rice farmers, particularly smallholders, lack access to financial resources, quality seeds, lack of access to information, the risk associated with the technology, and extension services necessary for implementing improved rice production technologies, which limits their ability to invest in and benefit from these technologies (FAO, 2013). Farmers often lack the necessary knowledge and training to implement advanced agricultural practices effectively. The diffusion of information about improved rice production technologies is uneven, with remote areas particularly underserved (Zhang et al., 2020). Socioeconomic status, social structures, and cultural beliefs can influence a farmer's willingness and ability to adopt new technologies, as wealthier farmers tend to absorb the initial costs better than their poorer counterparts, leading to a digital divide in technology utilization as well as the extent of utilizing the improved rice production technologies (Tiku et al., 2017). Inadequate infrastructure and limited access to markets hamper the effective distribution of inputs, which are often critical for the success of improved rice production technologies (Gulati et al., 2014). The use of high-yielding crop varieties facilitates and stimulates the transition from low-productivity subsistence agriculture to a high-productivity agro-industrial economy. The sustainability of increased production through improved rice production technologies often raises environmental concerns; thus, balancing high production with sustainable practices remains a critical challenge (Mwangi and Kariuki, 2015). Inefficient agricultural policies and weak institutional support can limit farmers' access to necessary resources and information, making it more challenging to implement new technologies and practices (Otsuka et al., 2016). The utilization of improved rice production technologies will not only boost rice production and ensure self-sufficiency in rice production but will also reduce the importation of rice and generally lead to food security in Nigeria. It is against this backdrop that this study intends to assess the utilization of improved rice production technologies among rice farmers in Ekiti State, Nigeria. Specifically, the study describes the socioeconomic characteristics of the rice farmers, types of improved rice production technologies utilized by the rice farmers, and constraints to effective utilization of improved rice production technologies by the rice farmers. It was hypothesized that there is no significant relationship between the socioeconomic characteristics of the rice farmers and the utilization of improved rice production technologies among rice farmers.

METHODS

Ekiti State is a state in south-west Nigeria and is bounded to the north by Kwara State, to the northeast by Kogi State, to the south and southeast by Ondo State, and to the west by Osun State. The Yorubas make up the majority of the state's population. Ekiti State was formed from a part of old Ondo State in 1996 and has its capital in the city of Ado-Ekiti. One of the smallest states of Nigeria, Ekiti is the 31st largest in area and 30th most populous with an estimated population of 3.592 million as of 2022 (National Population Commission web, and NBS web). The state is divided between the Nigerian lowland forests in most of the state and the drier Guinean forest–savannah mosaic in the north. Ekiti State is partially based around agriculture, mainly of yams, rice, cocoa, and cassava crops. The State is mainly an upland zone, rising over 250 m above sea level. It lies in an area underlain by metamorphic rock. It is generally an undulating part of the country with a characteristic landscape that consists of old plains broken by step-sided outcrops that may occur singularly, in groups, or in ridges. The State enjoys a tropical climate with two distinct seasons. These are the rainy season (April–October) and the dry season (November–March). The temperature ranges between 21°C and 28°C with high humidity. The southwesterly wind and the northeast trade winds blow during the rainy and dry (Harmattan) seasons, respectively. Tropical forest exists in the south, while savannah occupies the northern peripheries. Ekiti State consists of sixteen Local Government Areas. They are: Ado-Ekiti, Ikere, Oye, Aiyekire (Gbonyin), Efon, Ekiti East, Ekiti South-West, Ekiti West, Emure, IdoOsi, Ijero, Ikole, Ilejemeje, Irepodun/Ifelodun, Ise/Orun, Moba. The dominant religions in Ekiti State are Christianity and Islam. Although traditional religion adherents are found there. A multistage sampling procedure was employed for the selection of rice farmers for this study in the study area. Ekiti State has 16 Local Government Areas, out of which four (25%) were purposively selected, and these are: Efon Alaye, Irepodun/Ifelodun, Oye Ekiti, and Ikole Ekiti. The second stage involved purposive selection of 2 rice-producing communities, making 8 rice-producing communities, namely: Erio, Igbemo, Ode, Ijan, Efon Alaye, Ikere, Oye, and Ikole. The third stage involved random selection of 10% of all the registered rice farmers (1300) in the selected communities, making a total of one hundred and thirty (130) rice farmers that constituted the sample size for the study. The data obtained were subjected to both descriptive and inferential statistical tools. Descriptive statistical tools employed in the course of this study include: Frequency counts, percentage means, and weighted mean score (WMS), while Pearson Product-Moment Correlation was used for testing the stated hypothesis.

