

# 1 **Determinants of Rate of Adoption of Rice Production Technologies introduced by** 2 **Agricultural Research Outreach Centres (AROCs) by Farmers in Niger State, Nigeria**

## 3 4 **Abstract**

5 The study assessed the determinants of rate of adoption of rice production technologies  
6 introduced by Agricultural Research Outreach Centres in Nigeria. Data were collected using a  
7 multi-sampling technique. Data were analysed using simple descriptive statistics and multiple  
8 linear regression. Results revealed that respondents' mean age was 50 years; level of formal  
9 education of farmers was low and farm size was 2.5ha on the average. Age, farming experience,  
10 years of schooling and number of extension visits were the socioeconomic determinants affecting  
11 rate of adoption. It was recommended that more villages should be adopted with partnership  
12 between government and the private sector in order to cover more grounds and increase the rate  
13 of adoption of new technologies. Also, government and relevant stakeholders should prioritize  
14 establishment of the best extension teaching methods and systems as well as administration to  
15 help increase rate adoption of innovations and sustainability of the use of these technologies over  
16 time.

17 **Keywords:** Determinants, rate of adoption, rice production, technologies, farmers

## 18 **Introduction**

19 Rice is the most consumed staple in Nigeria with per capita consumption put at 32 kg per (PwC,  
20 2018). In the recent decade, consumption is said to have increased by 4.7%, this increase is  
21 almost four times the global consumption growth, and reached 6.4 million tonnes in 2017 –  
22 accounting for c.20% of Africa's consumption. As at 2011, rice accounted for 10% of household  
23 food spending, and 6.6% of total household spending. Given the importance of rice as a staple  
24 food in Nigeria, boosting its production has been accorded high priority by the government in the  
25 past 7 years. Significant progress has been recorded; rice production in Nigeria reached a peak of  
26 3.7 million tonnes in 2017 (PwC, 2018).

27 Although, the United States Department for Agriculture (USDA, 2018) report on Nigeria's  
28 import data has been reviewed downward from 3 million metric tonnes to 2.4 million metric  
29 tonnes there is still possibility that the country imports up to 3 million metric tonnes. This is due  
30 to illegal importations coming from Nigeria's porous borders. For instance, with data from the  
31 Thailand Rice Exporters Association and All India Rice Exporters Association a simple addition  
32 of exports from both countries shows 2.05 million metric tonnes of rice was exported to Benin in  
33 2016. The USDA figure only represents 21 percent of what Benin imported from just Thailand  
34 and India; its total imports understated by at least 79 percent. Also, whereas exports to Benin in  
35 2017 was at least 2.51 million metric tonnes from India and Thailand alone, the USDA stated the  
36 country had a total import of 525,000 metric tonnes (Ojewale, 2019).

37 Furthermore, India and Thailand alone recorded that 797,268.75 metric tonnes of rice were  
38 exported to Cameroon in 2017. Cameroon also shares a border with Nigeria. Both countries have  
39 imported parboiled rice which is not their preferred rice suggesting that they both target  
40 Nigeria's huge rice market. Several billions have been spent on improving productivity of rice in

41 Nigeria. Nigeria's greatest resource as far as productivity increase is concerned are its  
42 smallholder farmers. Increasing their capacity, knowledge, skill and performance is requisite for  
43 productivity enhancement. It is the realization of this fact that has birthed the establishment of  
44 the Agricultural Research Outreach Centres.

45 The Agricultural Research Outreach Centre (AROC) is an established centre sited within each of  
46 the identified adopted village communities in an accessible location to the farmers. According to  
47 (ARCN, 2009) the main objectives of the AROC centres are to serve as a knowledge/resource  
48 centre for the contiguous farming communities, where all available relevant information on  
49 agriculture and other aspects of community livelihood would be displayed; serve the purpose of  
50 farm service centre where NARIs and FCAs will display available technologies and render  
51 services to the communities; serve as training venue where NARIs and FCAs will conduct  
52 training for the farmers; serve as a demonstration centre; and serve as outreach centre where  
53 feedback on technologies being promoted could be received.

