



FACTORS INFLUENCING THE ADOPTION OF IMPROVED RICE PRODUCTION TECHNOLOGIES IN WESTERN ZONE, BAUCHI STATE NIGERIA

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ABSTRACT

The study examined the factors influencing the adoption of recommended rice production technologies in Western Agricultural Zone of Bauchi State, Nigeria. Multi-stage sampling techniques was used in selecting 202 respondents for the study. Data were obtained through the administration of structured questionnaires and analyzed using both descriptive and inferential statistics. The results revealed that majority (70.3%, 68.8%, and 62.4%) of the respondents were male, married and had attended post-secondary school level of education, respectively. Also majority (86.1%, 84.7%, 76.7%, 67.8% and 54.5%) of the respondents had extension contacts, were members of association, aware of recommended technologies, with access to extension and had extension contact quarterly, respectively. The findings further shows that majority (62.3%, 58.9%, and 57.9%) of the respondents were within the ages of 23-38 years, had 4-9 persons in their households and an estimated income of ₦100,000-₦300,000, respectively. In addition, Half (50.1%) of the respondents had 1.2ha of farm land. The result further reveals that sex (2.388), membership of association (2.351), years of membership (2.533) and awareness of technologies (2.583) were positive and significant ($P < 0.05$), while educational level (-2.517) was negative and significant ($P < 0.05$) in influencing technology adoption among respondents in the study area. The findings revealed that lack of technical skills (92.1%), high cost of technology (82.2%) and inadequate credit facilities (36.1%) were the major constraints to adoption of technology and were ranked 1st, 2nd and 3rd respectively. The study concluded that sex, membership of association, awareness and years of membership in association were the factors influencing the adoption of rice production technologies in the study area. Based on the constraints highlighted it is recommended that farmers association should hire extension to train respondents on the new technologies and also associations should help in acquiring inputs and the recommended technologies to their members at a subsidized rates.

Keywords: Adoption, Rice, Production and Technologies

INTRODUCTION

Rice belongs to the family “Gramineae” and the genus “*Oryza*”. There are about 25 species of *Oryza* where only two species are cultivated, namely *Oryza sativa* Linus and *Oryza glaberrima* Stead. The former is originated from North Eastern India to Southern China but has spread to all parts of the world. The latter is still confined to its original home land, West Africa. Rice (*Oryza sativa* Linu) is one of the main staple foods for 70% of the population of the world. Africa produces an average of 14.6 million tons of rough rice in the years 1989-1996 on 7.3 million ha of land equivalent to 2.6 and 4.6 percent of the world total production and rice area respectively. Africa also consumes a total of 11.6 million tons of milled rice per year, of which 3.3 million tons (33.6%) is imported (Srujana *et al.*, 2017). Rice (*Oryza sativa* L.) is one of the most valuable cereal crops cultivated and consumed all over the world. It is a staple food in several African nations and constitutes a large portion of the diet on a regular



basis (Merem *et al.*, 2017). Agriculture is a livelihood as well as an economic enterprise employing about 60 percent of the world's population and is intimately linked with food security, health, and nutrition through direct consumption and market linkages (Poole, 2017). Smallholder agriculture is one of the principal economic occupations in the world and is the main source of income and employment for 70 percent of the world's poor who live in rural areas and account for 60 percent of global agriculture (Poole, 2017). Estimates show that there are about 500 million farms globally which are being cultivated by smallholder farm households with more than 2 billion people making their livelihood from these farms (Abdullah *et al.*, 2017). In Africa, agriculture remains a strategic sector and its wealth directly affects economic development, food security, poverty alleviation and social welfare, particularly of countries in Sub-Saharan Africa whose agriculture is dominated by smallholder farmers (Mango *et al.*, 2017). Meanwhile, agriculture is the second largest economic sector in Nigeria after petroleum. It contributes more than 40% to gross domestic product (GDP) (NBS, 2013) and remain the most important sector in transforming rural communities (USDA, 2014).

