

**CLIMATE CHANGE
VULNERABILITY AND
ADAPTATION****STRATEGIES BY SMALLHOLDER RICE
FARMERS IN NORTH CENTRAL NIGERIA****G.A. UBANDOMA¹, D.H. YAKUBU², F.J.
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This study assesses climate change vulnerability and adaptation strategies among smallholder rice farmers in North-central, Nigeria. Multistage sampling procedure was used to select 270 rice farmers; data collection was done using structured questionnaires. Data were analyzed using descriptive statistics. The results on socioeconomic characteristics of the respondents' revealed the mean age of 37.46 years, majority (71.10%) were male, married (75.9%) with an average household size of 7 persons. Most (91.80%) of

them had formal education and are full-time rice farmers (74.0%) with 13.37 years of experience, earning ₦142,185 annually from rice. Land acquisition is mostly (54.40%) through inheritance with 1.44

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hectares on average. Many (75.60%) are cooperative members with 6.85 years of membership, and about half (50.40%) accessed credit. The results on farmers' knowledge of climate change, specifically recognizing destruction of vegetation and trees (82.90%), daily temperature increases (77.40%), and drought occurrences (68.50%). The results on farmers' perceive effects of climate change indicated that climate change poses risks to rice production ($\bar{x}$ = 2.60) and climate change

presents more risks than benefits to rice production ($\bar{x}=2.30$) were considered as high perceived effects on rice production. The results on the use of climate change adaptation strategies revealed the use of herbicides (87.8%), adoption of improved rice varieties (83.7%), and utilization of weather forecasts (83.0%). The results on constraints revealed high costs of farm inputs (66.7%) and the high cost of improved rice varieties (64.1%).

Policymakers and development initiatives should support and promote the diverse range of climate change adaptation strategies employed by smallholder rice farmers was offered as recommendation.

Introduction

Climate Change (CC) refers to change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties that persists for an extended period typically decades or longer, primarily caused by human activities and natural forces resulting to the increasing levels of greenhouse gases in the Earth's atmosphere. CC is now recognized to have a significant impact on disaster management efforts and pose a significant threat to the efforts to meet the growing needs of the vulnerable population (Intergovernmental Panel on Climate Change (IPCC), 2021). Climate change has widespread impacts, including more frequent and severe heat waves, flood, droughts, and storms, as well as rising sea levels and altered ecosystems. These changes can have devastating effects on food production, human health, economic stability, and environmental sustainability (Burke *et al.*, 2022).

Many countries, which have their economies largely based on rain-fed and weather-sensitive agricultural production systems like Nigeria, are particularly vulnerable to climate change. This vulnerability has been demonstrated by the devastating effects of flooding in North-Central region. Flood is the cause of widespread rice yield losses in north-central zone and making the smallholder rice farmers' vulnerable (Ntat *et al.* 2020). Rice farming is said to be threatened by climate change because of higher temperatures and changing rainfall patterns. Acute water shortages combined with thermal stress could adversely affect rice productivity. It was concluded that rice yield showed a decline when temperature and rainfall exceeds the critical levels (Prantilla and Laureto, 2017, Hikmatyar *et al.* 2024),

The vulnerability characteristics of a given population are connected to the process of adaptation, which provides a framework for improving the capacity of people to respond to stress. Also, identifying both the generic and climate-specific elements of farmers' adaptation behavior is vital in order to facilitate a societal response to the changes in climate. Thus, for poor countries like Nigeria that are highly vulnerable to effects of climate change, understanding farmers' response to climate change is crucial, as this will

help in designing appropriate adaptation strategies. The degree of climate change vulnerability can be reduced to a great extent if not completely eliminated through proper climate change adaptation strategies (IPCC, 2017).

Globally, rice is grown on more than 140 million hectares and consumed more than any other cereal food crop (Rodenurg and Saito, 2022). Rice is among the three most important cereals crops in the World, which has the capacity to fulfill food needs across the globe (Wang *et al.*, 2023). Rice is grown in about 40 out of 54 countries in Africa and its cultivation is the principal activity and source of income for more than 35 million smallholder rice farmers in Africa (Martins *et al.*, 2021). Nigeria is the largest producer of rice in Africa and ranked as the 14th largest producer Worldwide (Alih *et al.*, 2021). The annual rice demand in Nigeria has been on the rise, increasing by 7.7%, while supply has grown at contrasting rate of 5.5%, resulting in a deficit demand-supply gap of 2.2%. This is due to challenges such as climate change and over-dependent on smallholder farmers (Onoja *et al.*, 2024).

