AN ANALYSIS OF ACCESS TO CLIMATE CHANGE INFORMATION AMONG SMALLHOLDER RICE FARMERS IN NIGER STATE, NIGERIA

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ABSTRACT

The study analyzed rice farmers' access to climate change information. A multi-stage random sampling procedure was employed to select 365 rice farmers. Descriptive statistics was used to describe the socio-economic characteristics of the farmers and their sources of accessing climate information, while the binary logit regression was used in determining factors influencing farmers' access to climate information. The results indicated that rice production in the study area is male-dominated (91.0%), with 69.3% of *the rice farmers still in their most productive age and 72.6% having more than ten years of farming experience. Nearly half of the farmers lack access to climate information, while 26% and 14% of the farmers admitted to getting climate information from the radio and mobile phones, respectively. The results of the binary logit regression analysis showed that educational level (0.0073), radio ownership (0.3110), farming experience (0.0054), access to credit (0.0543), climate change awareness (0.1049), and mobile phone ownership (0.1982) have a significantly positive relationship with farmers' access to climate information. Further, age (-0.0029) and extension contact (-0.0078) had a significantly negative relationship with the farmers' access to climate information. The study therefore recommends that the use of the radio in raising awareness and disseminating climate change information among rice farmers should be incorporated in all efforts to encourage the adoption of practices that mitigate the effects of climate change within the rural setting.*

Keywords: Climate change, climate information, radio ownership, access to credit, extension contact

INTRODUCTION

The Agricultural sector in Nigeria is approximately 88 percent dominated by smallholder farmers who account for about 90 percent of the agricultural produce (FAO, 2022). These farmers have low adaptive capacity and are unable to adequately cope with environmental changes (FAO, 2022). Climate change impact is among the major challenges facing farmers in tropical and sub-tropical countries because of its adverse impact on agricultural activities (Arifah *et al.,* 2022). Climate change poses a consistent threat to food security and the agriculture production system (Saleem *et al.,* 2024). The sub-Saharan African region of which Nigeria is inclusive is highly dependent on rain-fed agriculture of which small variations in the patterns of rainfall lead to overwhelming consequences on the livelihood of many households (Antwi-Agyei *et al.,* 2020).

The occurrence of extreme weather conditions such as rising temperature, drought, wind and rain have a negative effect on rice production which results in significant financial losses (Kumar *et al.,* 2022). Climate change has been observed to impair water availability resulting in serious effects on rice production (Solaja *et al.,* 2024). To curb the adverse effects of climate change, rice farmers need to be provided with and/or access the basic forecast information on future climate trends. However, farmers' access to climate information services over the years has become a challenge (Bessah *et al.,* 2021). Farmers' use of climate information services can empower them to efficiently manage the risk related to changing climate through the adoption of suitable adaptation strategies (Bessah *et al.,* 2021; Vaughan *et al.,* 2017). Farmer's access to timely climate information could facilitate them to prepare for the uncertainty of the changing climate. Also, improving farmers' access to suitable climate information services will help them meet their information needs (Odawa *et al.,* 2024). Small-scale farmers' lack of access to climate information services is a significant hurdle to the adoption of climate-smart agriculture technologies (Autio *et al.,* 2021; Ngigi and Muange*,* 2022). However, farmers' information source is a basis for incorporating climate change mitigation measures in their farming activities. It is considered that information sources are means of publicizing ideas; and the higher the number of sources of information accessible to farmers, the higher the chance of farmers getting access to information on changing climate (Orifah *et al.,* 2021). Globally, a number of empirical studies (Alidu *et al.,* 2022; Antwi-Agyei *et al.* 2021; Bessah *et al.,* 2021; Eta, 2023; Odawa *et al.,* 2024; Orifah *et al.,* 2021; Sanga and Elia, 2020) have reported farmers sources of accessing climate information and determinants of farmers' access to climate information. However, specifically, there is a dearth of information on rice farmers' access to climate information and factors influencing their access to climate information in the study area. Therefore, it is against this backdrop that the study attempts to determine rice farmer's access to climate change information.