In recent years, the Government of Nigeria through the Federal Ministry of Agriculture and Rural development has expressed strong commitment to ensuring that rice production is accelerated to the level where the country becomes self-sufficient by 2025. Improved rice varieties have been widely recognized as a critical input for increasing rice production in the country. In view of this, efforts have been made by the Government of Nigeria to ensure that farmers across the country access improved rice variety through research institutes. Despite the introduction of improved rice technologies, rice production has remained low in Bauchi State. Food insecurity and high poverty level are still major concerns within the State. Furthermore, Agriculture in the area is mainly rain fed, the nature of the rainfall is also erratic, low in amount and uneven in distribution. Previous studies have shown that there is little or literatures on factors influencing the adoption of improved rice production technologies in the study area. It is against this backdrop this research wish to be conducted. The broad objectives of the study was to identify the factors influencing adoption of improved rice technologies in western Agricultural Zone, Bauchi State Nigeria. Specific objectives were to;

- i. describe the socio-economic characteristics of the respondents
- ii. determine factors influencing adoption of improved rice production technologies
- iii. describe constraints to adoption of improved rice production technologies in the study area

METHODOLOGY

The Study Area

The study will be carried out at Western Agricultural Zone of Bauchi State, Nigeria. Bauchi State comprises of three Agricultural Zones namely: Northern Zone (9 LGAs) Central Zone (4 LGAs) and Western Zone (7 LGAs). The Western Zone has 7 Local Government Areas, namely; Bauchi, Dass, Tafawa- Balewa, Toro, Kirfi, Bogoro and Alkaleri Local Government. The Study is located between latitudes 9°30' and 10°48' North of the equator, and between longitudes 8°45' and 15'. East of the greenwich meridian. The area has a total land mass of 49,259 square kilometres. The study area has the population of 2,591,767 million people (NPC 2018 Projection). The climate of the study area is characterized by long dry season (October-May) with a short rainy season (May-October), (Bauchi State Ministry of Land and Survey, 1999). The study area falls within the Sudan Savannah vegetation zone with an annual rainfall of 1300 mm per annum, which commences in April and ends in



October. The State has an average temperature of 28.3^{0C}; the warmest months are February to April, where temperatures exceed 45^{0C}. During the harmattan period, a dry cold dusty wind is experienced between November to February with a minimum temperature of about 19^{0C}. The vegetation of the study area falls within the Sudan Savannah agro-ecological zone which is characterized by scattered trees that have scaly barks and most of which are thorny in nature. The major occupations of the people include farming, livestock rearing and trading.

Sampling Procedure and Sample Size

Multi-stage sampling procedure was used for the selection of the respondents. In the first stage, western Agricultural zone was purposively selected because of its potentials for rice production. In the second stage, three local government areas were purposively selected from the zone which include; Toro, Tafawa Balewa and Dass. In the third stage, three districts were purposively selected from the selected local governments based on their potentials for rice production. In the fourth stage, three villages were randomly selected each of the selected district making a total of nine villages, viz; Tilden Fulani, Magama Gumau, Nabardo, Bula, Dull, Iere south, Bagel, Dass Katanga and Lushi. In the final stage, it involved proportionate selection of (5%) of registered from the sampling frame obtained from the source (BSEEDS, 2016).

Table 1: Sampling Procedure and Sample Size

| Agricultural zone | L.G.A | Districts | Villages | Population | Sample size (5%) |
|-------------------|---------------|-----------|---------------|------------|------------------|
| Western Zone | Toro | Toro | Tilden Fulani | 307 | 15 |
| | | | Magama Gumau | 982 | 49 |
| | | | Nabardo | 524 | 26 |
| | Tafawa Balewa | Bununu | Bula | 440 | 22 |
| | | | Dull | 328 | 16 |
| | | | Lere south | 305 | 15 |
| | Dass | Bajar | Bagel | 405 | 20 |
| | | | Dass/kantanga | 362 | 18 |
| | | | Lushi | 388 | 19 |
| Total | | | | 4,041 | 202 |

Methods of Data Collection

Primary data was obtained from the respondents through the administration of structured questionnaires in the study area.

Data Analysis

Data for the study were analyzed using both descriptive and inferential statistics. Descriptive statistics such as frequency, percentages and mean were used in achieving objectives i and iii. While Objective ii was analyzed multiple regression model (linear function form) .

Model Specification

In statistics, multiple regression analysis is a statistical technique for estimating the relationships among variables.