RESULTS AND DISCUSSION

Respondents' socioeconomic characteristics

Respondents' age

Results presented in Table 1 revealed that 41.4% the rice farmers were between the age range of 40 and 49 years, while 18.7% were between the age range of 50 and 59 years and 13.5% of them were between 30 and 39 years. Furthermore, 19.6% are below 30 years of age, and 6.8% were 60 years of age and above, with a mean age of 44 years. This indicates that the majority of the respondents (74.5%), were <50 years of age, hence considered as productive, economically active, able-bodied, and agile young men and women who possessed the physical strength to sustain rigorous and arduous tasks required in rice farming. The study's finding is in line with the reports of Nwofoke *et al*. (2024) that the mean age of the rice farmers was 44 years.

Respondents' household size

Results presented in Table 1 further revealed that 63.2% of the rice farmers had a household size of <5 people, while 23.3% of them had a household size of between 5 and 6 people, 13.5% of them had a household size of 7–8 people, with the mean household size of 4 people. This implies that the respondents in the study area had a small household size, which indicates that there would be an unavailability of family labor to carry out farming activities. This finding is in disagreement with the reports of Michael *et al*. (2024) and Oluwatusin and Sekumade (2016) that the mean household size was 7 and 9 persons per household.

Respondents' years spent in formal schools

Table 1 reveals that 46.6% of the rice farmers spent less or exactly 5 years in primary school, while 53.4% of them spent 6 years in primary school, with 4.9 years as the mean number of years spent in primary school. Furthermore, 80.5% of them spent less than or exactly 5 years in secondary school, while 19.6% of them spent 6 years in secondary school, with 4.5 years as the mean number of years spent in secondary school. Less than half (30.8%) of the rice farmers spent less or exactly 2 years in the polytechnic, while 44.4% of them spent 3 years in the polytechnic, and 24.8% spent 4 years in the polytechnic, with 3 years as the mean number of years spent in the polytechnic. Similarly, 37.6% of the respondents spent less than or exactly 4 years in the university, while 31.6% spent 5 years, and 30.8% of them spent 6 years in the university, with 4 years as the mean number of years spent in the university. The grand mean number of years spent in formal school by the rice farmers was 4.1 years. The above finding implies that the rice farmers had a relatively low level of formal education, which could affect the communication and comprehension of technical agricultural information. This finding is in tandem with the report of Apuyor *et al*. (2023) that the rice farmers had a low level of formal education, which could be a barrier to the adoption of innovation that could have improved their production and productivity level.

Respondents' years of experience in rice farming

Table 1 shows that 7.5% of the rice farmers had <5 years of experience in rice farming, 65.4% had between 5 and 6 years of experience in rice farming while 9% of them had between 7 and 8 years of experience in rice farming and 18.1% of them had 9 years and above in rice farming experience with 5.2 years as the mean year of experience in rice farming. This indicates that all the sampled rice farmers the study area had <10 years of experience in rice farming which implies that they may have limited knowledge and understanding of rice production technologies thus making it more challenging for them for them to grasp and effectively implement information provided through agricultural extension teaching methods and at the same time may be more resistant to change and less inclined to adopt new and improved technologies. Furthermore, these farmers may lack practical experience in the implementation of new rice production technologies. The above finding is in line with the report of Michael *et al*. (2024) that most of the respondents had experience of <10 years with 4.4 years as the mean years of experience in the study area.