METHODOLOGY

The Study Area

The study was carried out in Niger State, Nigeria. The state has a land mass of 74, 108.58 Square Kilometres with approximately 85% arable land. Geographically, Niger state is situated in the North central region of the country and lies between latitudes 11°30'N and longitudes $7^0$18'E. The projected population of the state is 5,556,247 inhabitants (National Bureau of Statistics, 2019). About 85% of the population representing the majority in the state are engaged in farming activities.

Data and Sampling Technique

A multi-stage sampling procedure was used in the selection of respondents and locations for this study. The first stage involved the random selection of two (2) Local Government Areas from each of the Agricultural Zones I, II and III of Niger State. The second stage is the random selection of three (3) farming communities from each of the selected LGAs. Thirdly, random sampling of the 365 rice farmers from the selected farming communities.

Methods of Data Analysis

Descriptive statistics

Descriptive statistics such as frequency, charts, and percentages were used to describe the socio-economic characteristics of the respondents and assess rice farmers' climate information sources.

Binary logit model

The binary logit regression model was used to analyse factors determining farmers' access to climate information. Binary logit regression is utilized when the dependent variable is dichotomous and the independent variables are either continuous or categorical (Park, 2013). The implicit form of the binary logit regression model following Khan *et al.* (2022) is expressed as:

$$Y_{ij} = \alpha + \Sigma X_k \beta_k + \varepsilon y_{ij} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where;

i = indicates a farmer who has no access to climate information

j = indicates farmer who has accessed climate information

α = intercept

β = coefficient of the binary regression model

X_k = vector of the exogenous independent variables that influence farmers' access to climate information

k = indicates a particular independent variable

εy_{ij} = error term

X_1 - X_{10} = are explanatory variables as defined in Table 1.

However, a binary variable is observed thus;

$$Y_{ij}^{*} = \begin{cases} 0, & Y \leq 0 \\ 1, & Y > 0 \end{cases} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where;

Y_i^* = an observed variable showing i^{th} farmers who have no access to climate information ($Y \leq 0$), indicates farmers who have accessed climate information ($Y > 0$). The above equation (equation 2) can be interpreted in terms of an observed (Y_{ij}^{*}). Where G denotes a specific binomial distribution (equation 3) (Khan *et al.,* 2022) expressed thus;

$$Pr\left(Y_{ij}^{*} = 1\right) = Y_{ij}^{*} = G\left(X_k \beta_k\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

The explicit form of the binary logit regression model is expressed as:

$$Y_{ij} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} \ldots\ldots (4)$$

Where;

Y_{ij} = Climate information access (1 = if farmer access, 0 = No)

β_0, β_1, β_3 ---------- β_{10} = are regression coefficients of the binary model

e = error term

X_1= Age ; X_2= Sex; X_3 = Educational level; X_4 = Extension contacts; X_5 = Radio ownership; X_6 = Farming experience; X_7 = Cooperative membership; X_8 = Access to credit services ; X_9 = Climate change awareness; X_{10} = Mobile phone ownership

Table 1: Summary of variables measurement

Variables	Measurement	Expected sign
Dependent variable		
Climate information access	1 = if farmer has access to climate information, 0 = No	
Independent variables		
Age	Years (continuous)	+
Sex	Male = 1, Female = 0	+
Educational level	Years of schooling (continuous)	+
Extension contact	Number of contacts received in a cropping season (continuous)	
Radio ownership	1 = if farmer owned a radio, 0 = otherwise	+
Farming experience	Years spent in rice farming (continuous)	+
Cooperative membership	1 = yes, 0 = otherwise	+
Access to credit services	1 = if farmer availed, 0= No	+
Climate change awareness	Aware = 1, Not aware = 0	
Mobile phone ownership	1 = if farmer owned a mobile phone, 0 = otherwise	+