54 Historically, adopted village/AROC concept is an approach introduced in 1996 under the World  
55 Bank assisted Project, National Agricultural Research Project (NARP) and recommended in the  
56 National Agricultural Research Strategy Plan of 1996–2010 (NARSP, 1996). The concept was  
57 introduced for developing and evaluating technologies emanating from the National Agricultural  
58 Research Institutes (NARIs) and to help in the early evaluation and dissemination of these  
59 technologies (NARSP, 1996). The scheme was initiated to facilitate the trial of new research  
60 findings by scientists under the farmer's environmental conditions. The scheme has the added  
61 advantages of involving the farmers in the trial either as observers, in the case of researcher  
62 managed, or executors in the case of farmer managed trials. The involvement of farmers will in  
63 turn speed up the rate of adoption of such technologies by neighbouring farmers, as the trial will  
64 also serve as demonstration plot. Also, technologies generated in the Institute are taken to the  
65 adopted villages for dissemination to farm families in the adopted villages (Adeogunet *al.*, 2017).

66 According to Abubakar (2009) Agricultural Research Council of Nigeria (ARCN) believes in  
67 institutionally pluralistic extension delivery arrangement that would reach and respond to diverse  
68 farmers and farming systems. The linear system of passing research results to extension agents  
69 who then transfer them to farmers, in the opinion of Byerlee (2004), is regarded widely obsolete.

70 Adenike (2012) affirmed the need to seek greater understanding of alternative pathways for rural  
71 economic development, and redefining the role, mission, and strategies of the Agricultural  
72 Research Institutes and Agencies as facilitators of rural economic growth. This calls for the  
73 change in the mind sets of the change agents and greater flexibility and creativity in defining the  
74 agenda as well as new public-private-civil society partnerships on the basis of whatever is  
75 necessary to improve opportunities, productivity and income generation capacity of poor rural  
76 households. The Adopted Village/AROCs programme is in line with this assertion as confirmed  
77 by Chikwendu (2009) who opines that even if the impact of research and extension is not  
78 immediately self-evident elsewhere in easily quantifiable terms, it must be felt in quantifiable  
79 terms in Adopted Village Communities.

80 Therefore, Since adoption of improved Agricultural technologies and modern farming techniques  
81 has been identified as an instruments of increase Agricultural Productivity of the farmers, poor  
82 adoption of modern farming techniques and new technologies by farmers would eventually lead  
83 to high cost of production with corresponding low yield and negative consequences such as poor  
84 standard of living, hunger, malnutrition, disease and unemployment. But, if farmers adopt and  
85 apply the improved techniques well, there would be increased productivity and food security.

86 Recently Agricultural Research Outreach Centres (AROCs) has been promoted and specifically  
87 in the Central Agricultural zone of Niger State, Nigeria to facilitate the dissemination of  
88 improved rice production technologies to farmers as an interventionist strategy to increase rice  
89 production. And since there has not been any empirical study on the assessment of the level of  
90 adoption of improved rice production technologies introduced and promoted by these AROCs in  
91 Central Agricultural zone 'A' of Niger State. It is against this background that this study  
92 intended to find answers to the following research questions:

- 93 i) What are the socio-economic characteristics of the rice farmers in the study area?  
94 ii) What are the effects of respondent's socio-economic characteristics on their level  
95 of adoption of AROC's introduced and promoted rice production technologies?

#### 96 **Objectives of the study**

- 97 i) describe the socio-economic characteristics of rice farmers in the study area;  
98 ii) determine the effects of respondent's socio-economic characteristics on their  
99 level of adoption of AROC rice production technologies.

#### 100 **Research Hypotheses**

101 The following hypotheses stated in null form were stated and tested

102  $H_{01}$ : There are no significant relationships between the socio-economic characteristics of the rice  
103 farmers and their level of adoption of AROC's introduced Rice Production Technologies in the  
104 study area.