Table 1: Distribution of respondents' socioeconomic characteristics (n=133)

Characteristics	Frequency	Percentage	Mean
Age (years)			
<30	26	19.6	
30–39	18	13.5	44 years
40–49	55	41.4	
50–59	25	18.7	
>60	9	6.8	
Household size			
<5	84	63.2	
5–6	31	23.3	4 people
7–8	18	13.5	
9>	0	0	
Number of years spent schooling			
Primary school (years)			
<5	62	46.6	4.9 years
>6	71	53.4	
Secondary school (years)			
<5	107	80.5	4.5 years
>6	26	19.5	
Polytechnic (years)			
<2	41	30.8	3 years
No Response	92	69.2	
University (years)			
4	50	37.6	
5	42	31.6	
6	41	30.8	4 years
Years of experience in rice farming			
<5	10	7.5	
5–6	87	65.4	
7–8	12	9	5.2 years
>9	24	18.1	
Size of rice farm (ha)			
<3	68	51.1	
3–4	42	31.6	2.9 ha
>5	23	17.3	
Annual income (₦)			
<300,000	5	3.8	
300,000–499,999	52	39.1	₦595,420
500,000–699,999	54	40.6	
>700,000	22	16.5	

Source: Field Survey, 2024

Respondents' size of rice farm

The results presented in Table 1 further show that 51.1% of the rice farmers cultivate <3 ha of rice farm, while 31.6% of them cultivate between 3 and 4 ha of rice farm, and 17.3% cultivate 5 ha of rice farm and above, with 2.9 ha as the mean size of rice farm cultivated by the respondents. This indicates that the rice farmers in the study area cultivate <3 ha of rice farm, thus operating on a small scale, which may be a result of the respondents having limited financial resources, making it more challenging for them to invest in new technologies. This finding corroborates the report of Alabi *et al*. (2023) that the majority of the rice farmers in the study area were smallholders.

Respondents' annual income

Table 1 shows that in Ekiti State, 39.1% of the rice farmers earned between ₦300,000 and ₦499,999 annually, and 40.6% earned an annual income of between ₦500,000 and ₦699,999, while 16.5% earned ₦900,000 and above annually. Less than 4% (3.8%) earned below ₦300,000 annually, with ₦595,420 as the mean annual income. The above finding indicates that rice farming in the study area is profitable. A higher mean annual income may indicate that the farmers have greater financial resources to invest in improved rice production technologies. This finding corroborates the report of Abdullahi *et al*. (2022) that rice production is highly profitable in the study area.

Types of improved rice production technologies utilized by the rice farmers

The result presented in Table 2 shows that knapsack sprayer ranked 1st with a WMS of 2.76, rice farming inputs ranked 2nd with a WMS of 2.75, and improved rice varieties ranked 3rd with a WMS of 2.71 were the types of improved rice production technologies mostly utilized by the rice farmers. This indicates that knapsack sprayer, rice farming inputs, and improved rice varieties were the types of improved rice production technologies utilized by the rice farmers on every occasion. Utilizing technologies, such as the knapsack sprayers, improved rice varieties, and rice farming inputs can lead to higher adoption rates among the rice farmers because when the farmers see the benefits of these technologies in action, they are more likely to be receptive to information provided through the extension teaching methods. This finding is in line with the report of Adisa *et al*. (2019) that the improved

Table 2: Distribution of respondents by types of improved rice production technologies utilized (n=133)