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Respondents

Table 2 revealed that 69.3% of the rice farmers are between the ages of 21 and 50 years, implying that most of the rice farmers are within their productive age. Pickson and He (2021) reported an average age of 54 years among rice farmers in Chengdu. They further revealed that older rice farmers are highly sensitive to climate stress. Rice production in the study area is male dominated (91.0%). This could be due to the cultural or religious adherence of the farmers that allocate job responsibility to male and female farmers. The male farmers are saddled with the responsibility of providing food to feed the family. However, women are solely saddled and/or recognized with the household chores. The statement corroborates the assertion of Orifah *et al.,* (2021) that prevailing socio-cultural and religious environments delineate job roles for both males and females. The result is in tandem with the findings of Onyeneke (2021) and Ho *et al.* (2022), who reported male domination in rice production. Approximately 38.6% of the farmers had farming experience of ≤10 years while 34.0% had farming experience of between 11 to 20 years. Farmers with more years of farming experience are better informed about climate changes, increasing their likelihood of adapting to changing climate (Yakubu and Oladele, 2021). Almost half (49.9%) of the rice farmers had no formal education. Farmers' low enrolment in formal education is suggested to impede the adoption of modern technologies. This is because education heightens farmers' awareness and knowledge of these technologies (Alidu *et al.,* 2022; Anang *et al.,* 2021).

Table 2: Socio-economic Characteristics of the rice farmers (n=365)

Characteristics	Frequency	Percentage	Mean
Age (yrs)			44.3
≤20	2	0.6	
21 – 30	54	14.8	
31 – 40	73	20.0	
41 – 50	126	34.5	
51 &Above	110	30.1	
Sex			
Male	332	91.0	
Female	33	9.0	
Level of Education			
Non-formal education	182	49.9	
Primary	39	10.7	
Secondary	111	30.4	
Tertiary	33	9.0	
Farming experience			16.8
≤10	141	38.6	
11 – 20	124	34.0	
21 – 30	60	16.4	
31 – 40	33	9.0	
41 and above	7	2.0	
Cooperative membership			
No	90	24.7	
Yes	275	75.3	
Access to extension services			
No access to extension services	248	67.9	
Access to extension services	117	32.1	
Access to credit			
No access to credit	292	80.0	
Access to credit	73	20.0	

Source: Field survey; 2023

The result of the analysis showed that respondents (80.0%) have no access to credit. Also, 67.9% of the farmers have no access to extension services. Abou *et al.* (2023) reported that 58.5% of the rice farmers in Bida, Shiroro and Wushishi local government areas of Niger state have access to extension services. Farmers' extension contact offers the opportunity for capacity building and livelihood enhancement (Orifah *et al.,* 2021). Further, 75.5% of the farmers are members of a cooperative association. Farmers belonging to a cooperative association could benefit by getting information on climate change from fellow farmers. Findings of rice farmers being members of cooperative associations were reported by Onyeneke (2021) and Gbemavo *et al.* (2021).

Farmer's Sources of Climate Change Information

Sources of climate information available to farmers are key to integrating climate change coping measures in their farming activities. This is because farmers could stand the chance of getting information on climate variability. The results in Figure 1 indicate that the majority (51%) of the rice farmers have no source of accessing climate information. Farmers not having a source of timely climate information could be confronted with numerous challenges that can significantly impact their food security. This is because they have no access to relevant information about climatic changes, which will help them to safeguard against the adverse impacts of the changing climate. For instance, without timely information on weather forecasts or climate, farmers may select unsuitable crops or plant at the wrong time, which may lead to reduced yield. However, through access to seasonal climate forecasts, smallholder farmers can efficiently plan their farming activities (Djido *et al.,* 2021; Guido *et al.,* 2020). The result further revealed that 26% of the farmers accessed climate information from the radio. The use of radio as a means of accessing climate change information by farmers is due to its affordability and farmers' perceived usefulness of the programs disseminated via radio (Sanga and Elia, 2020). The use of radio in accessing information by rice farmers was reported by Orifah *et al.* (2021). Radio offers convenience to farmers due to most of their time being utilized on farm obligations, which allows them to continue to get information even when on the move (Sanga and Elia, 2020). The respondents (14%) accessed climate information via mobile phone, while 2% of the rice farmers accessed climate information through television/news media. Orifah *et al.* (2021) reported that 12.6% and 18.8% of the rice farmers in Jigawa state accessed climate information through television and newspapers, respectively. The lack of electricity in rural areas and the initial cost required to purchase smartphones and televisions could impede farmers from using them to access climate change information (Sanga and Elia, 2020). Other sources from which rice farmers accessed climate information are extension agents (5%) and cooperatives and friends (2%). Similar findings of rice farmers utilizing extension agents and cooperative society in accessing climate information were reported by Orifah *et al.* (2021).

