SOCIO-ECONOMIC AND INSTITUTIONAL FACTORS INFLUENCING ACCEPTANCE OF NERICA 1 RICE PRODUCTION TECHNOLOGIES AMONG FARMERS IN GOMBE STATE, NIGERIA

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ABSTRACT

The study analysed socio-economic and institutional factors influencing the acceptance of NERICA 1 rice among farmers in Gombe State, Nigeria. A multi-stage sampling technique was used for the study. Primary data were collected through a well-structured questionnaire. Descriptive and inferential statistics were used to achieve the objectives of the study. The finding showed that the overall mean age of the respondents was 37.8 years. Also, about 43% of the respondents had 11-20 years' experience and majority (81.1%) were members of cooperative. The result of the logit regression estimate showed that age and farm size had a negative and significant influence on the acceptance of NERICA 1 rice at a $P \leq 0.01$ level of probability. Farming experience, amount of credit and membership of cooperative had significant and positive ($P \leq 0.01$) relationship with the acceptance of NERICA 1 rice. It was concluded that the majority of the respondents were young, male, literate, married, members of cooperative with moderate household size, and low rice farming experienced. Age, farming experience, farm size amount of credit and membership of cooperative were found to have a significant influence on the adoption of NERICA 1 rice. The study recommended that Federal, State, and Local Governments, private sectors, and NGOs should encourage youth to sustain the organizational spirit and create seminars and workshop to stimulate women participation in farming activities.

Keywords: Acceptance, NERICA, Rice, Technologies, Farmers.

INTRODUCTION

Rice is a staple food for millions of people in Nigeria. This makes it to be among the priority crop for food security. Therefore, rice enterprises provide employment opportunities to millions of Nigerians in their value chain. Presently, Nigeria is the largest producer of rice in Africa and the West Africa sub-region. Crop importation has been banned by the present administration because Government spends a huge amount of money on importing the crop. This allows importing countries such as Thailand, United States, and India to work hard to produce more rice and earn more money. This scenario implies that it reduces the employment

of local farmers by empowering more people from importing countries. Osagie (2014) observed that Nigeria spends about a billion Naira daily importing rice. The area under rice cultivation in Nigeria expanded from about 2.4 million harvested hectare (ha) in 2010 to 3.2 million harvested ha in 2017 (Olushola, 2018). Rice has become a food security crop as well as a cash crop in Nigeria, employing over 15 million people in its value chain (Daudu *et al.,* 2014). Therefore Nwachukwu *et al.* (2008) stated that as a staple food in Nigeria, rice account for 40% of the diet of the country's population but production has been growing at a slow rate relative to consumption within the last years. The crop has much potential to be grown throughout the year. Rice production is one of the major agricultural enterprises which provides employment, food, and income to a large proportion of farmers in Gombe State in particular and Nigeria in general (Bala and Mumini, 2020).

NERICA is an interspecific hybrid between the local African rice (*Oryza glaberrima)* and the Asian rice (*Oryza sativa*) offers new opportunities for upland rice farmers. NERICAs have unique characteristics such as shorter duration (mature between 30 and 50 days earlier than traditional varieties), higher yield, and tolerance to major stresses, higher protein, and good taste compared with the traditional rice varieties (Bala *et al*., 2019). NERICAs have also been reported to have stable yields under different management conditions and their introduction into farmers' fields was considered as the first step towards stabilization and sustainable intensification of Africa's fragile uplands rice (Paul *et al.,* 2010). The NERICA varieties promise to raise significantly the productivity, income, and food security of rain-fed upland rice farmers in sub-Saharan Africa (West African Rice Development Association [WARDA], 2008). There are currently 18 varieties suited for upland growth conditions (NERICA 1 to NERICA 18) and 60 varieties suited for lowland growth conditions (NERICA-L1 to NERICA-L60). Agronomic characteristics of these NERICA varieties vary widely but they are generally high yielding and early maturing (a trait much appreciated by farmers), do not lodge and shatter, are appreciated by farmers for their grain quality, and are relatively resistant to Africa's harsh growth environment in terms of biotic and abiotic stresses (Diagne *et al*., 2010). NERICA was introduced, on a trial basis, in all West African countries including Nigeria since 2003 and has been enthusiastically adopted (WARDA, 2008).