To find solution to the challenges posed by climate change in rice production, there is the need to investigate the climate change vulnerability and adaptation strategies by smallholder rice farmers. It is believed with understanding farmers' respond to climate change it will help in designing appropriate adaptation strategies. With appropriate adaptation strategies in place, the climate change vulnerability on rice production will be reduced or completely eliminated. It is against this background this study assessed the climate change vulnerability and adaptation strategies by smallholder rice farmers in north central Nigeria. The specific objectives were to:

(i.) describes the socioeconomic characteristics of smallholder rice farmers in the study area (ii.) determine the farmers' use of climate change adaptation strategies on rice production; and (iii.) identify the constraints to use of climate adaptation strategies by smallholder rice farmers in the study area.

Description of the Study Area

The study was conducted in three north central States of Nigeria namely: Benue, Nasarawa and Niger. The zone consists of Benue, Kogi, Kwara, Nasarawa, Niger and Plateau States and Federal Capital, Abuja. The area is located between Longitudes 2°30' to 10°30' E of Greenwich meridian and Latitudes 6°30' to 11°20' N of the equator. The zone occupies a total land area of about 296,898km² with a population of about 22,887,250 people as at 2016 and a projected population of 27,937,252 as at 2024 (National Bureau Statistics (NBS), 2016). The zone consists of more than 40 ethnic groups. Also, more than 77% of the people in the zone are rural dwellers and are mostly engaged in one form of agricultural activity or the other. The north central shares border with Cameroon and

Benin Republics in the north east and North West respectively (Isonguyo et al., 2021). The zone has two main seasons, namely dry and wet seasons. The wet seasons occur from the end of March till the end of October, while the dry season begins from November and end towards March. The rainfall per annum ranges from 1000mm to 1500mm with an average of 187 to 220 rainy days, and average monthly temperature ranging from 21°C and 37°C. The Zone's vegetation consists of the Forest Savannah Mosaic, Southern Guinea Savannah and Northern Guinea Savannah. The major crops cultivated include rice, maize, millet, sorghum, yam, potatoes, cassava, cowpea, soybean, vegetables and fruits (Isonguyo et al., 2021).

Sampling Procedure and Sample Size

The smallholder rice farmers in Benue, Nasarawa and Niger States constituted the sample frame for the study. A multistage sampling procedure and purposive selection were used for this study. In the first stage, three States (Benue, Nasarawa and Niger) out of six States in the zone were selected. The purposive selection was based on the intensity of rice production and the number of smallholder rice farmers in the three States. In the second stage, 4 producing Local Government Areas (LGAs) were purposively selected in Benue, 2 LGAs in Nasarawa and 3 LGAs in Niger States. This gave a total of 9 out of 29 LGAs in the study area at 30%. The LGAs selected in Benue State were: Guma, Tarka, Gwer east and Gboko, in Nasarawa State were Doma and Lafia and in Niger State were Katcha, Lavun and Wushishi. The third stage involved a selection of 24 villages out of 119 at 20% based on the high number of rice farmers. The fourth stage involved a random selection of 270 farmers out of 1350 (Sample frame) at 20% from the selected villages to give the study sample (Table 1).

Table 1: Sampling Procedure and Sample Size

Selected States	Number of rice producing LGAs	Selected LGAs (30%)	Number of rice producing villages	Selected villages (20%)	Number of rice farmers	Selected rice farmers (20%)
Benue	14	Guma	15	Abinsi	45	9
				Daudu	50	10
				Agasha	55	11
		Tarka	10	Akoodo	70	14
				Wannune	45	9
				Ikpayongo	35	7
		Gwer-east	13	Aghor	30	6
				Ahumbe	40	8
				Akpagher	55	11
		Gboko	12	Mbayion	25	5

Selected States	Number of rice producing LGAs	Selected LGAs (30%)	Number of rice producing villages	Selected villages (20%)	Number of rice farmers	Selected rice farmers (20%)
Nasarawa	6	Lafia	13	Shabu Kwandere	70	14
		Doma	15	Gidan mai akuya	100	20
				Iwashi	80	16
				Alagye	95	19
				Doma	50	10
					55	11
Niger	9	Katcha	12	Badeggi	60	12
		Lavun	13	Katcha	50	10
				Batage	50	10
				Mijin gari	60	12
				Ndaloke	40	8
		Wushishi	15	Bankogi	65	13
				Tungan	45	9
				kawo	80	16
				Wushishi		
Total	29	9	119	24	1,350	270

Source: Reconnaissance survey, 2024.

