



ANALYSIS OF THE SOURCES OF INFORMATION AND ADOPTION OF IRPTs AMONG MEMBERS AND NON-MEMBERS OF RICE COOPERATIVES IN GOMBE STATE, NIGERIA

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ABSTRACT

The study was carried out to assess the sources of information and adoption of IRPTs among members and non-members of rice cooperatives in Gombe State, Nigeria. A multi-stage sampling procedure was used to select 186 respondents comprising of 93 members and 93 non-members. Data were collected using structured questionnaires and analysed using descriptive and inferential statistics. The results showed that, the mean age of the respondents was 41 and 42 years for the members and non-members respectively, with the mean farming experience of 9 and 10 years for both the members and non-members respectively. The results showed a significant difference ($P < 0.05$) between the mean household size among members and non-members as the calculated Z-value (2.70) is higher than the tabulated Z-value (1.96). The result also showed a significant difference ($P < 0.05$) between the mean farm size among members and non-members as the calculated Z-value (4.80) is higher than the tabulated Z-value (1.96). The result revealed that, rice farmers cooperatives (67.4%), radio (63.0%) and friends (58.7%) were the major sources of information on IRPT among members of rice cooperatives in the study area and were ranked 1st, 2nd and 3rd respectively. All the members (100%) adopted all the improved rice production technologies at various level of adoption, high adoption (0.67 – 1.0) and Medium adoption (0.34 – 0.66) in the study area. The study concluded that members of rice cooperatives in the study area were better than non-members in terms of overall sources of information and adoption of improved rice production technologies. The study therefore recommends that, farmers should form formidable cooperative societies so as to enjoy economies of scale in pooling their resources to purchase farm inputs.

Keywords: Analysis, Source, Information, IRPTs and Technologies

INTRODUCTION

Agriculture rests the base of Nigerian economy through providing the significant basis of livelihood for most Nigerians, Food and Agricultural Organization (FAO, 2021), with limited adoption of research findings and technology. Given the importance of agriculture to the economy of sub-Saharan African countries, there is a need to find other ways of increasing the productivity in the region. Adesina (2020) reported that the need to achieve self-sufficiency in food production is more pertinent in the rice sub-sector where the local consumption of the commodity is in excess of the quantity produced by farmers thus creating a demand for imported rice to meet the shortfall.

Rice, the seed of the monocot plants *Oryza sativa* (Asian rice) or *Oryza glaberrima* (African rice) is a cereal grain that is widely consumed by a large chunk of the world population. It's production accounts for 29 percent (%) of the total output of crops



worldwide, with Africa accounting for about 10 to 13 % Abdullai *et al.*, (2020). Since growth in rice production is based on existing agricultural land area, improvement on rice yield is necessary (IRRI, 2016). Gombe State is one of the leading states in rice production in Nigeria due to the presence of two irrigation dams at Dadin Kowa and Balanga which ensure all year-round rice production. Adamu (2020), reported that Gombe State produce an average record of 3.5 tons/ha of paddy rice. The area under rice cultivation in Gombe State increases from 57.060 ha to 60.019 ha from 2015 to 2017 (Gombe State Agricultural Development Project [GSADP], 2020).

Adoption has been defined as the integration of a new technology into existing practice (Aebayo *et al.*, 2021) and is usually preceded by a mental processing on first hearing about the innovation. Bannor *et al.* (2020) indicated that the adoption of technologies and improved management practices should lead to substantial yield increase in rice production. Adoption of an innovation within a social system takes place through its adoption by individuals or groups. More so, adoption is not a permanent behavior, this implies that an individual may decide to discontinue the use of an innovation for a variety of personal, institutional, and social reasons, one of which might be the availability of another practice that is better in satisfying farmers' need. The importance of rice technologies stands to play for attaining the much-needed increase in rice production in GSADP has relevance to factors influencing farmers' decision to adopt rice technologies in their farms or otherwise rejection.

Cooperatives are all types of business enterprises or organizations owned and controlled by members in the pursuit of perceived mutual benefits and need actualization (Adeleye *et al.*, 2021). Farmer cooperatives are regarded as social instruments for making the market environment work for resource poor farmers who are faced with the challenge of limited and uncertain demand for the commodities they produce (Adeleye *et al.*, 2021).