Linear regression model:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5 X_5 + b_6 X_6 + b_7X_7 + b_8X_8 + U \quad \dots (1)$$

Where

Y = Number of recommended practices adopted

X₁= Age (years)

X₂ = Sex (1=Male, 2=Female)

X₃ = Marital Status (1=Single, 2=Married, 3=Divorce, 4=Widow)



- X₄= Educational level (1=Primary, 2=Secondary, 3=Tertiary, 4=Adult literacy)
X₅= Household size (Number)
X₆= Years of farming experience (years)
X₇= farm size (ha)
X₈ = Primary occupation (1=Farming, 2= Civil servant, 3=Pensioner, 4=Trading)
X₉ = Annual income (₦)
X₁₀ = Membership of association (1=Yes, 2=No)
X₁₁ = Years of cooperative membership (years)
X₁₂= Access to credit (Yes=1, No=0)
X₁₃= Access to extension (Yes=1, No=0)
X₁₄= Frequency of extension contact (1=Weekly, 2=Fortnightly, 3=Monthly, 4=Quarterly and annually=5)
X₁₅ = Awareness on improve technologies (Yes=1, No=0)
X₁₆ = Years of awareness (years)

RESULTS AND DISCUSSION

Socioeconomic Characteristics of the Respondents

The result from Table 2 reveals the qualitative characteristics of the respondents, the findings shows that majority (70.3%) of the respondents were male, while 29.7% of the respondents were female. This implies that most of the respondents were male which is not unconnected to the facts that religious belief and culture hinders the participation of female in some agricultural activities in the study area. This is in contrast with the finding of Bose *et al.* (2020), reported that majority of the respondents were female in Dass LGA, Bauchi State. The result also shows that majority (68.8%) of the respondents were married, while 28.7%, 1.5% and 1% of the respondents were single widowed and divorced respectively. This implies that most of the respondents were married which is connected to the fact that most married people have high level of responsibility and hence require to adopt technologies in production of rice in the study area. The result further shows that majority (62.4%) of the respondents had attended post-secondary as their level of education, while 21.3% and 15.8% of the respondents had attended adult literacy and secondary levels of education, respectively. This implies that most of the respondents had attended one levels of education or another which is an important factor in adoption of technology in agriculture. This agrees with the finding of Bose *et al.* (2020), who reported that 93.3% of respondents had acquired various forms of formal education in Dass LGA, Bauchi State.



Table 2: Qualitative Socioeconomic Characteristics of the Respondents (n=202)

| Variables | Frequency | Percentage |
|---|-----------|------------|
| Sex | | |
| Male | 142 | 70.3 |
| Female | 60 | 29.7 |
| Marital status | | |
| Single | 58 | 28.7 |
| Married | 139 | 68.8 |
| Widowed | 3 | 1.5 |
| Divorced | 2 | 1.0 |
| Educational status | | |
| Primary | 1 | .5 |
| Secondary | 32 | 15.8 |
| Post-secondary | 126 | 62.4 |
| Adult literacy | 43 | 21.3 |
| Other occupation | | |
| Farming | 96 | 47.5 |
| Civil servant | 8 | 4.0 |
| Retiree/pensioner | 57 | 28.2 |
| Trading | 41 | 20.3 |
| Membership of association | | |
| Yes | 171 | 84.7 |
| No | 31 | 15.3 |
| Access to credit | | |
| Yes | 65 | 32.2 |
| No | 137 | 67.8 |
| Extension contact | | |
| Yes | 174 | 86.1 |
| No | 28 | 13.9 |
| Frequency of extension contact | | |
| Weekly | 5 | 2.5 |
| Fortnightly | 16 | 7.9 |
| Monthly | 16 | 7.9 |
| Quarterly | 110 | 54.5 |
| Annually | 55 | 27.2 |
| Awareness of improved production technology | | |
| Yes | 155 | 76.7 |
| No | 47 | 23.3 |

Source: Field survey, 2021

The result also shows that 47.5%, 28.2% and 20.3% of the respondents were farmers, retirees/pensioners and traders, only 4% of the respondents were civil servant. This implies that most of the respondents were into one or more other occupations which helps to augment their livelihood, living standards and income apart from rice production. This is in tandem with Bose *et al.* (2020), who reported that majority (58.7%) of the respondents engaged in rice milling and marketing as their primary occupation. The result further reveals that majority (84.7%) of the respondents were members of one association or another, while 15.3% of the respondents were not members of any association. This implies that most of the respondents belongs to one form of association or another which in turn increases respondent access to extension services, farm inputs and credits. The result further reveals that majority (67.8%) of the respondents had no access to credit, while 32.2% of the respondents had access to credit. This implies that respondents' access to credit is low in the study area which



could be attributed to high interest rates, guarantor and conditional issues of collaterals associated requirement for loans from financial institutions.