Data Collection

Data for the study was obtained from primary and secondary sources. The former data was collected with the aid of structured questionnaires. The secondary information was obtained from survey data such as the patterns of temperature and rainfall for 30 years (1994-2024) collected from Nigerian Meteorological Agency (NIMET) and some relevant literatures related to the study.

Data Analysis

Data obtained for this study were analyzed using descriptive (frequency count, percentage and mean) statistics. Objectives i, ii and iii were achieved using frequency counts and mean.

Socioeconomic characteristics of smallholder rice farmers

Table 2 showed the mean ages were 39.23 years, 36.79 years and 36.36 years, in Niger, Nasarawa and Benue states respectively. This implies that Niger State had a relatively older population of rice farmers. The youthful population of farmers in Benue and Nasarawa States may be more receptive to innovations, which could enhance their adaptive capacity. Also, the overall (71.1%) were males. This implies that rice farming in

these three states was dominated by males. This finding collaborate the findings of Yakubu *et al.*, (2021), who asserted that the agricultural sector and the tedious activities are dominated by males. Table 2 shows that majority (75.9%) of the respondents were married. This is consistent with the study by Ogunniyi *et al.* (2021) who found that married households were mostly engaged in farming. Also, the mean household size varies across States, with Niger State having the largest mean household size. This may imply that households in Niger State have more labor available for farming activities.

Table 2: Distribution of Respondents according to Socioeconomic Characteristics (n =270)

Variables	Benue State (n=90)		Nasarawa State (n=90)		Niger State (n=90)		Pooled Sample (n=270)	
	Freq	%	Freq	%	Freq	%	Freq	%
Age (years)								
25-45	67	74.4	59	65.6	14	16.0	140	51.9
46-66	20	22.2	31	34.4	72	80.0	123	45.6
67-87	3	3.3	0	0.0	4	14.0	7	2.5
Mean		36.36		36.79		39.23		37.46
Sex								
Male	52	57.8	67	74.4	73	81.1	192	71.1
Female	38	42.2	23	25.6	17	18.9	78	28.9
Marital status								
Married	47	52.2	74	82.2	84	93.3	205	75.9
Single	28	31.1	10	11.1	3	3.3	41	15.2
Divorce	9	10.0	4	14.4	1	1.1	14	5.2
Widow	6	6.7	2	2.2	2	2.2	10	3.7
Household size (in number)								
0-5	61	67.8	49	54.4	21	23.33	131	48.5
6-11	15	16.7	30	33.3	47	52.22	92	34.1
12-17	4	4.4	5	5.6	19	21.11	28	10.4
18-23	8	8.9	6	6.7	2	2.22	16	5.9
>23	2	2.2	0	0.0	1	1.11	3	1.1
Mean		5.83		6.17		9.01		7.00
Occupation								
Full-time farmer	62	68.9	70	77.8	68	75.6	200	74.0
Part-time farmer	28	31.1	20	22.2	22	24.4	70	26.0
Educational attainment								
Informal education	1	1.1	9	10.0	12	13.3	22	8.2
Primary education	18	19.8	24	26.7	12	13.3	54	20.0
Secondary education	36	40.0	29	32.2	36	40.0	101	37.4
Tertiary education	35	38.9	28	31.1	30	33.3	93	34.4

Variables	Benue State (n=90)		Nasarawa State (n=90)		Niger State (n=90)		Pooled Sample (n=270)	
Farming experience (in years)								
1-10	60	66.7	27	30.0	26	28.90	113	41.9
11-20	20	22.2	39	43.3	22	24.44	81	30.0
21-30	6	6.7	24	26.7	40	48.44	70	25.9
>30	4	4.4	0	0.0	2	2.22	6	2.2
Mean		8.67		14.29		17.15		13.37
Income from rice (₦)								
30000-100000	16	17.6	18	20.0	17	18.9	51	18.9
101000-171000	42	46.7	36	40.0	53	58.9	131	48.5
172000-242000	32	35.6	36	40.0	20	22.2	88	32.6
Mean		139772		149105		137677		142185