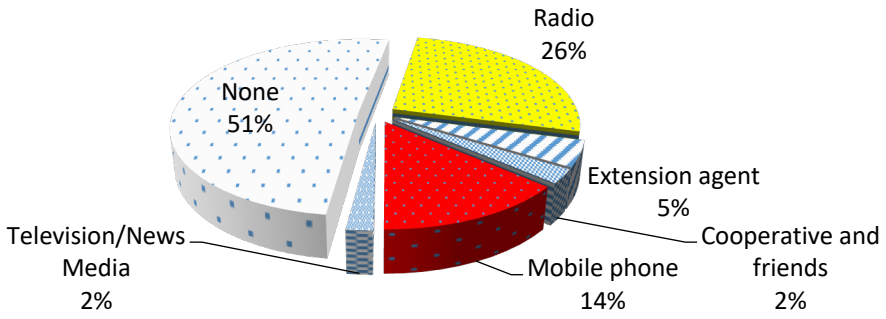

Figure 1: Farmer's source of climate information

Determinants of Farmers' Access to Climate Information

Table 3a and Table 3b shows the results of the parameter estimates and marginal effects of the binary logit model. Age is significant at a 10% probability level and indicates a negative relationship with the farmer's access to climate information.

Table 3a: Determinants of Farmers' Access to Climate Information

Explanatory variables	**Coefficient**	**Std. Error**	**z-values**	**p> |z|**
Age	-0.0955*	0.0550	-1.7400	0.0830
Sex	0.6700	1.3767	0.4900	0.6260
Education level	0.2422***	0.0803	3.0200	0.0030
Extension contact	-0.2563**	0.1093	-2.3400	0.0190
Radio ownership	10.1982***	1.7634	5.7800	0.0000
Farming experience	0.1773***	0.0642	2.7600	0.0060
Cooperative membership	1.2718	0.9168	1.3900	0.1650
Access to credit services	1.7811*	0.9782	1.8200	0.0690
Climate change awareness	3.4411***	1.2308	2.8000	0.0050
Mobile phone ownership	6.4993***	1.6805	3.8700	0.0000
Constant	-7.3418***	2.4608	-2.9800	0.0030
No. of observation	365			
LR $chi^2(10)$	431.4600			
Prob > chi^2	0.0000			
Pseudo Log Likelihood	-37.2588			
Pseudo R^2	0.8527			

**P≤0.1; **P≤0.05; ***P≤0.01 statistically at 10%, 5% and 1%*

Table 3b: Marginal effects on rice farmers' access to climate information

Explanatory variables	**Marginal effects (dy/dx)**	**Std. Error**	**z-values**	**p> |z|**
Age	-0.0029*	0.0016	-1.7900	0.0740
Sex	0.0204	0.0420	0.4900	0.6270
Education level	0.0073***	0.021	3.3600	0.0010
Extension contacts	-0.0078**	0.0030	-2.5500	0.0110
Radio ownership	0.3110***	0.0304	10.2200	0.0000
Farming experience	0.0054***	0.0017	3.0300	0.0020
Cooperative membership	0.03878	0.0270	1.4400	0.1510
Access to credit services	0.0543*	0.0290	1.8700	0.0610
Climate change awareness	0.1049***	0.0364	2.8800	0.0040
Mobile phone ownership	0.1982***	0.0410	4.8300	0.0000

**P≤0.1; **P≤0.05; ***P≤0.01 statistically at 10%, 5% and 1%*

Thus, based on the marginal effect estimates, a unit increase in the farmer's age is expected to decrease farmers' chance of accessing climate information by 0.29%. By implication, the likelihood of younger farmers accessing climate information is higher than that of aged farmers. Implicitly, aged farmers could be less inclined to utilize modern technologies such as smartphones and the internet in accessing climate information; but may depend on their experience and traditional understanding of changing climate rather than seeking information from external sources. The result is in tandem with the findings of Antwi-Agyei *et al.* (2021) who reported a negative association between a farmer's age and access to climate information.

