

## **Original Research Article**

### **AN ASSESSMENT OF FACTORS INFLUENCING ADAPTATION OF SPECIAL RICE PROJECT TECHNOLOGY PACKAGE BY FARMERS UNDER THE RICE VALUE CHAIN IN NIGER STATE, NIGERIA**

#### **Abstract**

The study was designed to identify “An Assessment Factors Influencing the Adaptation of Staple crop Special Rice Project (SRP) Technology among farmers in Niger State. The objectives of the study was to determine the level of awareness of the Staple Crop SRP technology, levels of adoption and adaptation of the technology, the socio-economic characteristics and the technology attributes that influenced adaptation of technologies, impact of adaptation on the yield of rice, and to identify the reasons why farmers adapted the recommended SRP technology package. The data that was used in this study was obtained by a field survey which was conducted on 100 rice farmers in each of the three agricultural zones of the State through the use of questionnaires in the study area. The analytical tools that were used in this study are distribution frequencies, percentages, mean, t-test, correlation and multiple regression models.

**Keywords:** Assessment, Adaptation, Special Rice, Technology, Farmers, Value Chain

#### **INTRODUCTION**

Rice (*Oryza sativa*) is a cash crop and a income source for rice farmers in Nigeria. There are two sub-species of rice namely Indica and Japonica. The Japonica species is typically shorter grain rice and is grown in sub tropical and temperate region. It becomes sticky and moist when cooked [1]. On the other hand, Indica rice species is a long grain mainly grown in tropical region and when cooked, it usually becomes fluffy and dry with easily separated kernels. Rice is the fourth major cereal crop in Nigeria after Sorghum, Millet and Maize in terms of output and cultivated land area. According to annual report of the Federal Ministry of Agriculture and Rural Development [2], the land area put to sorghum, millet, maize, and rice is 5.5million hectares, 3.3million hectares, 3.2million hectares and 1.82million hectares respectively. Rice is cultivated under diverse ecological conditions which include upland, lowland, mangrove and floating/deep water and these cut across the 36 States of Nigeria including FCT [2].

Rice production in Nigeria is dominated by small holder farmers with individuals’ holdings of 0.5 to 1.5 hectares (ha) on the average. Nigeria’s annual demand for rice is estimated at 5.0 million tones [3], while production level is 3.0 million tones resulting in 2.0 million tones deficit. Consequently, the country resorted to rice importation to bridge the gap. [4], the rice import bill was US \$655 million (N75.60 billion at US \$1 = N120) and US \$756 billion (N96.01 billion) at US \$1 = N 127) in 2011 and 2012, respectively [5]. From the foregoing, it is obvious that a lot of the country’s hard earned foreign exchange is expended on rice importation.

Rice is the most popular cereal grain consumed in a variety of ways – jollof, white rice with stew and paste form with soup. A combination of factors triggered the increase in rice consumption. The rising demand is partly the result of population growth, and also increase in income level [6]. Rapid urbanization and the associated changes in family occupational structures also contributed to the shift in consumer preferences away from traditional staples towards rice. As more people migrate into the urban areas, the opportunity cost of their time increases and the demand for convenient foods such as rice also increases. Other commercial uses of rice include

broken rice in the brewing business to make beer, rice flour in the manufacturing of some baby foods, a thickener in some canned foods and dusting of loaves of bread before they go into the oven in commercial bakeries. Rice hull is used as roughage in animal feed [1].

To reduce the drain in the foreign exchange earnings, rice importation was banned in Nigeria in 1985, in pursuit of a goal to make Nigeria self-sufficient in rice production in the shortest possible time. The Special Rice Project (SRP) was initiated in 1997 to increase land under rice cultivation and paddy yield improvement. The purpose of the study was to examine the Assessment of factors influencing adaptation of SRP technology package under the rice value chain by small holder rice farmers in three Agricultural zones of Niger State. The specific objectives were to:

- i. Determine the level of awareness of the SRP technology package by farmers;
- ii. Determine the levels of adoption and adaptation of the SRP technology by farmers;
- iii. Determine the socio-economic and technology attributes that influence adaptation of the SRP technology and