Source: Field survey, 2024

According to a recent study by Ndamani and Takeya (2022) who reported that household size can influence farmers' decision-making. Table 2 showed that majority (74.0%) considered farming as primary occupation. This implies that the high percentage of full-time farmers underscores the need for sustainable agricultural practices and climate-resilient technologies to support their livelihoods. According to Abdulai *et al.* (2020) who asserted that full-time farmers may require more intensive support and training on climate-resilient agricultural practices. Also, 98.7% of the respondents in Benue State, 90.0% in Nasarawa State and 86.6% in Niger State had primary, secondary and tertiary education. This implies that Benue State had high percentage of educated farmers. This finding agrees with Adebayo *et al.* (2017) who stated that about 70% of the farmers in Adamawa State, Nigeria had some form of formal education. Also, Table 2 revealed the mean farming experience of 17.15 years, 14.29 years and 8.67 years for Niger, Nasarawa and Benue States respectively. This implies that, farmers in Niger State were more experienced in farming. Ousmanou and Alhaji (2017) found that years of farming experience induced farmers' decision to use responses to climate change. Table 2 showed that the overall mean rice income was ₦142,185. This implies that the farmers in the study area were averagely financially to carter for farm expenses. Ayanlade *et al.* (2017) reported that farmers with higher incomes may be more likely to adopt climate change adaptation strategies.

Use of Climate Change Adaptation Strategies

Table 3 revealed that soil and land management strategies were widely used. Majority (70.4%) of the farmers used hand weeding, 87.8% used herbicides and 68.9% used organic

manure. This implies that the rice farmers in the study area depend on herbicides; hand weeding and organic manure as climate change adaptation strategies to curtail the impacts of climate change in their rice farms. According to Kumar *et al.* (2020) in a study on impact of climate change on rice production and adaptation strategies in India; stated that the widespread use of soil and land management strategies implies that the approach is effective and should be scaled up.

Table 3: Distribution of farmers according to use of climate change adaptation strategies (n=270)

	Benue State (n=90)		Nasarawa State (n=90)		Niger State (n=90)		Pooled Sample (n=270)	
Variable	Freq	%	Freq	%	Freq	%	Freq	%
Soil and land management								
Sand filling	29	32.2	76	84.4	55	61.1	160	59.3
Hand weeding	84	93.3	74	82.2	50	55.6	208	77.0
Cultural control of pest	58	64.4	77	85.6	55	61.1	190	70.4
Use of organic manure	60	66.7	73	81.1	53	58.9	186	68.9
Use of herbicides	83	92.2	71	78.9	83	92.2	237	87.8
Family supplied labour	55	61.1	73	81.1	50	55.6	178	65.9
Crop specific innovation								
Improved crop varieties	84	93.3	74	82.2	68	75.6	226	83.7
Pest and diseases resistant varieties	49	54.4	77	85.6	81	90.0	207	76.7
Early maturing crop	55	61.1	76	84.4	73	81.1	204	75.6
Changing planting dates	61	67.8	72	80.0	72	80.0	205	75.9
Use of nursery bed	70	77.8	76	84.4	79	87.8	225	83.3
Water linked management								
Irrigation	52	57.8	30	33.3	86	95.6	168	62.2
Water storage	37	41.1	72	80.0	70	77.8	179	66.3
Climate information services								
Weather forecast	78	86.7	76	84.4	70	77.8	224	83.0
Extension services \	51	56.7	81	90.0	72	80.0	204	75.6
Training on climate change	50	55.6	40	41.4	64	71.1	154	57.0
Access to finance								
Access to credit facilities	37	41.1	82	91.1	64	71.1	183	67.8
Access to insurance services	00	00	00	00	00	00	00	00
Livelihood diversification								
Off-farm employment	64	71.1	79	87.8	77	85.7	220	81.5
Migration	36	40.0	82	91.1	57	63.3	175	64.8