The study is therefore, expected to provide empirical data that will confirm or invalidate the premise that members of rice cooperative societies in the study area are better than non-members in terms of the overall sources of information and adoption of improved rice production technologies. The findings from the study will contribute to policy discourse on domestic rice production in the country. As far as rice production in Gombe State is concerned, there is paucity of data validating or rejecting the premise that members of cooperative societies perform better than non-members among rice farmers. It is against this backdrop that the study analyzed the sources of information and adoption of IRPTs among members and non-members of rice cooperatives in Gombe State, Nigeria. The study attempted to;

- iv. describe the socio-economic characteristics of rice farmers in cooperative societies in the study area;
- v. Identify the sources of information on IRPTs among members and non-members of rice cooperatives; and
- vi. examine the rate of adoption of improved rice production technologies among members and non-members of rice cooperative societies in the study area.

METHODOLOGY

The Study Area

Gombe State lies on latitude 10° 15' N and longitude 11° E (Omorogbe *et al.*, 2021). It has a total population of 2,365,040 (National Population Commission [NPC], 2006); this was projected to be 3,941,193 at 4.03% population growth rate in 2024. About 60% of the population in Gombe engages in agriculture and the State covers land mass of about 20, 266 square kilometer (Km²) (Gombe State, 2022). The annual temperature ranges from 14.5°C in



December and January to 39.7°C in April and August. The area experiences both dry and rainy seasons with a maximum rainfall of about 863.2 mm per annum. 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, pawpaw, 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 Techniques and Sample Size

Multi-stage sampling procedure was used for the selection of the respondents. In the first stage, Gombe was divided into three (3) senatorial zones for administrative convenience which were considered as strata. In the second stage, from each stratum (zone), proportionately 40% of L.G.As were randomly selected in Gombe State, one, two and two L.G.As from central, Southern and Northern Senatorial Zones were selected respectively, making a total of five L.G.As. Altogether, making a total of 5 L.G.As. In the third stage, two communities were purposively selected from each L.G.A across Gombe State giving a total of 10 communities. In the fourth stage, with the assistance of Agricultural Development Project (ADP) officers, a list of registered rice farmers cooperative societies were compiled from each of the communities earlier selected, proportionately 50% of the number of cooperative societies were randomly selected from each of the selected community. This gave a total of 28 rice farmers' cooperative societies. In the fifth stage, the researcher then applied the formula (Yamane) as used by (Ryan, 2013; and Ariola, 2006) to select the sample size proportionate to the population of registered rice farmers. In the sixth stage, based on the fact that the number of rice farmers was not equal in the communities selected, a proportionate formula was applied to select a sample of rice farmers from the sampling frame of rice farmers (members of cooperative societies) in each of the selected communities to obtain a sample size. In the final stage, simple random sampling technique was applied to select same number of non-members of rice cooperative societies from each of the selected 10 communities to serve as a control. Altogether a total of 186 respondents were randomly selected for the study. Yamane formula for determining sampling size is expressed as:

$$n = \frac{N}{1 + N(e)^2} \quad \dots (1)$$

where;

n=sample size for the study

N=Total sampling frame

e=limit of tolerable error or level of precision ($P \leq 0.05$)

1=unity

Proportionate Sampling Allocation Procedure is expressed as:

$$N_h = \frac{N(n)}{N} \quad \dots (2)$$

where;

n_h = Sample taken from the h^{th} stratum,

N_h = Sample population of the h^{th} stratum,

n = Sample size, and

N = Total population



Method of Data Collection

Primary data were collected through the administration of structured questionnaire as the survey instrument with the help of trained enumerators. The questionnaire was divided into sections to achieve the stated objectives.

Method of Data Analysis

Combinations of different statistical tools were used in analyzing the data for the study. The tools include both descriptive and inferential statistics. The descriptive statistics used include; frequency, percentages, means, and ranking. The inferential statistical tool used was adoption index.