### **Problem Statement**

In Nigeria, the small holder farmers constitute the bulk of the major producers of food and cash crops. However, the population increase as well as rural-urban migration continually put pressure on food demand and there is a gap in the demand and supply ratio [6]. The SRP is one of the development interventions to backup the Federal Government of Nigeria's (FGN) agricultural development derives. The project is jointly implemented by National Cereals Research Institute (NCRI), Badeggi and West African Development Association (WARDA), and the technology package is disseminated by the Agricultural Development Projects (ADPs). The project which was expected to bring about self-sufficiency in local production of rice has the following objectives [2]:

- i. Development of major lowland irrigated and swamp rice producing areas of the country;
- ii. Provision of subsidy on production inputs such as improved seeds, fertilizer and agro-chemicals;
- iii. Provision of tractors and implements to facilitate land preparation;
- iv. Extension delivery, expected to be strengthened through training workshops, extension bulletins and farm broadcast to rice farmers, and
- v. Dissemination of the SRP recommended packages to the farmers.

The Niger State Agricultural Mechanization Development Authority (NAMDA) began the dissemination of eight major SRP recommended package to rice farmers in 1998. The eight (8) major components of the "technology package" include [7]:

- i. The use of improved seed varieties;
- ii. Land preparation (leveling and building as necessary);
- iii. Row planting of 2-3 seeds/hill;
- iv. Plant spacing of 20cm x 20cm (inter row and intra row);
- v. Fertilizing 120kg N, 40kg P<sub>2</sub>O<sub>5</sub> and 80kg K<sub>2</sub>O split at 1-2 weeks and 6-7 weeks after sowing;
- vi. Water control (proper leveling and good water level of 3.0-5.0cm above soil surface);
- vii. Plant protection – application of seeds dresser, insecticide and fungicide.

It was expected that the participating farmers would apply completely the technology package to obtain the optimum expected yield of 4.0 tons per hectare. However, when adaptation was partial or incomplete, farmers expected yield of lowland rice was put at 0.9-3.0 tons per hectare [8]. Research findings make it clear that complete adaptation of technology differ considerably in

yield from those partially adopted or adapted. It is also common knowledge that Small scale farmers in their wisdom and understanding tend to adapt dissemination technologies to their needs and circumstances rather than wholesomely adopt recommended packages [9].

## METHODOLOGY

### The Study Area

The study was conducted in three agricultural zones of Niger State. Niger State shares common boundaries with North with *Zamfara* State, to the north east with *kebbi* state and north east and Federal Capital Territory (FCT) bordered the state to North East and South East. The state also shares a common international boundary with the republic of Benin along *Newbussa*, *Aguara* and *Wushishi* local government Areas. The state is located in the north central savannah of the vegetation zones between latitudes 8° and 11°N and longitudes 3°E and 7°E of the prime meridian.[10]

The State is the largest in Nigeria with a total land mass representing about 9.3 percent of the total land mass of the country. The population of the state was 3,950,429 in 2006[11]. The bureau of statistics has maintained an approximate population growth rate of 2.5% geometrically. Based on that, the projected population in 2012 was estimated to be 4,883,036. The state occupies an area of about 58,676.2 square kilometers [11]. the state is made up to 25 LGAs namely *Agaie*, *Agwara*, *Bida*, *Borgu*, *Bosso chanchaga*, *Edati*, *Gurara*, *Katch*, *Kontagora*, *Lapai*, *Lavun*, *Magama*, *Mariga*, *Mashegu*, *Mokwa*, *Munya*, *Paikoro*, *Rafi*, *Shiroro*, *Suleja*, *Tafa*, and *Wushishi* local government Areas.