105  $H_{02}$ : There is no significant relationship between the number of extension visits to farmer's farm  
106 and their level of Adoption of AROC's introduced Rice production technologies in the study  
107 area.

#### 108 **Methodology**

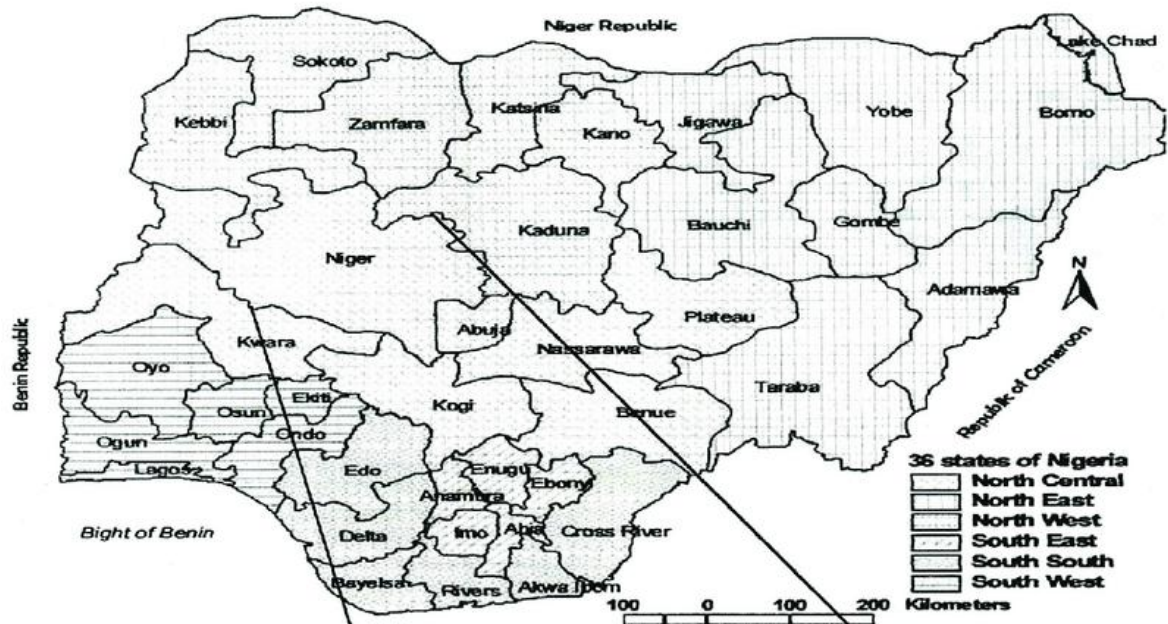
##### 109 **Study Area**

110 This study was conducted in the Central Agricultural zone 'A' of Niger State. Niger State has a  
111 population of 3,954,772 people (NPC, 2006). Applying the formular by Dotson (2018), the  
112 population of Niger State was projected to be 5,841, 121 persons at 2019. The study area is  
113 located in the North central zone along the Middle Belt region of Nigeria with coordinates of 100  
114 00/N 60 00/E (Alamu, 2013). According to NSN (2013), the State was created on 3rd February,  
115 1976 when the then North – Western State was transformed into Niger and Sokoto States.