Improved rice production technologies utilized	WMS	Rank
Tube well	1.56	19th
Bird-scarier	2.62	6th
Knapsack sprayer	2.76	1st
Rice farming inputs	2.75	2nd
Improved variety	2.71	3rd
Timeliness of fertilizer application	2.65	4th
Herbicide	2.64	5th
Pesticide	2.17	12th
Rodenticide	1.99	14th
25 by 25 plant spacing	2.53	8th
Use of a plough	1.77	17th
Use of a harrow	1.44	22nd
Rain fed irrigated lowland management	1.42	23rd
Rain fed irrigated upland management	1.53	20th
Long-grain seed selection	1.68	18th
Short-grain seed selection	1.93	15th
Seed selection	2.18	11th
Seed testing	2.61	7th
Processing	1.93	15th
Reaper	1.49	21st
Per boiler	2.08	13th
Dryer	2.44	9th
Packaging equipment	2.27	10th

Source: Field Survey, 2024. WMS: Weighted Mean Score

Table 3: Distribution of respondents by constraints to effective utilization of improved rice production technologies (n=133)

Constraints to the effective utilization of improved rice production technologies	WMS	Rank
Inadequate finance and credit facilities	3.43	6th
Poor soil fertility	2.58	12th
Inadequate size of farmland	2.89	10th
Lack of adequate and timely information	3.09	8th
Excessive weed, pest, and disease infestation	3.53	4th
The soil erosion problem and flood	2.74	11th
High cost of farm inputs	3.56	3rd
Inadequate/lack of seed testing laboratories	3.07	9th
Poor access road and other infrastructure	3.65	1st
Absence of processing facilities	3.51	5th
Inadequate supply of farm inputs	1.91	13th
Lack of transport facilities	3.57	2nd
Non-availability of the market for rice produce	3.23	7th

Source: Field Survey, 2024. WMS: Weighted Mean Score

rice production facilities, such as rice farming inputs, field preparation/planting, and harvesting/processing, were utilized by the rice farmers.

Constraints to the effective utilization of improved rice production technologies by the rice farmers

Table 3 shows that the most commons constraints to effective utilization of improved rice production technologies by the rice farmers were poor access road and other infrastructure ranked 1st with a WMS of 3.65, lack of transport facilities ranked 2nd with a WMS of 3.57 and high cost of farm inputs ranked 3rd with a WMS of 3.56 and excessive weed, pest and disease infestation ranked 4th with a WMS of 3.53. This implies that the rice farmers in the study area considered poor access roads and other infrastructure, lack of transport facilities and high cost of farm inputs, and excessive weed, pest, and disease infestation as the most strenuous and tough constraints encountered in rice farming. This implies that poor access roads and transportation facilities can hinder extension workers from reaching out to the rice farmers, which will result in limited dissemination of information to the rice farmers on improved production technologies. Furthermore, without proper infrastructure and facilities, it will be difficult for the extension workers to provide practical demonstrations of improved production techniques to the rice farmers, which can limit the effectiveness of extension teaching methods in conveying complex information and encouraging the adoption of new practices. This finding is in line with the report of Kshash and Oda (2022) that the major constraints faced by the rice farmers include high cost of inputs (fertilizer, pesticides), unavailability of improved varieties, lack of capital, High cost of improved varieties, unfavorable government marketing system, and poor marketing information.

Hypothesis testing

Ho1: There is no significant relationship between the socioeconomic characteristics of the rice farmers and the utilization of improved rice production technologies among rice farmers.

Relationship between the socioeconomic characteristics of the rice farmers and utilization of improved rice production technologies among rice farmers.

Pearson Product Moment Correlation analysis result presented in Table 4 show that there is significant relationship between rice farmers age (r=0.310, p=0.000), household size (r=0.409, p=0.000), number of years of spent schooling (r=0.131, p=0.034), years of experience in rice farming (r=0.505, p=0.000), size of rice farm (r=0.470, p=0.000), and annual income (r=0.142, p=0.000) and utilization of improved rice production technologies among rice farmers. This implies that younger and less experienced rice farmers may benefit more from specific interventions and hands-on training, thus, tailoring extension programs to meet their needs can improve utilization rates of new technologies. Larger households may have different labor dynamics influencing the utilization and implementation of new technologies, thus the extension services could consider household size when designing outreach programs. This is in line with the report of Rilwanu *et al*. (2024) that household size and age were among the factors influencing the utilization of improved rice production technologies among the respondents.