Niger state is divided into three Agricultural zones namely I, II and III for better Administration of agricultural activities each of these Agricultural zones has their headquarters at *Bida*, *Kuta* and *Kontagora* respectively. The Climate and Ecological conditions of the state is favored with mean annual rain fall of 782-1250mm and temperature is about 82°C or 27.7°C [12]. The state has abundant wild vegetation of Shea trees and dominated by small scale farmers. The major crops cultivated are millet, rice, maize, guinea corn, beans, cassava, groundnuts and sweet potatoes. Majority of the farmers keep livestock like poultry, goat and sheep. Other engaged in crafts such as sculptures, weaving and blacksmith [12]. About 85% of the population of the state are farmers, while 15% are involved in other vocation such as white collar jobs, businesses, crafts and arts [12].

### Method of Data collection and sampling procedure.

A multi-stage sampling procedure was employed in the selection of the respondents. The first stage was purposive selection of Agric cultural zones I, II and III of the State Agricultural Mechanization and Development Authority (AMADA). This was followed by random selection of three Local Government Areas from each of the Agricultural zones. The third stage was random selection of eight (8) extension cells from each of the extension blocks. A total population sample size of 300 small scale rice farmers was randomly selected across the three Agricultural zones of the State.

### Analytical techniques.

In this study, descriptive statistics such as frequency counts, means, t-test and percentages was used to report the findings of objectives 1, 2, and 3 t-test is useful for comparing differences between means and ascertaining significant relationship between variables. The calculated t-value is compared with appropriate table value at the chosen level of significance (this is the critical value in table value). For this study, this was done at 0.05 level. The model is expressed as follows:

$$\frac{X_1 - X_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

$X_1$  = mean value of the yield and income of SRP participants, respectively.

$X_2$  = mean value of the yield and income of non-participants, respectively.

$S_1$  = standard deviation of SRP participants.

$S_2$  = standard deviation of SRP non-participants.

$n_1$  = sample size of the participant.

$n_2$  = sample size of the participant.

To determine the influence of socio-economic characteristics and technology attributes on adaptation of the SRP technology (objectives 3), correlation and multiple regression analyses was used. The chosen significant level is at 0.05 level.

The multiple regression model is implicitly specified as follows:

$$Y = f(b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + b_{11}X_{11}, e)$$

**Where:**

$Y$  = Adaptation of SRP technology.

$F$  = constant

$b_1$ - $b_{11}$  = regression co-efficient.

$X_1$  = Age of farmer (years).

$X_3$  = level of education (years spent in formal education)

$X_4$  = farm size (hectares)

$X_5$  = farming experience (years)

$X_6$  = farm credit (amount in naira)

$X_7$  = extension contact (frequency of visits)

$X_8$  = perceived cost of technology

$X_9$  = perceived labour requirements

$X_{10}$  = perceived benefits of technology

168  $X_{11}$ = perceived complexity of technology

169  $e$ = Stochastic error term

## 170 **Results and Discussion**

### 171 **Level of Awareness of the SRP Technology Package by Farmers**

172 Farmer's awareness of improved technologies of the Special Rice Project (SRP) programme. It  
173 was found that 8 percent of the farmers were aware of 3 and below of the technologies, 18  
174 percent were aware of 4 to 6 of the technologies, 74 percent were aware of 7 to 8 of the  
175 improved technologies and more than half (63farmers) were aware of all the 8 improved  
176 technologies (Table 1).

177 Similarly, it was found that 79 percent of the non-participants were aware of 3 and below of the  
178 technologies, 20 percent were aware of 4 to 6 of the technologies while 1 percent were aware of  
179 7 to 8 of the improved technologies. Expectedly, the data indicate that there was much higher  
180 awareness of the improved rice technologies among the project/participating famers compared to  
181 non-participating farmers. The creation of awareness on the SRP technology was effected mainly  
182 through the VEAs efforts. The extension efforts where Training Plots (MTPs) and Small Plots  
183 Adoption Techniques (SPATs) on proven technology.

184 The findings on awareness agreed with that of [13], who affirmed that the primary function of  
185 awareness stage is to initiate the sequence of later stages that lead to eventual adoption of  
186 rejection of an innovation.

187 Hence, the higher awareness level of the SRP participants give them an age over the non-  
188 participants in the adoption.