Descriptive statistics was used in analyzing objectives i, and iii. Z - Statistics was also used to test whether there is a significant differences or not in the socioeconomic characteristics and other institutional factors (objective i) among members and non-members of rice farmers cooperative societies. Z-statistics was calculated using the formula below:

$$Z = \frac{m_1 - m_2}{\sqrt{\frac{sd_1^2}{n_1} + \frac{sd_2^2}{n_2}}} \quad \dots(3)$$

Where:

m_1 = mean of members of cooperative societies

m_2 = mean of non-members of cooperative societies

sd_1 = standard deviation of members of cooperative societies

sd_2 = standard deviation of non-members of cooperative societies

n_1 = number of members of cooperative societies

n_2 = number of non-members. of cooperative societies

Adoption index

Adoption index shows the rate of use of a number of recommended practices by farmers which is measured by adoption score (number of improved practices used) or by an adoption quotient (number of improved practices used over total number of recommended practices). For the purpose of the study, adoption index was calculated to obtain each farmer's level of use of multiple practices from the 9 recommended components of rice production and finally categorize them into low, medium and high level of adoption. In order to determine the level of adoption of the improved production packages, adoption index of individual farmer was calculated using the following formula of adoption quotient adapted from Sani *et al.* (2018). This was done to achieve objective ii of the study.

$$A_i = \sum_{i=1}^n \left(\frac{BVQSA_i}{RRV_i} + \frac{FPA_i}{FPR_i} + \frac{SDTA_i}{SDTR_i} + \frac{TPA_i}{TPR_i} + \frac{WMA_i}{WMR_i} + \frac{FAA_i}{FAR_i} + \frac{PDMA_i}{PDMR_i} + \frac{SA_i}{SR_i} \right) \quad \dots(4)$$

N_p

Where:

A_i = Adoption index (non – adoption = 0, low adoption = 0.01 – 0.33; Medium adoption = 0.34 – 0.66; and high adoption = 0.67 – 1.0)

$i = 1, 2, 3, 4, n$, and n = total number of farmers.

N_p = number of practices

A_i = adoption Index of i th farmer

$BVQSA_i$ = best variety and qualitative seeds by i^{th} farmer (varieties)

RRV_i = recommended rice varieties for the crop (varieties)



FP_{Ai} = field Preparation by i^{th} farmer (Number of times)
 FPR_i = field preparation recommended for the crop (Mechanize)
 SDT_{Ai} = seed dressing/treatment by i^{th} farmer (g)
 $SDTR_i$ = seed dressing/treatment recommended for the crop (g)
 TP_{Ai} = time of planting by i^{th} farmer (month)
 TPR_i = time of planting recommended for the crop (month)
 WMA_i = weed management by i^{th} farmer (agro-chemicals)
 WMR_i = weed management recommended for the crop (g/l)
 FAA_i = fertilizer application by i^{th} farmer (bags/ha)
 FAR_i = fertilizer application recommended for the crop (bags/ha)
 $PDMA_i$ = pest and disease management by i^{th} farmer (g/l)
 $PDMR_i$ = pest and disease management recommended for the crop (ml/l)
 HA_i = harvesting by i^{th} farmer (time)
 HR_i = harvesting recommended for the crop (Mechanize)
 SA_i = storing by i^{th} farmer (bags)
 SR_i = storing recommended for the crop (Paddy in bags)

The actual adoption index score ranges from 0 – 1. The adoption score of 0 implies non-adoption and the adoption score of 1 implies the farmers adopted all the recommended components. Thus, adoption indices of the farmers was categorized into four, cited also in (Ndagi, 2015), that is, non – adoption = 0, low adoption = 0.01 – 0.33; Medium adoption = 0.34 – 0.66; and high adoption = 0.67 – 1.0.

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Respondents

To describe the socio-economic characteristics of the respondents in the study area frequency, mean and percentage was used to summarize the data obtained from the field. So that more important components would be accentuated. Z - Statistic was also used to test whether there is a significant differences or not in the socioeconomic characteristics and other institutional factors among members of rice cooperatives and non-members in the study area.