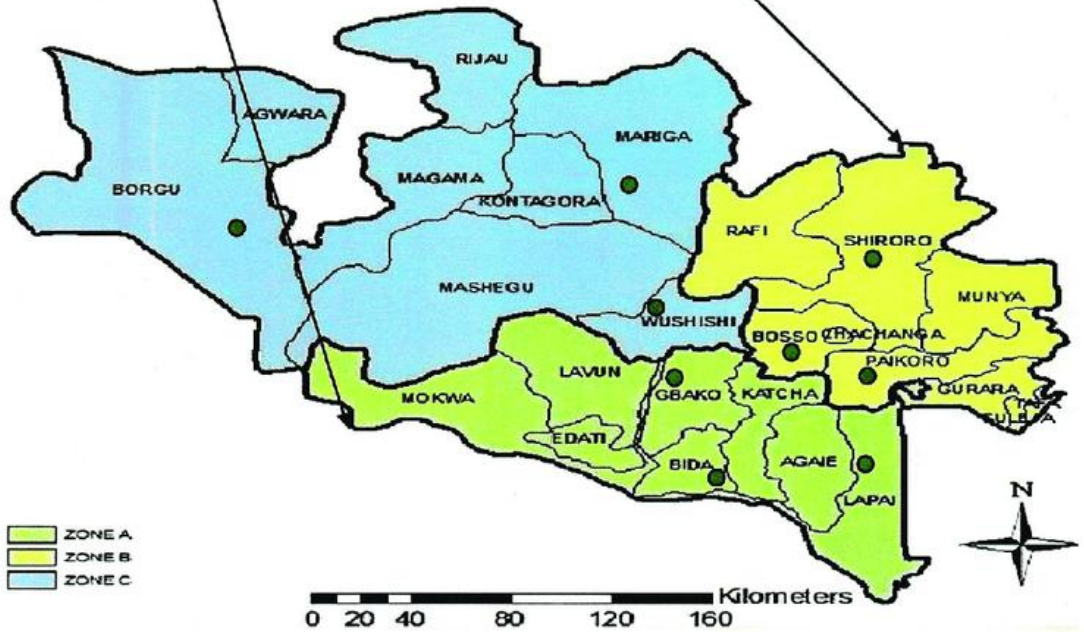
116 The State is classified as one of the largest States in the country spanning over 76,363 km<sup>2</sup>  
117 (29,484 sq ml) in land area with 80% of the land mass conducive for agriculture (Tologbonse,  
118 2008). With 9.30% of the total land area of the country, Niger state is divided into three  
119 agricultural zones (Niger State Agricultural Mechanization Development Authority Central zone  
120 'A', North zone 'B' & South zone 'C') under climatic features containing nearly all classes of  
121 soils of the savannah regions of West Africa (Tologbonse, 2008). The Central zone 'A' of which  
122 the study was carried out, comprises of eight (8) local government areas: Lavun, Gbako, Bida,  
123 Agaye, Makwa, Edati, Katcha and Lapai. A multi-stage sampling technique was used to select a  
124 sample size of 180 respondents.

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UNDER PEER REVIEW



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127 Source: Alhaji *et al.* (2018)

128 Fig.1. Map showing study location in Nigeria

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131 **Analytical Techniques**

132 Arithmetic mean was computed according the following formulae;

133 
$$\bar{X} = \frac{\sum Xi}{N} = \frac{x1+x2+x3+x4.....xn}{N} \dots\dots\dots (1)$$

134  
135  $\bar{X}$  = Mean

136  $\sum Xi$  = summation of the sample

137 N = Total number of observations

138  $\Sigma$  = Summation

139 Xi = Individual observation

140 Percentage was mathematically expressed as:

141 
$$\text{Percentage (\%)} = \frac{X}{N} \times 100 \dots\dots\dots (2)$$

142 Where,

143 X = Individual observation

144 N = Total number of respondents

145

146 **Regression Analysis**

147 The regression equation is expressed as follows:

148 
$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + U$$

149 Where;

150 Y = Level of adoption of AROC's rice production technology in percentage (%)

151

152 Therefore, 
$$Y = \frac{\text{Number of AROC's technologies adopted by farmer}}{\text{Total number of technologies introduced by AROC}} \times 100$$

153

154  $X_1, \dots, X_n$  = Explanatory/Independent variables

155  $X_1$  = Age of the farmer (years)

156  $X_2$  = Household size (number of persons in the household)

157  $X_3$  = Farming experience (years)

158  $X_4$  = Education (years of formal schooling)