189 **Table 1: Level of awareness of the 8 SRP technologies by farmers**

| Number of<br>Technologies<br>Aware of | Percentage<br>of SRP<br>participants | Percentage of<br>non-participants |
|---------------------------------------|--------------------------------------|-----------------------------------|
| 1                                     | 0                                    | 34                                |
| 2                                     | 2                                    | 29                                |
| 3                                     | 6                                    | 16                                |
| 4                                     | 3                                    | 14                                |
| 5                                     | 5                                    | 4                                 |
| 6                                     | 10                                   | 2                                 |
| 7                                     | 11                                   | 1                                 |
| 8                                     | 63                                   | 0                                 |
| <b>Total</b>                          | <b>100</b>                           | <b>100</b>                        |

190

### 191 **Level of Adoption and Adaptation of the SRP Technologies**

192 [14], affirmed the importance of access to information, contact with extension services and  
193 market orientation of rice production as major determinants of technology adoption at the  
194 farmers' level. In this study, farmers who fully adopted 5 out of the 8 technologies were  
195 considered as high adopters. Similarly, farmers who fully adapted 5 out of the 8 technologies  
196 were considered as high adapters.

197 It was found that 40 percent of the SRP participants adopted 5 out of the 8 technologies while 94  
198 percent of the participants adopted 8 of the recommended practices (Table2). This indicates high  
199 level of adoption of the SRP technology package by participants. Among the non-participants of  
200 the SRP technology, 60 percent of the farmers adapted 5 out of the8 recommended practices  
201 while 16 farmers adapted 7 to 8 of the practices. This portrays high level adaptation of the SRP  
202 technology by the non-participants.

203 **Table 2: Levels of Adoption and Adaptation of the 8 SRP technologies**

| Number of Technologies | Percentage adoption of participants | Percentage of non-participants |
|------------------------|-------------------------------------|--------------------------------|
| 5                      | 40                                  | 60                             |
| 6                      | 76                                  | 24                             |
| 7                      | 90                                  | 10                             |
| 8                      | 94                                  | 6                              |

204  
205 **Socio-economic Characteristics and Technology Attributes that; Influence Adaptation of**  
206 **SRP Technologies**

207 The study posited positive association between age of farmers, household size, level of  
208 education, farming experience, farm size, access to credit, extension contact, perceived cost of  
209 technology, perceived labour requirement of technology, perceived benefits of technology,  
210 perceived complexity of technology and adaptation of the SRP technology (Table 3).

211 The correlation coefficient ( $r = 0.33$ ) showed only perceived complexity of technology to be  
212 positive and statistically significant in relation to adaptation of the SRP technology at 0.01 level.

213 The SRP technology is complex (mechanized land preparation, leveling, bunding, row planting,  
214 close spacing and spot method of fertilization). This indicates that the more complex the SRP  
215 technology, the more the farmers seek for alternative to the technology.

216 Therefore, the complexity of the SRP technology appear to necessitate concerted extension  
217 effort. This finding is in the hypothesized direction.

218 The correlation coefficients for the perceived cost of the technology ( $r = 0.17$ ), the perceived  
219 labour requirements of the technology ( $r = 0.11$ ) and the perceived benefits of the technology  
220 ( $r = 0.19$ ) were not statistically significant at 0.05 level. The coefficients for age of farmers ( $r =$   
221  $0.03$ ), household size ( $r = 0.07$ ), level of education ( $r = 0.09$ ), extension contact ( $r = 0.05$ ), farm  
222 size ( $r = -0.14$ ), farming experience ( $r = -0.07$ ) and access to credit ( $r = -0.04$ ) were not  
223 statistically significant at 0.05 level.