Table 4: Summary of correlation analysis showing the relationship between respondents' socioeconomic characteristics and utilization of improved rice production technologies among rice farmers

Characteristics	r-value	p-value	Decision
Age	0.310	0.000	Significant
Household size	0.409	0.000	Significant
Years spent schooling	0.131	0.000	Significant
Years of experience in rice farming	0.505	0.000	Significant
Size of rice farm	0.470	0.000	Significant
Annual income	0.142	0.000	Significant

Source: Field Survey, 2024. Significant at 1% level of significance

CONCLUSION AND RECOMMENDATIONS

In conclusion, the study assessed the utilization of improved rice production technologies among rice farmers. The successful utilization of improved rice production technologies holds the key to addressing the pressing challenges of food security and agricultural sustainability. The study underscores that while there is recognition of the benefits these technologies bring, the utilization rate remains suboptimal. Factors, such as poor access roads and other infrastructure, lack of transport facilities and high cost of farm inputs, and excessive weed, pest and disease infestation significantly influence farmers' decisions. To maximize the potential of improved rice cultivation methods, it is crucial to foster an environment that is conducive to innovation uptake. Facilitating collaboration among stakeholders-farmers, extension services, government agencies, and the private sector can drive the desired changes. It was recommended that;

1. There should be the implementation of comprehensive training programmes to educate the farmers on the benefits and practices associated with the utilization of improved rice production technologies. Interactive workshops and field demonstrations can enhance understanding and foster confidence in utilizing new methods.
2. The establishment of financial assistance programmes to alleviate the cost burden associated with utilizing new technologies. Partnerships with financial institutions can provide tailored solutions for the farmers.
3. Investment in rural infrastructure to improve access to markets and resources necessary for the utilization of improved technologies.
4. Encouraging collaboration between agricultural extension officers, research institutions and farmers to ensure continuous knowledge exchange and support. This collaboration can also involve organizing farmer cooperatives to collectively address challenges.

REFERENCES

Abdullahi, A. Daramola, A. G., & Amos, T. T. (2022). Determinants of profit efficiency among small scale rice farmers in North Central, Nigeria: A profit function approach. *Asian Journal of Agricultural Extension, Economics and Sociology*, *40*(1), 56-66.

Adisa, R. S., Ahmed, T. A., Ebenehi, O., & Oyibo, F. O. (2019). Perceived benefits of adoption of improved rice production technologies among small-scale farmers in Kogi State, Nigeria. *Journal of Agricultural Extension*, *23*(1), 138-148.

Ajah, J., & Ajah, F. C. (2014). Socio-economic determinants of small-scale rice farmers' output in Abuja, Nigeria. *Asian Journal of Rural Development*, *4*(1), 16-24.

Ajala, S., & Gana, A. (2015). Analysis of challenges facing rice processing in Nigeria. *Journal of Food Processing*, *20*(15), 1-6.

Ajoma, C., Ezihe, J. A. C., & Odoemenem, I. U. (2016). Allocative efficiency of rice production in cross River State, Nigeria: A production function approach. *IOSR Journal of Agriculture and Veterinary Science* (IOSR-JAVS), *9*(8), 32-38.

Akinniran, T. N., & Faleye, G. R. (2020). Economic analysis of rice production and processing in Nigeria 1981-2019. *International Journal of Agriculture, Environment and Bioresearch*, *5*(5), 113-132.

Akinola, A. O., Adeyemo, R., & Adekunle, O. A. (2020). Effect of improved rice technologies on productivity and profitability of rice farming in Kwara State, Nigeria. *Asian Journal of Agricultural Extension, Economics and Sociology*, , 38-44.

