ADOPTION OF IMPROVED RICE PRODUCTION AND PROCESSING TECHNOLOGIES AMONG FARMERS IN EKITI STATE, NIGERIA

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ABSTRACT

The study investigated the adoption of improved rice production and processing technologies among farmers in Ekiti State, Nigeria. A multi-stage sampling procedure was employed to select 120 respondents in the study area. Primary data were elicited using a well-structured interview schedule. Data were analysed using descriptive statistics such as frequency counts, percentages, mean, as well as regression analysis. The respondents had a mean age of 45 years, a mean farming experience and a farm size of 16 years and 5 hectares. Improved technologies adopted include the use of herbicides (85.0%), rice milling machine (82.5%), improved rice varieties (72.5%) and use of fertilizer (60.8%). Most (70%) had a medium adoption level of improved technologies, and factors influencing adoption included technology maintenance cost (90.8%), lack of engineers to repair damages (82.5%), inadequate access to credit facilities (81.7%) and price of technologies (77.5%). Significant influence exists between the cost of technology maintenance, the price of technologies, the lack of subsidized machinery and the lack of access to credit facilities, and the adoption of improved rice production technologies. Therefore, farmers should be motivated to adopt technologies, especially destoning machines, tractors and mechanical threshers, by providing training on the use of technologies, incentives and technical support for improved rice quality and increased production.

Keywords: Technology Adoption; Rice Varieties; Production; Processing; Improved Technologies

INTRODUCTION

In Africa, consumer demand for rice has continued to outpace domestic supply. The second-most important staple in Nigeria is rice, which accounts for 10.5% of daily calorie intake (FAO, 2019). Due to Nigeria's expanding urbanization, rising income levels, and changing family and occupational structures, the demand for rice is growing (Uduma et al., 2016). However, under rain-fed conditions, rice is mostly grown by subsistence farmers (80% of whose farmland is less than a hectare), which results in a relatively decreased yield productivity (Takeshima & Bakare, 2016).

Nigeria imported 2.4 million metric tons of rice yearly on average over the past ten years, ranking second only to China (Durand-Morat et al., 2019), and the anticipated trend to persist in the upcoming ten years. Local production had been negatively impacted by rice imports into the nation (Vanguard, 2013). Local rice farmers may encounter challenges such as unexpected weather, a lack of storage facilities, and low farm returns, which may contribute to the poor supply of local rice (Ajayi and Ajiboye, 2020). Hence, Nigeria, as a major rice consumer, experiences difficulty in meeting the demand of its populace.

Despite Nigeria's enormous potential for rice production, the frequency of the demand-supply gap for the grain has been a recurrent tendency throughout the years, and the trend would continue if the proper steps are not implemented (Oyinbo et al., 2015). At this time, few rice farmers use more advanced input technologies; instead, they mostly rely on locally available technology. For farmers to boost productivity and rice production, it is crucial that they embrace improved varieties and have a solid understanding of rice production technologies. The process of introducing new technology, such as enhanced technologies, to rice farmers is known as adoption. Improved rice varieties, procedures for soil preparation, the use of agrochemicals, fertilizer application, and the use of suitable harvesting techniques such threshing, winnowing, milling, and destoner to increase the quality of the rice are some of the technologies mentioned. Poor or non-adoption of technology by farmers, including the use of millers, threshers, winnowers, and destoner machines in the production of rice, results in poor quality of rice, which lowers customer demand (Ngochembo et al., 2022).

In Ekiti State, as a major rice producing states in Nigeria, the consumers prefer the local rice greatly (Ajayi and Ajiboye, 2020). However, quality preferences for rice vary among consumers which determine their demand for it. Quality of rice and presence of particles such as stone, pebbles had significant influence on consumers' preference for rice in Ekiti State (Ajayi and Ajiboye, 2020). Additionally, to improper post-harvest management, poor planting materials and ineffective agronomic procedures also contribute to the quality flaws (Diako et al. as cited in Opeyemi et al., 2015). In Nigeria, the bulk of rice is produced and processed by underprivileged, impoverished subsistence farmers who have no financial or social ability to completely adopt technologies (Onu, 2018). Thus, rice farmers face some challenges such as low production, poor quality of rice, presence of paddy or stones in processed rice, and presence of broken rice grain (rice fragment) as a result of inadequate rice technologies, which may lead to poor marketing of rice (Ajayi and Ajiboye, 2020). However, with the increasing demand for rice due to an ever-increasing population, adopting rice technologies by farmers is essential for meeting consumers' demand for rice. Hence, there is a need to investigate the adoption of improved rice production and processing technologies among farmers in Ekiti State. Therefore, the study investigates the adoption of improved rice production and processing technologies among farmers in the study area to enhance their level of production to meet consumers' demand. Specifically, the study sought to:

i. describe the socio-economic characteristics of the respondents;
ii. identify rice production technologies by the respondents;
iii. determine the level of adoption of improved rice production and processing technologies by the respondents;
iv. determine factors influencing adoption of improved rice technologies by the respondents; and
v. identify challenges faced by farmers in adoption of improved rice technologies.

METHODOLOGY

The study was conducted in Ekiti State. Ekiti State is located in Southwest Nigeria. There are 16 local governments in it. With two distinct seasons, the State has a tropical climate. April through October is the wet season, and November through March is the dry season. The humidity is high and the temperature ranges from 21 to 28 °C. Using a systematic interview schedule that had been evaluated beforehand, the main data were collected. The tool that was employed was created with the intention of achieving the study's unique goals. This study used a multi-stage sampling approach. At the first stage, three (3) Local Government Areas (LGAs) were purposively selected. The Irepodun/Ifelodun, Emure, and Ise-Orun LGAs of Ekiti State, which are mostly known for producing rice, have a significant comparative advantage over other parts of the state. Then, using a random sampling technique, four (4) communities were selected from the identified Local Government Areas. The final step was selecting ten (10) rice farmers at random from each village, yielding a sample size of one hundred twenty (120) respondents.

Descriptive statistics analysis such as frequency counts, percentages and mean were used to analyse objectives 1 and 2. Objective 3 were measured in dichotomy where, Yes = 1 and No = 0. The level of adoption of the highlighted nine rice production and processing technologies was derived by computing the adoption scores. The scores were low, moderate and high adoption level. The category of low adopters were farmers who adopted 1 to 3 out of the nine improved rice technologies, moderate adopters were who adopted between 4 to 6 out of the nine technologies and the high level of adopters were those who adopted above 6 of the rice production technologies. This was later re-categorized into two groups; high adopter = 1 and low adopter = 0. Objective 5 was analyzed using descriptive statistics. Logistic regression model was used to analyze factors influencing adoption of rice production technologies by the respondents in the study area.

Logistic Regression

Logistic regression is a statistical model employed in a binary dependent variable.

$$\log\left[\frac{p_i}{1-p_i}\right] = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + +\varepsilon_1$$

Given the estimated coefficient of the regressors, the logit model enables a rather simple computation of the relative mean of the dependent variable or elasticity.

It can be assumed that Y takes the value of 0 or 1, where 0 signifies a low adoption score and 1 denotes a high adoption score, if Y is a random variable (dichotomous) Where, log = logit function; Pi = dependent variable; β= logistic coefficient for the independent variables.

$x_1 \ldots x_7$ = lack of technical know-how, price of the technologies, cost of technology maintenance, lack of engineers to repair damage, lack of access to credit, lack of follow up by extension agent and lack of subsidized machineries

ε_1 = error term

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Respondents

The study provided information about the socioeconomic background of the study's respondents. The respondents' median age was 45 years. This demonstrates that the study area's respondents were in their prime working years. According to the research, 80.8 percent of people were married. Five (5) people made up the average household size. This shows that the majority of respondents had households with average sizes. With a mean yearly income of ₦1,467,775, the majority of respondents (77.5%) had formal schooling. The respondents had a mean farming experience of 16 years and a mean farm size of 5 hectares. This means that most of the respondents were more experienced rice farmers on small-scale production.