159  $X_5$  = Farm size (hectares)

160  $X_6$  = Marital status using dummy (if single = 0, married = 1)

161  $X_7$  = Membership of cooperatives (Member = 1, Non-Member = 0)

162  $X_8$  = Training/AROC staff visits

163 U = Error term  
164  $b_0$  = Constant term  
165  $b_1 - b_8$  = Regression Coefficients

## 166 **Results and Discussion**

### 167 **Socioeconomic characteristics of respondents**

168 The majority (74.4%) of respondents were between the ages of 41 and 60 years. Respondents  
169 between the ages of 21 and 40 years and those above 60 years of age both accounted for 12.7%  
170 respectively. The mean age of respondents was 50 years. This implies that the median age falls  
171 within 41 – 60 years suggesting that they are a workforce still energetic and productive. This  
172 finding is in line with those of Mustapha *et al.* (2012) and Matanmiet *et al.* (2011) in their study in  
173 Kwara State Nigeria who reported that majority of farmers involved in rice production were  
174 within the middle age group who are energetic and highly productive. This finding agrees with  
175 that of Hayrolet *et al.* (2009) who also revealed that the average age of farmers in developing  
176 countries is in excess of 46 years.

177 Most (54.3%) of the respondents had no formal education, 20.5% of the respondents had primary  
178 education while 17.7% and 7.2% had secondary education and tertiary education respectively.  
179 The results further show that even though the educational level of the respondents was low, there  
180 may be a likelihood of effective interaction amongst farmers with no formal education, those  
181 with formal education and AROC staff/extension agents which enhanced the level of  
182 understanding and bolstered the rate of adopting new farm technologies by farmers. The  
183 implication of this finding is that with proper advisory services and good follow up trainings  
184 farmers, notwithstanding their educational status, can access and incorporate necessary  
185 innovations into their agricultural practices.

186 Majority (76%) of the famers had between 1 and 10-years farming experience and 23.8% had 11  
187 – 20 years. The mean years of farming experience was 7 years. The findings show that the  
188 smallholder rice farmers in the study area had relatively moderate experience in rice production  
189 which may likely to contribute to the awareness/familiarity and adoption of AROC introduced  
190 rice production technologies. Although, farming experience has been reported to improve  
191 adaptiveness of farmers the fact that the population is mostly young will contribute in increasing  
192 receptiveness of farmers to new technologies.

193 Further, majority (98.8%) of the respondents had between 1 – 5 hectares of rice farm land and  
194 only 1.2% had 6 – 10 hectares. The mean farm size was 2.5 ha. This shows that rice farmers in  
195 the study area were mainly smallholder/small-scale farmers. The finding might be connected  
196 with the fact that farm acquisition in the area was virtually through inheritance and continued  
197 fragmentation of big farms into small plots amongst the family members. This result corresponds  
198 with the findings of Mustapha *et al.* (2012) and Fakayode (2009) in which majority (61.25%) of  
199 the respondents of that study had 1-3 hectares of rice farms. It also agrees with Fasasi  
200 (2010), who reported that highest percentage of food produced in Nigeria was produced by small-  
201 scale farmers.

202 Majority (71%) of the respondents acquired their farmlands through inheritance, 23.9 percent  
203 through rent/lease, and 3.4 through purchase while 1.7 percent of the respondents acquired their  
204 farmlands through communal effort. The result indicated that no change has taken place in  
205 method of land acquisition over the years. This also underscores the near absence of land  
206 markets in most states of Nigeria. The result also justified the consistent farm land fragmentation  
207 into smaller farms that exist in Nigeria. The findings agree with the known fact that Nigerian  
208 agriculture is dominated by ageing population who are small scale famers that largely acquired  
209 their productive farm lands through inheritance.