Age of the Respondents

The result in Table 1 revealed that the average age of members of rice cooperatives in Gombe State were 41 years and 42 years for non-members meaning that the mean age of non-members was slightly higher than that of the members mean age in Gombe State. The difference in age among members and non-members was found to be not significant ($P < 0.05$) in Gombe State as the calculated Z-value (1.94) is lower than the tabulated Z-value (1.96). This result implies that farmers are in the study areas are young, energetic and can actively perform well in agricultural activities more especially in rice production. Okwoche and Obinne (2020) found no significant difference in the mean age of women cooperative members (38) and non- members (40) in Benue State, North Central Nigeria.

Years of Experience in Rice Farming

The mean farming experience of members of rice cooperatives in Gombe State were 9 years and were lower than that of non-members 10 years. The results showed significant difference between the mean years of experience in rice production among members and non-members at $P < 0.05$ as the calculated Z-value (2.62) is higher than the tabulated Z-value (1.96). This implies that, the length of farming experience will affect technology adoption positively or negatively depending on the age of the farmer. This agrees with the findings of



Yusuf *et al.* (2022) who reported that, majority (76%) of the famers had between 1 and 10-years farming experience and 23.8% had 11 – 20 years.

Household Size of the Respondents

The average household size of members of rice cooperatives in Gombe State was 9 persons and was higher than that of non-members 8 persons. The results showed significant difference between the mean household size among members and non-members at $P < 0.05$ as the calculated Z-value (2.70) is higher than the tabulated Z-value (1.96). The result implies that, the number of household members involved in farming activities is an important factor in technology adoption especially when the technology is labour intensive. This agrees with the findings of Adenuga *et al.* (2020) in a research Adoption of Improved Rice Varieties and its Impact on Multi-dimensional Poverty of Rice Farming Households in Nigeria, who reported that, the mean household size for adopters 8 persons while 7 persons for non-adopters.

Farm Size of the Respondents

The average farm size of members of rice cooperatives in Gombe State was found to be 2.4 ha and was lower than that of non-members 2.7 ha. The results showed significant difference between the mean farm size among members and non-members at $P < 0.05$ as the calculated Z-value (4.80) is higher than the tabulated Z-value (1.96). This shows that rice farmers in the study area were mainly smallholder/small-scale farmers. Umar and Mohammed (2021) in their research increasing rice production through adoption of improved variety in Niger State, Nigeria, revealed that the mean farm size of the respondents in the study area was 2.1 hectares.

Income of the Respondents

the average income of members of rice cooperatives in Gombe State was ₦847,000.00 and was higher than that of non-members ₦586,315.00. The results showed significant difference between the mean income in rice among members and non-members at $P < 0.05$ as the calculated Z-value (2978.24) is higher than the tabulated Z-value (1.96). This implies that, the a priori expectation was met because farmers with increased annual income are expected to adopt innovations more than those with lower annual income. This agrees with the findings of Chukwu *et al.* (2021), the annual income of the respondents was statistically significant at 1% and bore a positive coefficient.

Amount of Credit Collected by the Respondents

The average amount of credit collected by the members of rice cooperatives in Gombe State was ₦294,416.60 and was higher than that of non-members ₦233,554.00. The results showed significant difference between the mean amount of credit collected by the members and non-members at $P < 0.05$ as the calculated Z-value (545.92) is higher than the tabulated Z-value (1.96). This implies that, farmers who belong to cooperative associations are more likely to obtain agricultural credit than those who operate as individuals. Okwocha and Obinne (2020) found significant difference in the amount of agricultural credit obtained by women co-operators (₦ 43,350) and non- cooperators (₦ 22,183). In the pooled data from Ekiti and Ogun States, Afolami *et al.* (2021) reported that 19.4% of the respondents had access to credit as opposed to 80.6% with no access.