224

225

**Table 3: Product-moment correlation (r) matrix showing the relationship between some selected socio-economic variables and technology attributes and SRP technology adaptation**

| Variables                                       | (X <sub>1</sub> ) | (X <sub>2</sub> ) | (X <sub>3</sub> ) | (X <sub>4</sub> ) | (X <sub>5</sub> ) | (X <sub>6</sub> ) | (X <sub>7</sub> ) | (X <sub>8</sub> ) | (X <sub>9</sub> ) | (X <sub>10</sub> ) | (X <sub>11</sub> ) | (X <sub>12</sub> ) |
|-------------------------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|--------------------|--------------------|--------------------|
| Age of farmer(X <sub>1</sub> )                  | 1.00              |                   |                   |                   |                   |                   |                   |                   |                   |                    |                    |                    |
| Household size(X <sub>2</sub> )                 | .65               | 1.00              |                   |                   |                   |                   |                   |                   |                   |                    |                    |                    |
| Level of education(X <sub>3</sub> )             | .49               | .62               | 1.00              |                   |                   |                   |                   |                   |                   |                    |                    |                    |
| Farm size(X <sub>4</sub> )                      | .23               | .29               | .00               | 1.00              |                   |                   |                   |                   |                   |                    |                    |                    |
| Farming Experience(X <sub>5</sub> )             | .08               | -.19              | -.25              | -.18              | 1.00              |                   |                   |                   |                   |                    |                    |                    |
| Access to credit(X <sub>6</sub> )               | -.06              | -.04              | .10               | -.12              | .18               | 1.00              |                   |                   |                   |                    |                    |                    |
| Extension contact (X <sub>7</sub> )             | .20               | .18               | .23               | -.03              | -.06              | -.07              | 1.00              |                   |                   |                    |                    |                    |
| Perceived cost of tech. (X <sub>8</sub> )       | -.26              | -.25              | -.13              | -.18              | -.10              | .00               | -.33              | 1.00              |                   |                    |                    |                    |
| Perceived labour req. (X <sub>9</sub> )         | .14               | .19               | .22               | -.05              | -.06              | .06               | .72               | -.48              | 1.00              |                    |                    |                    |
| Perceived benefit of tech.(X <sub>10</sub> )    | .02               | .13               | .14               | -.05              | -.12              | .01               | .64               | -.44              | .86               | 1.00               |                    |                    |
| Perceived complexity of tech.(X <sub>11</sub> ) | .05               | .11               | .17               | -.23              | -.16              | -.07              | .11               | .12               | .07               | .10                | 1.00               |                    |
| Adaptation of SRP tech(X <sub>12</sub> )        | .03               | .07               | .09               | -.14              | -.07              | -.04              | .05               | .17               | .11               | .19                | .33*               | 1.00               |

\*coefficient statistically significant at 1% level.

The double-log functional form of multiple regressions was used as it gave the best fit to the data collected based on statistical criteria such as high  $R^2$  value and significance of coefficient. The result of the double-log produced two statically significant variables, and a coefficient of multiple determinations ( $R^2$ ) of 0.553 which implies that about 53% of the variation in adaptation of the SRP technology is accounted for by the action of the technology attributes investigated (table 4).

**Table 4: multiple regression results of selected socio-economic characteristics and technology attributes and adaptation of SRP technology.**

| Independence variable                     | Coefficient | Standard Error | T-values | Level of significant of T-value |
|-------------------------------------------|-------------|----------------|----------|---------------------------------|
| Age of farmer( $X_1$ )                    | -2.090      | .040           | -52.25   | NS                              |
| Household size( $X_2$ )                   | .152        | .095           | 1.600    | NS                              |
| Level of education( $X_3$ )               | -2.653      | .061           | -43.491  | NS                              |
| Farm size( $X_4$ )                        | -.1.137     | .062           | -18.338  | NS                              |
| Farming Experience( $X_5$ )               | -7.718      | .047           | -164.212 | NS                              |
| Farm credit( $X_6$ )                      | -5.103      | .061           | -83.655  | NS                              |
| Extension contact ( $X_7$ )               | .1.749      | .074           | 23.635   | NS                              |
| Perceived cost of tech. ( $X_8$ )         | .319        | .077           | 4.142    | **                              |
| Perceived labour req. ( $X_9$ )           | .234        | .093           | 2.516    | *                               |
| Perceived benefit of tech.( $X_{10}$ )    | .116        | .064           | 1.812    | NS                              |
| Perceived complexity of tech.( $X_{11}$ ) | .2.901E-02  | .044           | 665      | NS                              |
| Constant = 7.68                           |             |                |          |                                 |