The result further indicates that majority (86.1%) of the respondents had access to extension services, while 13.9% of the respondents had no access to extension. This implies that respondents in the study area had good access to extension service in the study area. The result also shows that majority (54.5%) of the respondents had contact with extension agents once every four months, while 27.2%, 7.9% and 2.5% of the respondents had contact with extension agents once annually, monthly and fortnightly respectively. The result also reveals that majority (76.7%) of the respondents were aware of the improved recommended rice production technology, while 23.3% of the respondents were not aware of the improved rice production technology in the study area. This implies that most of the respondents were aware of the recommended improved rice production technology, which is considered an important factor in dissemination and adoption of recommended technology in agricultural production in the study area.

The result from Table 3 reveals the quantitative socioeconomic characteristics of the respondents, the findings showed that 37.1%, 26.2% and 23.3% of the respondents were within the age brackets of 31-38 , 23-30 and 39-46 years respectively, while 7.9% and 5.4% of the respondents were within the ages of 47-54 and 55 years and above with mean of 37 years. This implies that most of the respondents were within their active ages to participate in agricultural production in the study area. This is in line with the finding of Bose *et al.* (2020), who reported that the average age of the farmers was 40.3 years in Dass LGA, Bauchi State.

The findings further reveals that 32.2% and 26.7% of the respondents had a household size of 4-6 persons and 7-9 persons, while 17.8%, 14.9% and 8.4% of the respondents had a household size of 13 persons and above, 10-12 persons and 1-3 persons respectively, with a mean household size of 8 persons. This implies that most of the respondents had relatively large household size which is an added advantage to cheap source of family labour in agriculture and by implication will enable them to accept and practice technologies that are labour intensive.



Table 3: Quantitative Socioeconomic Characteristics of the Respondents (n=202)

| Variables | Frequency | Percentage | Mean |
|------------------------------------|-----------|------------|------------|
| Age (years) | | | |
| 23-30 | 53 | 26.2 | 37 |
| 31-38 | 75 | 37.1 | |
| 39-46 | 47 | 23.3 | |
| 47-54 | 16 | 7.9 | |
| 55 and Above | 11 | 5.4 | |
| Household size (number of persons) | | | |
| 1-3 | 17 | 8.4 | 8.0 |
| 4-6 | 65 | 32.2 | |
| 7-9 | 54 | 26.7 | |
| 10-12 | 30 | 14.9 | |
| 13 and Above | 36 | 17.8 | |
| Farming experience (years) | | | |
| 1-2 | 1 | 0.5 | 6 |
| 3-4 | 25 | 12.4 | |
| 5-6 | 100 | 49.5 | |
| 7-8 | 62 | 30.7 | |
| 9 and Above | 14 | 6.9 | |
| Farm size (hectare) | | | |
| 1-1.5 | 82 | 40.6 | 1.9 |
| 1.6-2.1 | 21 | 10.4 | |
| 2.2-2.7 | 94 | 46.5 | |
| 2.8 and Above | 5 | 2.5 | |
| Estimated income (₦) | | | |
| 100,000-200,000 | 84 | 41.6 | 309,841.58 |
| 201,000-300,000 | 33 | 16.3 | |
| 301,000-400,000 | 22 | 10.9 | |
| 401,000-500,000 | 40 | 19.8 | |
| 501,000 and Above | 23 | 11.4 | |
| Years of membership | | | |
| 0 | 31 | 15.3 | 4 |
| 1-2 | 9 | 4.5 | |
| 3-4 | 65 | 32.2 | |
| 5-6 | 45 | 22.3 | |
| 7-8 | 39 | 19.3 | |
| 9-10 | 13 | 6.4 | |
| Years of awareness | | | |
| 1-3 | 73 | 36.1 | 5 |
| 4-7 | 90 | 44.6 | |
| 8-11 | 30 | 14.9 | |
| 12-15 | 8 | 4.0 | |
| 16 and Above | 1 | .5 | |