As a staple food in the diet of most Nigerians, there is a high demand for rice which has cumulated in a large gap between the supply and demand for rice. In the last decade, rice consumption has increased at an annual mean of 10.3% (Maji *et al.,* 2015). The demand and supply gap in rice is the result of the increase in annual consumption per capita of 32kg of rice was the highest of any staple in Nigeria (Olusola, 2018) and is expected to rise due to growth in population and urbanization. Both rice production and consumption in Nigeria have greatly increased. Notwithstanding, the production increase was insufficient to match the consumption due to the rise in population and consumer preference. This demand-supply gap is being met through rice import which now represents over 25% of all agricultural imports and more than 40% of domestic consumption during the last years (Umeh and Chukwu, 2015).

Rice demand in Nigeria is high and meeting this demand is among the food security priorities (National Rice Development Strategy [NRDS], 2009). The rise in the demand for rice couple

with the increase in population may lead to pressure in the demand and this could lead to the idea of importation. In 2017 the rice consumption was 6.4 Million Tons (MT) (United States Department of Agriculture [USDA], 2017) while domestic production was about 3.7 MT of milled rice (Bayo, 2018). Hence, there is a shortage of 2.7 MT. As a result, there has been a growing gap between the demand for rice and its supply arising from low productivity. A study was conducted to determine the Level of Adoption of NERICA1 Technologies among Farmers in Gombe State by Bala *et al*. (2019). Another study was conducted by Bala and Mumini (2020) to examine the acceptance and use of Improved Upland Rice Production Practices in the Balanga Local Government Area of Gombe State. The results of these studies indicated a low level of adoption of technologies. Hence, the need to study and understand socio-economic and institutional factors influencing acceptance of NERICA 1 rice production technologies among farmers in Gombe State, the specific objectives were to; describe socio-economic and institutional characteristics of farmers in the study area, determine factors influencing acceptance of NERICA 1 rice technologies. It was hypothesized that Socioeconomic and institutional factors have no significant influence on the acceptance of NERICA 1 rice in the study area.

MATERIALS AND METHODS

The Study Area

Gombe State was created on 1st October 1996 by the Military Government headed by General Sani Abacha, the Commander-in-chief of Armed Forces of the Federation. It was formally under Bauchi State. The State has 11 local government councils with its administrative headquarters in Gombe and shares a common boundary with Adamawa, Bauchi, Borno, and Yobe State to the south, west, east, and north, respectively. It is located in the northern guinea savanna agro-ecological zone of Nigeria (Gombe State Agricultural Development Programme [GSADP], 2018). The State lies on latitude 10015ʹ N and longitude 110 E (Omorogbe *et al*., 2017). It has a total population of 2,365,040 out of which 1,244,228 are males and 1,120,812 were females (National Population Commission [NPC], 2010); this is projected to be 3,216,454 which constitute 1,692,232 males and 1,524,304 females at 3.0% growth rate in 2018. About 60% of the population in Gombe engages in agriculture and the State covers a landmass of about 20, 266 square kilometers (Km2) (Gombe State, 2017). The crops grown in the State are, cereals (Maize, Millet, Sorghum, Rice, and Wheat), legumes (cowpea, groundnut, soya beans, and bambara nut), fruits (mango, guava, paw paw, orange, lemon, and grapes), vegetables (tomatoes, onion, pepper, okro, pumpkin, and melon), tree crops (gum arabic, moringa) and livestock such as cattle, sheep, goats, poultry, rabbits, pigs and fishes (Gombe, 2017).

Sampling Procedure and Sample Size

A Multi-stage sampling technique was used to determine the sample for the study. In the first stage, Balanga and Yamaltu-Deba LGAs were randomly selected through balloting. In the second stage, 10 rice-producing communities were randomly selected through balloting from Balanga and Yamaltu-Deba LGAs. The third stage involves using a Slovian formula

adopted by Abdulazeez *et al*. (2018) for calculating sample size based on the assumption of 5% expected margins of error, 95% confidence interval, and applying the finite population correction factor. The formula is expressed as follows:

$$no = \frac{N}{1+(e^2)} \qquad \qquad \dots (1)$$

Lastly, 58% of NERICA 1 rice farmers were randomly selected from each village, giving a total of 164 samples. Primary data were collected through a well-structured questionnaire and used for the study.