Education of the farmers has a strong relationship with the farmers' access to climate information and is statistically significant at $p \leq 0.01$. Implying that if farmers attain one more year of education, the likelihood of accessing climate information increases by 0.73%. Also, this suggests that farmers with higher educational levels are aware of the importance of climate information in their farming activities. Therefore, the higher the farmers' level of education, the more likely to have higher access to climate information. The comparable finding of positive association on education was reported by Eta (2023). Education heightens farmers' understanding of best agricultural practices for responding to the adverse impacts of climate change (Sanga and Elia, 2020). Further, a negative relationship is found between farmers' extension contact ($p \leq 0.05$) and access to climate information. Suggesting that as the number of extension contacts increases, the likelihood of rice farmers accessing climate information decreases by 0.78%. This could be because extension agents may lack adequate resources to deliver timely and precise information to the farmers. Hence, farmers may depend on other sources of information such as radio, television or cooperative organizations rather than extension services. The result disagrees with the finding of Alidu *et al.* (2022) who reported that farmers who have access to agricultural extension services are more likely to access climate information.

The result of the analysis further revealed that ownership of radio ($p \leq 0.01$) was positively associated with farmers' access to climate information. Thus, farmers who own radio are more likely to access climate information. This indicates that radio is an effective channel for the dissemination of climate information to farmers. This may be due to radios' easy accessibility even in remote areas and it is moderately inexpensive to own and operate. Also, radio stations frequently broadcast in local dialects and the contents are tailored to the specific needs of farming communities. Sanga and Elia (2020) posited that farmers resort to radio use because they can easily access information at a minimal cost. Farming experience has a positive relationship with the farmers' access to climate information, it is significant at a 5% probability level. This implies that the more experienced the farmers are, the more likely to access climate information. Also, a year increase in the farmers' experience, increases their ability to access climate information by 0.54%. The finding is in agreement with the findings of Antwi-Agyei *et al.* (2021) and Eta (2023) who reported a positive relationship between farmers' years of farming experience and their access to climate information.

Farming experience can positively impact farmers' access to climate information because there exists knowledge and/or information garnered on various ways of accessing climate information.

Access to credit services and climate change awareness both had a positive relationship with farmers' access to climate information. They are statistically significant at 10% and 5% probability levels respectively. The marginal effect (0.0543) of access to credit shows that farmers who accessed credit were more likely to access climate information. By implication, the finding shows that access to financial capital enhances farmers' capability to explore different sources to access climate information. Access to credit facilities is a strong predictor of farmers' readiness to pay for climate information services (Antwi-Agyei *et al.,* 2021). Furthermore, the more aware the farmers are about the changing climate, the more likely to access climate information. This is in tandem with the findings of Bessah *et al.* (2021). Farmers' awareness of the changing climate raises their curiosity to seek out information on weather forecasts to effectively prepare to mitigate probable negative shocks from the changing climate (Bessah *et al.,* 2021). Further, farmers' mobile phone ownership ($p \leq 0.01$) significantly influenced their access to climate information. Suggesting that mobile phone is a valuable tool for disseminating climate information to farmers. Mobile phones allow farmers to interact directly with extension agents to receive weather forecasts or interact with fellow farmers to exchange climate-related knowledge. Antwi-Agyei *et al.* (2021) posited ownership of assets such as radio, mobile phone, internet and television does not influence farmers' access to climate information. However, Alidu *et al.,* (2022) reported that smallholder farmers who own assets are more likely to access climate information.

CONCLUSION AND RECOMMENDATIONS

The study concludes that rice production in the study area is male-dominated; with majority of the farmers still in their productive age. While radio emerged as the most used source of accessing climate information, almost half of the farmers have no source of accessing climate change information. Further, some socioeconomic and institutional factors such as educational level, access to radio, farming experience, access to credit, climate change awareness, and access to mobile phones were found to have a significant influence on the farmers' access to climate information. However, age and extension contact negatively impacted information access.

The following are therefore recommended;

i. The use of radio in raising awareness and disseminating climate change information among rice farmers should be incorporated into all efforts to encourage the adoption of practices that mitigate the effects of climate change within the rural setting.

ii. Efforts should be made to encourage farmers' enrolment in formal education as it is one of the factors that influence their access to climate information.

iii. Also, accessing affordable credit facilities is important in enhancing farmers' capability to access climate information. Thus, farmers should form cooperative associations to enhance their chances of accessing credit.

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