**$R^2 = 0.553$**

**Adjusted  $R^2 = 0.480$**

**F- Ratio = 7.538**

**\*\* Coefficient statistically significant at 1% level**

**\* Coefficient statistically significant at 5% level**

**NS = Not significant**

### **Conclusion and Recommendation:**

The was designed to achieve three specific research objectives all aim at Factors Influencing Adaptation of Special Rice Project Technology Package By Farmers Under The Rice Value Chain in Niger State. While appreciable numbers of Rice Based Technologies has been disseminated, from the records of NAMDA. Results indicated high level of awareness among the participants compared to non-participants which was low, the level of adoption and adaptation of each of these 8 SRP technologies among participants were high and low respectively. Results of the correlation analysis shows a positive and statistical significant relationship between the perceived complexity of the technology and the adaptation of the SRP technology package ( $r =$

0.33). The major reasons why farmers adapted the SRP technology were the technology attributes, the socio-economic variables were not statistically having influence on the farmers adaptation in study area. The study showed that the yield of the participants were higher than those of non-participants. Based on these findings it was recommendations that, since the level of awareness of the SRP technology were higher compared to non-participants, efforts should be made by the VEAs (through visit, radio, and television programmes) to create more awareness of the improved farm practices to non-participants so also since the result shows that the level of adoption of SRP technology by non-participants were low due to variations at the farm conditions, pressure of the labour and time. Therefore the study recommends that the adopter extend the technology to non-participants for them to benefit from the package too. And the researchers should package the technologies that are appropriate for the farming system and farmer's needs at different stage of the technological development.

## Reference

1. Purseglove, J.W. (2010). *Tropical Crops Monocotyledons*. Singapore: *Longman publishers*.
2. Federal Ministry of Agriculture and Rural Development (2013). *Report of the Presidential Committee on Increased Rice Production and Export*. FMARD, Abuja, Nigeria.
3. Food and Agricultural Organization (2013). *Bulletin of Statistics: (4) No.1. FAO, Rome, Italy*.
4. Central Bank of Nigeria (1999). *Annual Report and Statements of Accounts*, Lagos, Nigeria.
5. National Cereals Research Institute (2013). *Annual Report, Badeggi, Nigeria*.
6. Akanji, B.O. (2005). Hedonic-Price Analysis of the Demand for Grain Crops in Nigeria: The Case of Rice and Cowpea. *Unpublished Ph.D thesis* Submitted to the theses submitted to the department of Agricultural Economics, University of Ibandan, Ibandan, Nigeria.
7. *Niger State Agricultural and Mechanization Development Authority NAMDA (2012) Respondents/Cooperative Group Report*, Department of Women in Agriculture (WIA).
8. National Fertilizer Company of Nigeria (1986). *Field Note*, Onne-Port Harcourt, Nigeria.
9. Stewart, J.J. (2003). "Crop Yield and Returns Under Different Soil Moisture Regimes" In: J.C, Holmes and W.M. Tahir (eds). *More Food from better Technology* FAO, Rome:427-437.
10. Niger State Bureau of Statistics (NSBS). (2006). *Records of population of Female and Male in Agricultural zone 1 Niger State*.
11. National population Commission of Nigeria (2006). *Report on the Census, 2006 Final Results*. Federal Republic of Nigeria. Official Gazette. No2 Abuja 2<sup>nd</sup> Federal Government Printer Abuja, Nigeria.

12. Tswanye, P.B. (2007). Focus on women farmers in Niger State Agricultural Zone 1 *paper Presentation* at women in Agricultural Programme (WIA) Conference at Niger State 22<sup>nd</sup> Nov. (2007).
13. Omotayo, A.M (2006). Analysis of the Utilization and Impact of Animal traction in Kaduna State, Nigeria. *Unpublished Ph.D Thesis* submitted to the Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University, Zaria.
14. Edwin and fall (2000). Synthesis of Rice Economies Task Force of West Africa (RETWA) Research Reports (1994-1998). Paper presented at the Rice Research Regional Conference Mbe, Coted'Ivoire. April 2000.