Analytical Techniques

Descriptive statistics such as frequencies, percentages, means, and standard deviation and inferential statistics (Logit regression model) was used to achieve the objectives of the study. A binary logistic model is appropriate when the dependent variable to be evaluated is dichotomous (Abubakar *et al*., 2019). The model is typically used when the dependent variable is dichotomous and the independent (explanatory) variables are either continuous or categorical variables. The model was used by (Saddiq, 2015; and Hago *et al.,* 2018). Hence, the following Logit regression formula was used;

$$Y = \alpha + (\beta_1 X_1) + (\beta_2 X_2) + (\beta_3 X_3) \dots (\beta_9 X_9) + \varepsilon_i \qquad \dots (2)$$

where;

Y = Farmers (1 = NERICA 1 rice farmers; 0 = otherwise)

α = constant

$\beta_1 - \beta_9$ = Coefficients of independent variables

ε_i = Independently error term

$X_1 - X_9$ = are the factors influencing the of adoption of NERICA 1 rice

X_1 = Age (in years)

X_2 = Sex (male = 1, female = 0)

X_3 = Educational level (formal education = 1, non-formal education = 0)

X_4 = Farming experience (in years)

X_5 = Household size (number)

X_6 = Farm size (hectares)

X_7 = Marital status (0 = single, 1 = married)

X_8 = Amount of credit (amount in naira)

X_9 = Membership of cooperative society (number of groups farmer belongs to).

RESULTS AND DISCUSSION

Socio-economic Characteristics of Respondents

About 34% of the respondents were within the age range of 31-40, this is followed by 18-30 (31.7%). The least of 3.7% was obtained at the age group greater than 60. The overall mean age was 37.8 years. This result implies that farmers in the study area were young and can actively perform agricultural activities more especially rice production which requires more skilled and unskilled labour. This is consistent with Ndaghu *et al*. (2015) who reported in their

study Socio-economic factors affecting adoption of early maturing maize varieties by Small scale farmers in Safana LGA of Katsina State, Nigeria that the average age of farmers was 44 years; this means that they are in their active stage to farm crops. The result of the sex revealed that a majority (90.2%) of the respondents were males. The least 9.8% were females. This finding indicates that females have less participation in NERICA 1 rice production; this could be attributed to the cultural and religious background of the people in the study area which restricted women from going out to look for family needs. This result corroborates with the findings of Omorogbe *et al*. (2017) who reported that the majority 98.3% of the sweet melon producers in the Balanga LGA were males. The majority (62.8%) of respondents had one form of formal education or the other. On the other hand, about 37.2% of the respondents had non-formal education in form of Quranic education. The average years of schooling were 11.9 years. The result indicates that most of the respondents in the study areas were literate hence; they can read, write and understand information concerning new technologies that help in making a prudent decision concerning the acceptance of NERICA 1 rice. The finding agrees with Amponsah *et al*. (2018) who reported in their study Assessment of Rice Farmers' Knowledge and Perception of Harvest and Postharvest Losses in Ghana that, over 70% of the farmers were educated. They further said farmers with some level of formal education may better understand the benefits of improved harvest and post-harvest technologies than those with no formal education.

The result of farming experience revealed that most (42.7%) of the respondents had experience in rice farming between 11-20 years; this is followed by respondents with 1-10 years of rice farming experience which constitutes 39.6%. Very little 3.7% of respondents had the experience of 31-40 years in rice farming. This finding shows that the respondents had the farming experience, therefore; they could have the ability to accept NERICA 1 rice. This finding corresponds with Abubakar *et al*. (2019) who reported in their study that most 75% of adopters of the rice production practices had more than 20 years of farming experience. This implies that rice production experience and the ability to perceive the effectiveness of improved practices over the traditional methods endear farmers to be receptive to innovative ideas. The finding revealed respondents had a household size of 1-6 people which constitutes 47.6% of the sample of the study. The overall average of 8 persons was obtained from the study area. This result implies that farmers in the study area have available family labour which can greatly reduce their cost of production and this could be attributed to extended family nature in the study area. This result is dissimilar with Omorogbe *et al*. (2017) who reported that the average household size of the sweet melon farmers in Balanga was found to be 13 persons and this is most likely attributed to the polygamous nature in Northern Nigeria.