Table 1: Socio-economic Characteristics of the Respondents

Variables	Frequency	Percentages	Mean
Age (years)			
<36	27	22.5	45
36- 45	39	32.5	
46- 55	39	32.5	
> 55	15	12.5	
Marital Status			
Single	14	11.7	
Married	97	80.8	
Divorced	3	2.5	
Widowed	6	5.0	
Household size (persons)			
1 -5	80	66.7	5
6 – 10	40	33.3	
Level of education			
No Formal Education	27	22.5	
Primary Education	30	25.0	
Secondary Education	47	39.2	
Tertiary Education	16	13.3	
Annual Income (₦)			
<1,000,000	54	45.0	1,467,775
1,000,001-2,000,000	55	45.8	
2,000,001-3,000,000	2	1.7	
>3,000,000	9	7.5	
Farming Experience (years)			
<11	52	43.3	16
11-20	41	34.2	
21-30	18	15.0	
>30	9	7.5	
Farm size (hectares**)**			
<4	26	21.7	5
4-6	84	70.0	
<6	10	8.3	

Source: Field survey, 2021

Rice Production and Processing Technologies Adopted by the Respondents

The result from Table 2 showed that 85.0 percent of the respondents made used of herbicide for land clearing and herbicides for weed control after planting of rice in the study area. This was followed by rice milling machine (82.5%) and use of improved rice varieties (72.5%). The study also showed that use 60.8 percent of the respondents adopted NPK-fertilizer as rice production technologies. This means that most of the respondents adopted herbicide for land clearing, herbicide for weed control after planting, rice milling machine, use of improved rice varieties and use of fertilizer (NPK). This study is in line with Onyeneke (2017) who found that the use of improved varieties, use of agrochemicals (herbicides), and fertilizer application were majorly adopted by the farmers. The result further revealed that 50.8 percent of the respondents adopted mechanical winnower. This means that about half of the respondents adopted mechanical winnower.

Furthermore, mechanical thresher (40.0%) and tractor for land preparation (32.5%) were adopted by the respondents as rice production technologies. This indicates that less than a half of respondents adopted mechanical thresher and tractor for land preparation in the study area. This could be because these technologies are capital intensive and Small-scale farmers make up the majority of the respondents.

On the other hand, only few (15%) of the respondents adopted destoner machine as their rice production technology. This could be because the respondents could not afford the cost of the technology due to their level of production. This implies that rice produced by these farmers would be of less quality such as having presence of sands, pebbles, and other foreign matters and this could command lower price. This finding is in line with that of Adisa et al. (2020), who found that the destoner machine was the technology that rice farmers adopted the least.

Table 2: Distribution of Rice Production and Processing Technologies

Rice production technologies	Frequency	Percentage
Tractor for land preparation	39	32.5
Improved rice variety	87	72.5
Use of herbicide for land clearing	102	85.0
Use of herbicide for weed control after planting	102	85.0
Use of fertilizer (NPK)	73	60.8
Mechanical thresher	48	40.0
Rice milling machine	99	82.5
Mechanical winnower	61	50.8
Destoner machine	18	15.0

Multiple responses

Source: Field survey, 2021

Level of Farmers' Adoption of Rice Technologies

The level of adoption of the highlighted nine rice production technologies was derived by computing the adoption scores. The scores were low, moderate and high level adopters. The category of low adopters were farmers who adopted 1 to 3 of the nine rice production technologies, moderate adopters were who adopted between 4 to 6 of the technologies and the high level of adopters were those who adopted above 6 of the rice production technologies as shown in Table 3. According to the study, the average score for rice farmers' technologies was 5.1, with a medium degree of acceptance among 70% of the farmers. Most of the respondents had a moderate level of adoption of rice production methods as a result. This result is consistent with that of Adisa et al. (2020), who discovered that the majority of respondents implemented rice technologies at a modest level.

Table 3: Distribution of rice farmers' technologies adoption scores

Adoption scores	Frequency	Percentage	Mean score
Low	26	22.0	
Moderate	84	70.0	5.1
High	10	8.0	
Total	120	100	

Source: Field survey, 2021

Challenges Faced by Farmers in the Adoption of Rice Production and Processing Technologies

The findings in Table 4:13 illustrate the variables that affect the research area's adoption of enhanced rice production and processing technology. Cost of technology maintenance (90.8%) was considered as the most farmers' challenges rice production technology the respondents. This was followed by lack of engineers to repair them when damage (82.5%), lack of access to financial resource (81.7%), price of the technologies (77.5%), lack of follow up by extension agent (75.8%). Also, 75.0 percent each of the respondents indicated lack of technical know-how and lack of subsidized machinery as factors influencing adoption of rice production technology. This means that cost of technology maintenance, lack of engineers to repair them when damage, lack of access to financial resource, price of the technologies, lack of follow up by extension agent, lack of technical know-how and lack of subsidized machinery were identified by the respondents as challenges faced by farmers in adopting rice production technologies.