210 Majority of the respondents (about 63 percent) had a household size of 1–10 members and were  
211 mostly used for farm family labour. About 33.8 percent had family size within 11–20  
212 households, 2.7 percent had within 21–30 household members. This shows that the respondents  
213 had fairly large households which could probably serve as an insurance against short falls in  
214 supply of farm labour. According to Olumba (2014) large family size could be as a result of  
215 polygamous nature of the rural farmers. He further opined that this could be linked to the fact  
216 that most rural farmers look at large household size as a good and economical way of  
217 maximizing farm returns by using family labour. The finding also agrees with Igbajiet *al.* (2015)  
218 who posits that married farmers with their households are usually better off to adopt labour  
219 intensive farming technologies and hence household size have a positive influence on the output  
220 of rice farmers.

221 A greater proportion of the respondents (46%) had an annual income between ₦201,000 –  
222 300,000 and 40.5% of the respondents earned annual income of between ₦101,000 – 200,000.  
223 The mean annual income of the respondents was ₦250,000. The finding also revealed that the  
224 current annual income from rice production in the study area was as a result of adoption of  
225 improved rice production technologies introduced by AROC as income prior to adoption was  
226 markedly lower. This agrees with the findings of Ojoet *al.* (2013) which revealed that access and  
227 adoption to improved technologies, agronomic practices of staple crops will result to increase in  
228 the efficiency and income generation. This result was also in line with the findings of Johannes  
229 *et al.* (2010) and Mwambuet *al.* (2008) who opined that the adoption of improved varieties of  
230 crops and modern farming techniques had the potential of increasing incomes that will lead to  
231 stable income and poverty reduction.

232 Most of (56.7%) of the respondents had their farms visited 6 to 10 times per annum by the  
233 AROC staff or extension agents. The result revealed that majority of the farmers had their farms  
234 visited more often with an average mean of 7 times and such contacts afforded farmers the  
235 opportunity of sharing ideas and information on modern rice production practices which may  
236 likely lead to high level of adoption of these technologies. The finding corresponds with Jamiluet  
237 *al.* (2016) and Namwataet *al.* (2010) who reported that increased extension contact was  
238 positively and significantly associated with overall adoption of improved agricultural  
239 technologies among farmers. This is also a significant improvement on Nigeria's redundant  
240 public extension service where farmers rarely receive a single visit all-year round.

241

242

243

244



**Table 1: Socio-economic Characteristics of Respondents**

Variables	Frequency	Percentage	Mean
<b>Age (years)</b>			
21 – 40	23	12.7	
41 – 60	134	74.4	50 yrs
Above 60	23	12.7	
<b>Marital Status</b>			
Single	6	2	1
Married	174	97	
<b>Educational Qualification</b>			
No Formal Education	98	54.3	
Primary Education	37	20.5	
Secondary Education	32	17.7	
Tertiary Education	13	7.2	
<b>Farming Experience (Years)</b>			
1 – 10	137	76	
11 – 20	43	23.8	7 yrs
Above 20	-	-	
<b>Farm Size (Hectares)</b>			
1 – 5	178	98.8	
6 – 10	2	1.2	2.5 ha
Above 10	-	-	
<b>Farm Acquisition</b>			
Inheritance	128	71	
Communal	3	1.7	
Purchase	6	3.4	
Rent/Lease	43	23.9	
<b>Household Size</b>			
1 – 10	114	63.3	
11 – 20	61	33.8	8
21 – 30	5	2.7	
Above 30			
<b>Annual Income from Rice Production (₦)</b>			
1,000 – 100,000	18	9.9	
101,000 – 200,000	74	40.5	250,000
201,000 – 300,000	83	46	
301,000 – 400,000	7	3.8	
401,000 – 500,000	-	-	
Above 500,000	-	-	
<b>Credit/Loan for Rice Production</b>			
Accessed/Collected	59	32.8	
Not collected	121	67.2	
<b>Number of Extension visits/Year</b>			
1 – 5	57	31.7	
6 – 10	102	56.7	7
11 – 15	21	11.6	
<b>Number of Attendance of training/Year</b>			
1 – 3	131	72.8	
4 – 6	48	26.7	3
7 – 9	1	0.5	
<b>Membership of Cooperative Societies</b>			
Member	169	90.6	1
Non-Member	17	9.4	
<b>Years spent as Member of Coop Societies</b>			
0 – 3	37	20.6	
4 – 7	139	76.7	4.5
8 – 11	4	2.2	