Table 1: Socio-economic Characteristics of the Respondents

Variable	Frequency	Percentage	Mean
Age			
18 – 30	52	31.7	
31 – 40	55	33.5	37.8
41 – 50	37	22.6	
51 – 60	14	8.5	
>61	6	3.7	
Educational level			
Primary	23	14.0	
Qur'anic education	61	37.2	11.9
Secondary	43	26.2	
Tertiary	37	22.6	
Farming experience			
1 – 10	65	39.6	
11 – 20	70	42.7	
21 – 30	23	14.0	14.5
31 – 40	6.0	3.7	
>40	0.0	0.0	
Household size			
1 - 6	78	47.6	
7 - 12	50	30.5	
13 – 18	26	15.9	8
19 - 24	9	5.4	
>25	1	0.6	
Farm size			
<1.5	92	56.1	
1.6 -3.2	66	40.2	1.5
>3.3	6	3.7	
Amount of credit			
Not access	88	53.7	
<30,000	20	12.2	
30,000 - 60,000	48	29.3	42,868.4
60,001 - 90,000	1	0.6	
90,001 - 120,000	4	2.4	
>120,000	3	1.8	
Membership of cooperative			
Yes	133	81.1	
No	31	18.9	

Source: Field survey, 2018

Table 1 further reveals the respondent's average farm size of 1.5 ha. This result implies that the majority of the NERICA 1 respondents were smallholder farmers. The smallholder nature of the respondents could affect their acceptance because it will be difficult to allocate a small portion of land for the trial of new practices. The finding varies with Adenuga *et al.* (2016) who found that the average farm size for the adopters of improved rice varieties was 2.82 ha. The result showed that a majority (81.1.7%) of respondents were married with only 18.9% single. This finding indicates that farmers in the study area had more responsibilities; this makes them work hard to cater to family needs, hence could produce more NERICA 1 rice because of high yield with low inputs requirement. This finding is in agreement with Abdulrahman *et al*. (2018) who opined that married respondents with an additional member of households could encourage income diversification. The result showed that the larger part (53.7%) of respondents had no access to any amount of credit. Credit access by farmers helps them to accept and practices innovation because it mostly requires capital which will not be readily available to farmers because of their poorest nature. On the other side, the result from the respondents that access credit revealed that about 29.3% had access about ₦30, 000 - ₦60, 000 and the lowest 1.8% (greater than ₦120, 000). On average about ₦42, 868.42 received by the respondents as credit. This result indicates that the majority of the respondents had no access to credit for their NERICA 1 rice production; this could be attributed to the smallholder farming system of the respondents. The finding differs from Chekene and Chancellor (2015) who reported that the majority of the respondents 65% have access to credit with a larger part of fast adopters. The result showed that most (81.1%) of the respondents were members of the cooperative. This result implies that a larger portion of the respondents could have a great chance of getting credit, inputs, and useful information associated with NERICA 1 rice. The finding of this study is in contract with Chekene and Chancellor (2015) who found that majority of the respondents 65% were members of the association and the bulk of fast adopters.

Factors Influencing Acceptance of NERICA 1 Rice

Table 2 revealed the result of the logit regression estimate of factors influencing the acceptance of NERICA 1 rice. Among the nine (9) variables included in the regression five (age, farming experience, farm size amount of credit, and membership of cooperative) indicate significant influence on the acceptance of NERICA 1 rice. Likewise, three (3) variables insignificantly influenced the respondents to accept NERICA 1 rice technologies; these are educational level, household size, and marital status. The result is contrary to *a priori* expectation. The implication is that these variables are not important in terms of predicting the probability of NERICA 1 rice acceptance. Each of the coefficients shows the degree to which the independent variables exercise influence the acceptance of NERICA 1 rice. The pseudo R2 0.3205 means the predictors exert 32% of the influence on the acceptance of NERICA 1 rice on the respondents. The log-likelihood -154.48503 indicates LR ch2 value of 145.73 which is significant at a 1% probability level. This implies that the model is well fitted. In the same vein, it means all the exogenous variables together influence the acceptance of NERICA 1 rice by the respondents.

The result of the logit regression estimate showed that age has a negative and significant influence on the acceptance of NERICA 1 rice at a 5% level of probability. This is consistent with *a priori* expectation. The result indicates that the older the farmer the lesser the acceptance of NERICA 1 rice because older people are less energetic and have more farming experience which could make them reject new technologies and stick to traditional ways of farming practices. The result concurs with Ogunya *et al*. (2017) who reported that the age of farmers was found to be significant and negatively related to the level of NERICA rice adoption.