Table 4: Challenges Faced by Farmers in Adoption of Rice Production and Processing Technologies

Farmers' challenges in adoption of rice production technology	Frequency	Percentage
Lack of technical know how	90	75.0
Price of the technologies	93	77.5
Cost of technology maintenance	109	90.8
Lack of engineers to repair them when damage	99	82.5
Lack of access to financial resources (credit facilities)	98	81.7
Lack of follow up by extension agent	91	75.8
Lack of subsidized machineries	90	75.0

Multiple responses
Source: Field survey, 2021

Result of the Logistic Regression

The findings showed that, at the 0.01 level of significance, the price of the technologies and the expense of maintaining them had a substantial negative impact on farmers' adoption of rice technology. This suggests that the likelihood of farmers adopting rice technologies would grow as the cost of technology acquisition and maintenance decreased. This result is consistent with that of Abubakar et al. (2019), who found that farmers are more likely to embrace rice production technology when they are less expensive. This is also consistent with research by Mwangi and Kariuki (2015), who found that farmers' willingness to adopt new technology is negatively impacted by the expense of doing so.

At the 0.1 level of significance, the absence of financial resources (credit facilities) had a detrimental and significant impact on farmers' adoption of rice technologies. According to this, farmers are more likely to adopt rice technologies if there is a decrease in their inability to access financial resources (credit facilities), while an increase in their inability to access these resources would be counterproductive. This result supports Ibrahim's (2014) findings that the adoption of agricultural technology is constrained by a shortage of credit. This result supports the finding of the study by Abubakar et al. (2016) that the adoption of rice innovations is hindered by a shortage of financing.

The findings also showed that farmers' adoption of rice technology was negatively and significantly ($P \leq 0.05$) impacted by the absence of equipment subsidies. This suggests that the adoption of rice technologies by farmers is inversely correlated with the amount of machine subsidies for rice production, with farmers adopting rice technologies increasing as machine subsidies decrease. This result also supports the findings of Abubakar et al. (2016) that the adoption of rice technologies may be constrained by high technology costs in the absence of subsidies.

Table 5: Result of the Logistic Regression

Factors	Coefficient	Standard Error	P-value
Lack of technical know how	0.281	0.698	0.688
Price of the technologies	-1.864***	0.601	0.002
Cost of technology maintenance	-2.669***	0.976	0.006
Lack of engineers to repair them when damage	0.111	0.904	0.902
Lack of access to financial resources (credit facilities)	-1.391*	0.794	0.080
Lack of follow up by extension agent	-0.681	0.773	0.378
Lack of subsidized machineries	-1.537**	0.788	0.051
Constant	4.517	1.226	0.000

***, ** and * denotes significance at the 0.1, 0.05 and 0.01 probability levels
Source: Field survey, 2021.

CONCLUSION AND RECOMMENDATIONS

The study investigated the adoption of improved rice production and processing technology among farmers in Ekiti State, Nigeria. Most of respondents adopted use of herbicides, rice milling machine, improved rice varieties, use of fertilizer and winnower as improved rice technologies. However, mechanical thresher (40.0%) and tractor for land preparation (32.5%) were less adopted by the respondents. Also, destoning machine (15.0%) was the least adopted technology by the rice farmers. The respondents had moderate (70.0%) level of adoption.

The findings also showed that factors that greatly affect the adoption of enhanced rice production technologies include the expense of technologies' maintenance, their price, the absence of subsidized machinery, and the lack of access to credit facilities. The government should exert greater effort to encourage farmers to embrace technologies such as destoning machines, in order to improve the quality of rice, tractor and mechanical thresher to improve production and by removing factors that greatly influence its adoption. The moderate level of adoption of rice technologies underlines the necessity for this. Therefore, in order to improve rice quality and increase production, farmers need be given incentives such as technology subsidies, maintenance supports, and financing facilities for technology affordability.

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