Source: Field survey, 2021

The result further shows that 49.5% and 30.7% of the respondents had 5-6 and 7-8 years of farming experience while 12.4%, 6.9% and 0.5% of the respondents had 3-4, 5-6 and 7-8 years, respectively, with a mean of 6 years of farming experience. This implies that most of the respondents had relatively good years of farming experience which plays a great role in influencing the adoption of technologies and innovations in agriculture. The result also shows that 46.5% and 40.6% of the respondents had a farm size of 2.2-2.7ha and 1-1.5ha of farm land, while 10.4% and 2.5% of the respondents had a farm size of 1.6-2.1ha



and 2.8ha and above, with a mean farm size of 1.9ha. This implies that most of the respondents in the study area are subsistence farmers who carry out their farming activities with the aim of meeting their family needs. The result also reveals that 41.6% of the respondents had an estimated income of ₦100,000-₦200,000, while 19.8%, 16.3%, 11.4% and 10.9% of the respondents had an estimated income of ₦401,000-₦500,000, ₦201,000-₦300,000, above ₦501,000 and ₦301,000-₦400,000 respectively, with a mean annual income of ₦309,841.58. This implies that respondent had relatively high income in the study area which motivates respondents to participate actively in agricultural activities in the study area. The implication also shows that respondents with higher income have higher tendency to take risk and put new technologies into practice.

The result further indicates that 32.2% and 22.3% of the respondents had 3-4 years and 5-6 years of membership in association, while 19.3%, 15.3%, 6.4% and 4.5% of the respondents had 7-8 years, zero, 9-10 years and 1-2 years of membership in association respectively in the study area, with an average of 4 years association membership. This implies that most of the respondents had good years of membership in association in the study area. The result also shows that 44.6% and 36.1% of the respondents had 4-7 years and 1-3 years of awareness on improved rice production technology, while 14.9%, 4.5% and 0.5% of the respondents had 8-11 years, 12-15 years and 16 years and above on awareness of improved rice production technologies respectively, with a mean of 5 years in the study area. This implies that respondents had good years of awareness of improved rice production technology which helps the adoption and practice of technology in agriculture.

Factors Influencing Adoption of Technologies

The result from Table 4 presents the factors influencing the adoption of recommended rice production technologies in the study area. The finding reveals that the coefficient of sex was positive and significant ($P < 0.05$). This implies that an increase of male in rice production will result to increase in adoption of recommended rice production technologies. This is not unconnected to the facts that men participation in rice production increases due to recommended rice technology adoption which had over the year's yielded positive and significant increase in production and living standards of the farmer.

Table 4: Regression Result showing Factors Influencing Adoption of Recommended Technology

| Model | B | Std. Error | Beta | t | Sig. |
|------------------------------------|----------|------------|-------|--------|--------|
| (Constant) | .977 | .431 | | 2.265 | .025 |
| Age | -.003 | .004 | -.044 | -.617 | .538 |
| Sex | .188 | .079 | .180 | 2.388 | .018** |
| Marital status | .048 | .064 | .053 | .753 | .452 |
| Educational level | -.144 | .057 | -.188 | -2.517 | .013** |
| Household size | -.013 | .009 | -.100 | -1.365 | .174 |
| Farming experience | .021 | .018 | .087 | 1.187 | .237 |
| Farm size | .004 | .035 | .010 | .124 | .901 |
| Primary Occupation | -.031 | .031 | -.080 | -.979 | .329 |
| Estimated income | 1.450E-8 | .000 | .006 | .075 | .941 |
| Membership of Association | .326 | .139 | .246 | 2.351 | .020** |
| Years of membership | .049 | .019 | .276 | 2.533 | .012** |
| Access to credit | .054 | .077 | .053 | .703 | .483 |
| Extension contact | -.030 | .100 | -.021 | -.296 | .768 |
| Frequency of extension contact | -.012 | .037 | -.024 | -.327 | .744 |
| Awareness of improved technologies | .204 | .079 | .180 | 2.583 | .011** |
| Years of awareness | .009 | .012 | .055 | .736 | .463 |

Source: Field survey, 2021 **Significant at 5% ($P < 0.05$)



The result further shows that the coefficient of membership of association was positive and significant ($P < 0.05$) which implies that as membership of association increases farmers adoption of recommended rice production technology will also increase and vice-versa. This shows that as farmers increase their membership of association the more the adoption of technologies. It is also connected to the facts that associations and cooperatives plays significant role increasing farmers access to extension services, inputs and credits. Which by implication increases the adoption of rice production technologies.