247 **Respondents' Socio-economic determinants of level of Adoption of AROC's Rice**  
248 **Production Technologies**

249 The analysis of the effect of respondents' socio-economic characteristics on the level of adoption  
250 of AROC's Rice Production Technologies is presented in Table 2. The R-squared ( $R^2$ ) shows  
251 that 84.99% variation in the output was explained by variables included in the model; this shows  
252 the level of fitness of the model. The coefficients of Age ( $t = -3.88$ ), Farming experience ( $t = -$   
253  $3.121$ ), Education level ( $t = 8.20$ ) and Extension visits ( $t = 5.074$ ) were significant at 1% while  
254 Farm size was significant at 10% probability level. The result also indicates that marital status,  
255 family size and cooperative membership were not significant.

256 Number of extension visits to farmers' fields had a positive and significant relationship with the  
257 level of adoption of technologies introduced by AROC programme at 1%. This implies that the  
258 level of adoption of AROC introduced rice production technologies will be directly and  
259 significantly increased by number of extension visits. The number of extension visits to farmers'  
260 fields and visits by farmers to demonstration plots/AROC centres was observed to increase  
261 confidence and knowledge of farmers towards technologies that were offered, thereby increasing  
262 the level of adoption of new technologies. The result agrees with Ayoola (2012), Nyanga (2012)  
263 and Bello *et al.* (2012) who advanced that the increasing the number of contacts in an extension  
264 programme had a positive and significant effect on the application of agricultural technology.  
265 The finding further bears rich parallels to those of Okoruwa *et al.* (2009) who opined that  
266 extension (and advisory services), are not merely there to influence farmers physical input but  
267 more importantly to initiate a needed change in behaviour and attitudes towards the environment  
268 and relating modern inputs.

269 Years of formal education was observed to be positive and significant at 1% implying that  
270 adoption rate of AROC's rice production technologies was higher with higher levels of education  
271 of the respondents. This is evidenced by the fact that respondents with relatively higher number  
272 of years spent in school were more likely to have the attitude, behaviour and mindset that would  
273 induce higher levels of adoption of improved rice production technologies. The finding re-echoes  
274 findings of Oyedele (2016) who revealed that good education propels heads of households to  
275 adopt innovations and technologies that are vital for enhancing productivity. Furthermore, Xu  
276 and Wang (2012), Singha *et al.* (2012) and that of Abdullah and Samah (2013) posited that the  
277 level of education affects the type of decision farmers take in rice production and determines the  
278 level of opportunities available to improve livelihood strategies and managerial capacity in  
279 agricultural production. The result is contrary to the findings of Issa *et al.* (2016) that advanced  
280 that adoption of improved maize production practices in Ikara Local Government Area of  
281 Kaduna State is irrespective of level of education and farming experience.

282 Age had a 1% statistically negative significance with the level of adoption of AROC introduced  
283 technologies. This implies that the older the farmers were less likely to adopt AROC's  
284 introduced rice production technologies. The result implies that older farmers in the study area  
285 were more reluctant to adopting new techniques, they were more prone to maintaining the  
286 customs that had existed previously and that they were used to. The result agrees with the  
287 findings of Paxton *et al.* (2011) and Moga *et al.* (2012) who showed that age was negatively  
288 correlated with the adoption and application of new agricultural technology. The finding also  
289 agrees with Afolabi *et al.* (2012) that younger farmers adopt new technology faster.