Farming experience revealed a significant and positive relationship with the acceptance of NERICA 1 rice at a 1% level of precision. This is consistent with *a priori* expectation. This implies that an increase in farmers' experience in rice production would increase the chance of acceptance of new technology (NERICA 1 rice). This is consistent with Abubakar *et al*. (2016) who revealed in their study that farming experience has a positive and significant ($P \leq 0.01$) relationship with the adoption level of the production technologies. This implies a more experienced farmer may have a lower level of uncertainty about innovations performance and also be able to evaluate the advantage of technology being considered.

The result of the farm size showed significant but negatively related to acceptance of NERICA 1 rice at 1% probability level. This result is not consistent with *a priori* expectation and it denotes that a unit increase in farm size can decrease farmers' yield because they cannot afford the necessary inputs to manage the farm. The finding varies with Abubakar *et al*. (2019) who stated that farmland was found to be positive and significant ($P \leq 0.05$). This implies that a unit addition of hectares of land owned by farmers would prompt farmers to adopt more rice production technologies.

The amount of credit results has a positive and significant influence on the acceptance of NERICA 1 rice at a 1% probability level. The result is consistent with *a priori* expectation. This implies that an increase in the amount of credit access helps farmers to purchase farm inputs (NERICA 1 seeds, farm tools/equipment, hire farm machines, purchase agrochemicals and fertilizer as well as pay for hired labour) which increase acceptance of NERICA 1 rice. This is in line with Sadiqq (2015) who reported that credit received by the respondent was positive and significant at a 10% level of probability.

Table 2: Logit Rgression Analysis

Variable	Coefficient	Standard error	t-value	P>t
Age	-0.0627342	0.0249519	-2.51	0.012***
Educational level	0.0188583	0.147821	0.13	0.898NS
Farming experience	0.0778804	0.0252635	3.08	0.002***
Household size	0.0124558	0.0404611	0.31	0.758NS
Farm size	-1.107859	0.2576157	-4.30	0.000***
Marital status	-0.1597521	0.4580501	-0.35	0.727NS
Amount of credit	0.8482439	0.3131624	2.71	0.007***
Membership of cooperative	2.315219	0.3112766	7.44	0.000***
Constant	-0.3027564	0.8135113	-0.37	0.710
Analytical variables				
Number of observation	328			
LR chi^2 (8)	145.73			
Prob > chi^2	0.0000			
Pseudo R^2	0.3205			
Log likelihood	-154.48503			

Note: *** indicates significant influence at 1% level of precision
Source: Field survey, 2018

Table 2, result on membership of the cooperative reveals a positive and significant influence on the acceptance of NERICA 1 rice. This result is contrary to *a priori* expectation hence it indicates that members of cooperative benefits from the group through sharing useful information, training, obtaining credit, farm inputs (NERICA 1 seeds, fertilizer, agrochemicals, and so on) which could be attributed to increasing acceptance of NERICA 1. The result rejects Diran (2015), who reported in his study that membership of farmers' association, was not statistically significant but negatively related to the adoption of NERICA varieties. Therefore, the null hypothesis stated is rejected and alternative hypothesis accepted thus, socioeconomic and institutional characteristics have a positive and significant influence on the acceptance of NERICA 1 rice by the respondents.

CONCLUSION AND RECOMMENDATIONS

Based on the findings of this study, it is concluded that the majority of the respondents were male, literate, married with moderate household size, young, energetic, and can actively perform well in Agricultural activities more especially in rice production with low rice farming experienced, therefore; they can accept NERICA 1 rice. Age, farming experience, farm size amount of credit and membership of cooperative were found to have a significant influence on the acceptance of NERICA 1 rice at a 1% probability level while education has no significant influence on the acceptance of NERICA 1 rice. Therefore, it was recommended that:

1. Federal, State, and Local Governments, private sectors, and Non-Governmental Organizations (NGOs) should encourage youth to sustain the organizational spirit and create seminars and workshops to stimulate women participation in farming activities.

2. Government at all level in collaboration with NGOs and other stakeholders in agriculture should make farming more attractive to the youth (men and women) in the study areas through the annual agricultural show, provision of free grant and scholarship to best farmers to study agriculture in higher institution of learning.

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