The finding also reveals that the coefficient for years of membership in association was positive and significant ($P < 0.05$) in influencing the adoption of recommended rice production technologies among the farmers. This implies that an increase in years of membership of association will result to a unit increase in adoption of recommended rice production technology in the study area. The findings also indicates that awareness of recommended rice production technology was positive and significant ($P < 0.05$) in and influencing the adoption of recommended rice production technologies. This implies that an increase in awareness of recommended rice production technologies will result to a unit increase in adoption of recommended rice production technologies in the study area. It can also be attributed to the facts that awareness is the key that exposes farmer to the process of adoption of technology in agriculture and as well as backbone of adoption.

In addition, the result shows that educational level of the respondents was found to be negatively significant ($P < 0.05$) influencing adoption of recommended rice production technology. This implies that a unit increase in level of education will lead to decrease in adoption of rice production technologies and vice-versa. This is contrary to a prior expectation under normal circumstances level of education positively influence adoption.

Constraints to Adoption of Rice Production Technology by the Farmers

The result from Table 5 presents the constraints faced by the respondents in adopting recommended rice production technologies in the study area. The finding reveals that the major constraints faced by the respondents were lack of technical skills, high cost of technology and inadequate credit facilities which were ranked 1st, 2nd and 3rd respectively. While high weed growth, disease infestation and inadequate inputs were ranked 4th, 5th and 6th respectively. Other constraints were complexity of technology and limited land which were ranked 7th and 8th respectively. This implies that though respondents had adopted recommended rice production technologies they had some challenges that hinders them from absolute adoption of recommended technologies in the study area. Joseph (2016) reported that the major constraints include: the scarcity and high cost of inputs ($M = 2.75$), inadequate rural road network ($M = 2.63$), poor soil fertility ($M = 2.41$) and poor access to institutional credit ($M = 2.30$).

According to Musa *et al.* (2018) the constraints, covering a wide array of issues included land acquisition and tenure, market fluctuation, input variability, communication and training, techniques. The problems were found to be interwoven and influence each other. As constraints of land tenure persist, farmers are bound to be confronted with production, inputs and technology constraints. Lack of adequate information was found to be related to economic, input and production constraints of the farmers.



Table 5: Distribution of Respondents According to their Constraints to Technology Adoption (n=202)

| Variables | Frequency* | Percentage | Rank |
|------------------------------|------------|------------|-----------------|
| Lack of technical skills | 186 | 92.1 | 1 st |
| High cost of technology | 166 | 82.2 | 2 nd |
| Inadequate credit facilities | 73 | 36.1 | 3 rd |
| High weed growth | 49 | 24.3 | 4 th |
| Disease infestation | 40 | 19.8 | 5 th |
| Inadequate inputs | 34 | 16.8 | 6 th |
| Complexity of technology | 27 | 13.4 | 7 th |
| Limited land | 22 | 10.9 | 8 th |

Source: Field survey, 2021 *Multiple response

CONCLUSION AND RECOMMENDATION

The study concludes that sex, membership of association, awareness and years of association membership were the factors influencing the adoption of rice production technologies. Even though the adoption of rice production technologies was constraint by inadequate skills, high cost of technologies to mention few. The need to provide capacity building on technologies of rice production and give farmers access to credit cannot be over emphasize because it has potentials for stimulating adoption and by implication improving farmers productivity.

Based on the findings of the study the researcher makes the following recommendations;

- Farmers association should hire technicians to train respondents on the new technologies in the study area
- Farmers associations should acquire the recommended technologies and give their members at a subsidized rates
- Government and NGOs should provide incentives to the respondents so as to improve their productivity levels
- Farmers should adopt the use of weed resistant varieties to reduce the cost of chemicals in the study area

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