Table 1: Distribution of Respondents Based on the Socio-economic Characteristics Among Members of Rice Cooperatives and Non-members in Gombe State

	Members (n=170)				Non-members (n=170)		
	Min.	Max.	Mean	Z- statistics	Min.	Max.	Mean
Variables:							
Age	25.00	70.00	41	1.94	23	70	42
Farming experience	1.00	30.00	9	2.62*	1	30	10
Household size	1.00	30.00	9	2.70*	1	23	8
Farm size	1.00	10.00	2.4	4.80*	1	9	2.7
Income	₦184,000	₦3,450,000	₦847,000	2978.24*	₦171,000	₦798,000	₦586,315
Credit collected	₦100,000	₦4800000	₦294416.6	545.92*	₦50,000	₦2,500,000	₦233,554

Source: Field survey, 2023 *P<0.05, Tabulated Z-value = 1.96

Sources of Information on Improved Rice Production Technologies among Members and Non-members of Rice Cooperatives in Gombe State.

The findings from Table 2 revealed the sources of information on IRPT among members and non-members of rice cooperatives in Gombe State. The result revealed that, rice farmers cooperatives (67.4%), radio (63.0%) and friends (58.7%) were the major sources of information on IRPT among members of rice cooperatives in the study area and were ranked 1st, 2nd and 3rd respectively. Followed by extension agents (40.2%), field days (39.1%), television (37.0%), relatives (35.9%), contact farmers (33.7%), newspapers (22.8%), input suppliers (19.6%) and what's app (18.5%) which were ranked 4th, 5th, 6th, 7th, 8th, 9th, 10th and 11th respectively. The trend was not similar among non-members in Gombe State. The result further revealed that, friends (98.9%), contact farmers (85.9%), rice farmers cooperatives (84.8%), extension agents (82.6%) and what's app (70.7%) were the major sources of information among non-members of rice cooperative in the study area and were ranked 1st, 2nd, 3rd, 4th and 5th respectively. Others include, input suppliers (63.0%), field days (62.0%), radio (60.9%), newspapers (59.8%), television (58.7%) and relatives (39.1%) and were ranked 6th, 7th, 8th, 9th, 10th and 11th respectively.

The findings from the results indicated that farmers depended on multiple information sources and a combination of sources highlighted above might be a better way of reaching them with information on improved rice production technologies. This is somewhat in line with the findings of Adetimehin *et al.* (2021) in their research utilization of agricultural information and knowledge for improved production by rice farmers in Ondo State, Nigeria, showed that the respondents' major sources of information were friends and relatives (95.2%), radio (92.8%) and input suppliers (91.6%) The implication is that most of their respondents relied on interpersonal sources in accessing agricultural information, probably because of their regular availability and accessibility. Adisa *et al.* (2021) reported that, most of the respondents use more than one source of information on agricultural production. Their result revealed that the majority (60.8%) of their respondents depends on extension agents for information on rice production, and 32.1% used radio as source of information and other sources (1.4%) used friends and relatives.



Table 2: Distribution of Respondents Based on the Sources of Information on IRPTs among Members and Non-members in Gombe State

Sources of Information	Members (n=92)		Non-members(n=92)	
	Frequency*	Rank	Frequency*	Rank
a) Rice farmers cooperative societies	62(67.4)	1 st	78(84.8)	3 rd
b) Radio	58(63.0)	2 nd	56(60.9)	8 th
c) Friends (Rice farmers)	54(58.7)	3 rd	91(98.9)	1 st
d) Extension agents	37(40.2)	4 th	76(82.6)	4 th
e) Field days	36(39.1)	5 th	57(62.0)	7 th
f) Television	34(37.0)	6 th	54(58.7)	10 th
g) Relatives (Rice farmers)	33(35.9)	7 th	36(39.1)	11 th
h) Contact rice farmers	31(33.7)	8 th	79(85.9)	2 nd
i) Newspapers	21(22.8)	9 th	55(59.8)	9 th
j) Input suppliers	18(19.6)	10 th	58(63.0)	6 th
k) Whats' app	17(18.5)	11 th	65(70.7)	5 th

Source: Field survey, 2023 Figures in parenthesis are percentages *Multiple response

Overall Adoption Index of Improved Rice Production Technologies among Members and Non-members of Rice Cooperatives in Gombe State.

The analysis of the overall adoption of improved rice production technologies among members and non-members of rice cooperatives is presented in Table 3. The findings indicated that, members of rice cooperatives adopted all the improved rice production technologies at various adoption indices (mean scores) which include, using best varieties (0.69), field preparations (0.71), seed dressing (0.91), improved planting techniques (0.70), weed management (0.85), fertilizer application (0.76), pests and disease management (0.73) and storing (0.81) were highly adopted respectively by the members, followed by improved harvesting techniques (0.55) which was medium adopted by the members of rice cooperatives in Gombe State.