290 Farming experience was significant at 1% but negatively significant. The finding implies that as  
 291 the farmers get older, they become more averse to risk taking. Therefore, the more the number of  
 292 years in farming the less likely the adoption of AROCs introduced rice production technologies.  
 293 The result agrees with Ajani (2009) who opined that farming experience is an important factor  
 294 determining both the adoption, productivity and the production level in farming activities. The  
 295 result is in line with the *a priori* expectation that rice farmers with high level of farming  
 296 experience obtained increased production not necessarily because of higher adoption level of  
 297 new technology but due to higher efficiency in resource utilization. This finding is contrary with  
 298 that of Ainembabaziet *al.* (2014) who suggested that farming experience is useful in early stages  
 299 of adoption of a given technology when farmers are still testing its potential benefits, which later  
 300 determines its retention or rejection over time.

301 Further, the result shows that the coefficient of farm size was significant at 10%. This indicates  
 302 that larger farm size justified the adoption of AROC's rice production technologies. As farm size  
 303 increases, the probability of adoption of new technologies increases because the size of the farm  
 304 can drive the investment into new technologies as a precursor to higher yields and more incomes.  
 305 This finding is supported by previous studies of Ayoola (2012), Nyanga (2012) and Bello *et al.*  
 306 (2012) who suggested that the Farm size has positive and significant effect on the adoption of  
 307 new technologies. The result is also in line with the findings of Johannes *et al.*, (2010) who  
 308 asserted that farmers with more land may have easier access to new technologies and the  
 309 capacity to bear risk in case of technology failure. However, this finding negates the findings of  
 310 Idrisaet *al.* (2012) that farm size had nothing to do with adoption of new technologies.

311  
 312 **Table 2: Socio-economic Effects on Adoption of AROC's introduced Rice Production**  
 313 **Technologies**

Variable	Coefficient	Std Error	t-statistic	Probability
Constant	0.598931	0.073543	8.143904	0.0000***
Age	-0.003081	0.000794	-3.881772	0.0001***
Coop. Membership	0.022148	0.016453	1.346150	0.1800 <sup>NS</sup>
Faming Experience	-0.006227	0.001995	-3.121843	0.0021***
Household Size	-0.005678	0.004531	-1.253169	0.2119 <sup>NS</sup>
Farm Size	0.013815	0.007032	1.964638	0.0511*
Marital Status	0.005116	0.033419	0.153096	0.8785 <sup>NS</sup>
Years of Schooling	0.010309	0.001257	8.201990	0.0000***
Number of Extension Visits	0.016251	0.003202	5.074713	0.0000***

314  $R^2 = 84.99$

315 **Source:** Field survey, 2018\*\*\* = Significant at 1% \*\* = Significant at 5% \* = Significant at  
 316 10%<sup>NS</sup> = Not significant

317

318

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## 320 Conclusion

321 It can be concluded that the rate of adoption of rice production technologies introduced by  
322 Agricultural Research Outreach Centres (AROCs) in Nigeria are determined by socioeconomic  
323 characteristics of farmers. Age, farming experience, years of schooling and number of extension  
324 visits were the socioeconomic determinants affecting rate of adoption.

325

## 326 Recommendations

- 327 1. As the findings showed that age is a key determinant of adoption rate indicate the fact  
328 that deliberate policy needs to be put in place to increase the influx of young people into  
329 agriculture as they are innovative, energetic and creative.
- 330 2. Clearly, farmers with exposure to extension services have proved to be able to  
331 accumulate more income due to greater productivity, this gives credence to the need to  
332 develop a better extension service delivery system in the country to reach more farmers  
333 over more visitation periods.
- 334 3. Incorporation of innovations and new technologies by farmers have proved to be the key  
335 to raising farmers' productivity levels, therefore government and relevant stakeholders  
336 should prioritize establishment of the best extension teaching methods and systems as  
337 well as administration to help increase rate adoption of innovations and sustainability of  
338 the use of these technologies over time.
- 339 4. More villages should be adopted with partnership between government and the private  
340 sector in order to cover more grounds and increase the rate of adoption of new  
341 technologies.

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