Akinsuyi, Y. (2011). *Local Government Intervention: Impact in Small-Scale Farming This Day Live*. Retrieved Jul 4, 2012 from https://www.thisdaylive.com

Alabi, S. I., Umar, S. Panwal, E. F., & Taru, B. (2023). Effect of adoption of rice varieties on income of farmers in Birnin Kebbi Local Government Area, Kebbi State, Nigeria. *Taraba Journal of Agricultural Research*, , p.16-21.

Apuyor, A., Mohammad, U. S., & Ojo, A. O. (2023). Socio-economic characteristics of rice farmers in flood-prone areas of Niger State, Nigeria. In: *Proceedings of the first faculty of agriculture international conference*, Nnamdi Azikiwe University, Awka, Nigeria.

Chikezie, C., Benchendo, G. N., Ibeagwa, O. B., Oshaji, I. O., & Onuzulu, O. A. (2020). Analysis of technical efficiency among rice farmers in Ebonyi State of Nigeria: A stochastic frontier approach. *Journal of Agriculture and Food Sciences*, *18*(1), 40-49.

Demont, M. (2013). Revising urban bias in African rice markets: A review of 19 National Development Strategies. *Global Food Security*, *2*(3), 172-181.

Food and Agriculture Organisation (FAO). (2013). *FAO rice market monitor (RMM)*. *Trade and market division* (Vol. 16) (pp. 1-36). Rome, Italy: Food and Agriculture Organization of the United Nations.

Food and Agriculture Organisation (FAO). (2022). *Nigeria agriculture at a glance*. Rome: FAO. Retrieved from https://www.fao.org/nigeria/fao-innigeria/nigeria-at-a-glance/en

Kshash, B. H., & Oda, H. K. (2022). Constraints facing rice farmers in Iraq. *IOP Conference Series: Earth and Environmental Science*, *1060*, 012141.

Margaret, M., & Samuel, K. (2015). Factors determining adoption of new agricultural technology by smallholder farmers in developing countries. *Journal of Economics and Sustainable Development*, *6*, 5-12.

Michael, I.W., Garba, A., & Hamidu, B. (2024). Information and communication technology (ICT) use among hungry rice (ACCHA) farmers in Plateau State, Nigeria. *Nigerian Journal of Agriculture and Agricultural Technology (NJAAT)*, *4*(2), 9-19.

Muzari, W., Gatsi, W., & Muvhunzi, S. (2012). The impacts of technology adoption on smallholder agricultural productivity in Sub-Saharan Africa: A review. *Journal of Sustainable Development*, *5*(8), 69.

Mwangi, M., & Kariuki, S. (2015). Factors determining adoption of new agricultural technology by smallholder farmers in developing countries. *Journal of Economics and Sustainable Development*, *6*(5), 208-216.

Nwofoke, C., Igwe, G. V. C., & Anagah, F. I. (2024). Utilization of improved rice production technologies among rice farmers' cooperative societies in Ohaukwu L.G.A of Ebonyi State, Nigeria. *IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)*, *17*(8), 31-38.

Oluwatusin, F. M., & Sekumade, A. B. (2016). Farm household income sources diversification behaviour in Nigeria. *Journal of Natural Sciences Research*, *6*(4), 102-111.

Rilwanu, S. M., Sulaiman, A., & Bose, A. A. (2024). Factors influencing adoption of improved rice production technologies in Western Agricultural Zone of Bauchi State, Nigeria. *Nigerian Journal of Agriculture and Agricultural Technology (NJAAT)*, *4*(2), 41-54.

Tiku, N. E., Sanusi, S. O., Adedeji, I. A., & Ebira, A. J. (2017). Socio-economic factors affecting local rice production in Biase local government area in Cross River State, Nigeria. In *Conference proceedings of the 18th annual national conference of the Nigerian association of agricultural economists held at federal University of Agriculture, Abeokuta, Nigeria*.

Uduma, B. U., Adeoye, S. O., & Agbonlahor, M. U. (2016). Irrigation potentials and rice selfsufficiency in Nigeria: A review. *African Journal of Agricultural Research Review*, *11*(5), 298-309.