The trend was also similar among non-members who also adopted all the 9 technologies in the study area at various adoption indices (mean scores) which include, using best varieties (0.82), field preparation (1.00), seed dressing (0.85), improved planting techniques (0.89), fertilizer application (1.00), pests and disease management (0.88), improved harvesting techniques (0.79) and storing (0.63) were highly adopted by non-members of rice cooperatives in the study area respectively, weed management (0.23) was adopted low. This implies both the members and non-members of rice cooperatives adopted all the nine (9) IRPTs in the study area at various adoption indices.

This agrees with the findings of Alarima *et al.* (2021) in their research adoption of sawah eco-technology in rice production by farm households in Kebbi State, Nigeria, reported that. bond construction had 100% adoption, nursery 99%, puddling 98%, flooding 95%, leveling and smoothening 94% and power tiller use 88% adoption. This reveals that sawah technology package has high adoption among the respondents. This disagrees with findings of Bala *et al.* (2022) who revealed that, 11.6% and 10.9% of the respondents are high and medium adopters of NERICA 1 rice technologies in the study areas. Similarly, majority 77.4% of the NERICA 1 respondents are low adopters of the production technologies. This result implies that adoption of NERICA 1 rice technologies is low in the study areas, this could be attributed to high cost and complexity of the technology coupled



with smaller holder nature of the farmers which produce the crop mainly for family consumption.

Table 3: Adoption of Improved Rice Production Technologies by Members and Non-members of Rice Cooperatives in Gombe State

Improved rice production Technologies	Members (n=92)		Non-members (n=92)	
	Mean Score	Decision	Mean Score	Decision
a. Using best varieties	0.69	High adoption	0.82	High adoption
b. Field preparations	0.71	High adoption	1.00	High adoption
c. Seed dressing (chemical)	0.91	High adoption	0.85	High adoption
d. Improved planting techniques	0.70	High adoption	0.89	High adoption
e. Weed management	0.85	High adoption	0.23	Low adoption
f. Fertilizer application	0.76	High adoption	1.00	High adoption
g. Pests and disease mgt.	0.73	High adoption	0.88	High adoption
h. Improved harvesting techniques	0.55	Medium adoption	0.79	High adoption
i. Storing	0.81	High adoption	0.63	High adoption

Source: Field survey, 2023

Non – adoption = 0, low adoption = 0.01 – 0.33; Medium adoption = 0.34 – 0.66; and high adoption = 0.67 – 1.0.

CONCLUSION AND RECOMMENDATIONS

The study concluded that members of rice cooperatives in the study area were better than non-members in terms of overall sources of information and adoption of improved rice production technologies. This indicates that IRPTs has an enormous potential in reinforcing the rice farmers in increasing production and productivity. However, the superiority of members over non-members in terms of the adoption of improved rice production technologies led to better rice yield per hectare and income of members of cooperative societies in the study area. In addition, low availability of inputs and other major challenges constraint farmers to optimally comply with the recommendations.

From the finding of the study the following recommendations were made:

- vi. Farmers should be sensitized to pool their resources so as to enjoy economies of scale in purchasing farm inputs.
- vii. There is the need for sensitization and enlightenment campaign by the cooperative Finance Agency on the importance of farmers' cooperative societies in accessing loans and other farm inputs.
- viii. Financial institutions should provide loan to farmers at a single digit interest rate. Those stringent collaterals to be removed considering the status of these farmers, most of them are small scale farmers.
- ix. ADPs and other relevant authorities should be up and doing in terms of sensitization so as to create awareness on the improved rice production technologies in order to boost the productivity of rice farmers in the study area.
- x. The ratio of extension agents to farmers is very wide in Nigeria. In the recent literatures the gap is about 1:1100 meaning an extension agent is to take care of 1100 farmers. In line with the above therefore, there is the need for the government to



recruit more extension personnel as the experienced ones are retiring with no replacement.

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