Source: Field survey, 2024

In Table 3 Majority (93.3%) of the farmers in Benue State, 82.2% in Nasarawa State and 75.6% in Niger State used improved crop varieties. This implies that Benue State uses improved rice varieties more than Nasarawa and Niger States. Similarly, majority (87.8%) in Niger State, 84.4% in Nasarawa State and 77.8% in Benue State used nursery bed. In the same vein, Niger State uses nursery bed in rice cultivation more than Benue and Nasarawa States. This implies that, crop specific innovation was commonly and widely used in the study area. Bello (2023) in a study on analysis on adaptation to climate change among rice farmers in Western Zone of Bauchi State, Nigeria; reported that the use of improve variety was a satisfying climate change adaptation strategies.

Table 3 revealed the overall (66.3%) of the farmers used water storage with 80.0% in Nasarawa, 77.8% in Niger and 41.1% in Benue States respectively. Similarly, majority (95.6%) of the farmers used irrigation in Niger, 57.8% in Benue and 33.3% in Nasarawa States respectively with overall 62.2% of the farmers. This implies that Water-linked management strategies were used by a significant proportion of farmers. Water storage was used most in Nasarawa State while irrigation was used most in Niger State. Having water storage system will avoid complete rice failure. This was in line with Yakubu *et al.* (2021) in a study on Assessment of perceived effects of climate change in rice production among farmers in North-west zone, Nigeria; who reported that the most significant climate change adaptation strategy used by farmers was water harvesting to improve soil moisture.

Table 3 revealed the overall (83.0%) of the farmers used weather forecast with 86.7% in Benue, 84.4% in Nasarawa and 77.8% in Niger States respectively. Similarly, 90.0% of the farmers in Nasarawa, 80.0% in Niger and 56.7% in Benue States, used extension services with overall 75.6% of the farmers in the study areas. The rice farmers used weather forecast and extension services as climate change adaptation strategies in the study areas. The use of weather forecast by the rice farmers will enable the farmers to predict weather and its derivatives in order to plan and prepare with the appropriate climate change adaptation strategies ahead to avoid climate change effects on rice production. Nabara *et al.* (2023) in a study on Perception of climate change and Proposed adaptation strategies among Rice Farmers in North central Nigeria; reported that frequency of extension contacts to farmers during production plays a vital role on the level of accuracy and prediction of weather with respect to climate change.

Table 3 revealed that 91.1%, of the farmers in Nasarawa State, 71.1% in Niger State and 41.1% in Benue State used credit facilities. The farmers used credit facilities to harness their efforts in curtailing the effects of climate change. Fund is needed to purchase farm implements, farm inputs and other items necessary to negate the effects of climate change and improvement on livelihoods. This finding agrees with Alawode (2021) on income diversification and savings pattern among rural women in Oyo State, Nigeria; who

stated that access to credit increases the farmers' investment in agricultural activities and livelihoods.

Table 3 showed that majority (81.5%) of the farmers used off-farm employment proceeds to reduce the adverse effects of climate change on their rice production, with 87.8% in Nasarawa State, 85.7% in Niger State and 71.1% in Benue State. Similarly, 91.1% of the farmers in Nasarawa State, 63.3% in Niger State and 40.0% in Benue State used migration as climate change adaptation strategies in the study areas. This implies that livelihood diversification strategies were used by many rice farmers to reduce the effects of climate change and improve on their welfare. Yakubu *et al.* (2021) in a study on assessment of perceived effects of climate change in rice production among farmers in North-west zone, Nigeria; asserted that rural households in Nigeria engaged in different kinds of off-farm activities in order to supplement earnings from agriculture and family welfare.

Constraints to Use of Climate Change Adaptation Strategies

Table 4 revealed the most significant personal constraints were inadequate knowledge of climate change (58.2%), farm distance (48.2%), low literacy level (47.8%) and farm size (43.3%).

This implies that the rice farmers in the study areas had various constraints related to personal constraints to climate change adaptation strategies that hindered the maximum of rice production. According to Akinbode *et al.*, (2021), small farm sizes limit the adoption of climate-resilient practices, such as agroforestry and conservation agriculture, which require larger land areas.

Table 4: Distribution of farmers according to constraints to use of CCAS

Variable	Benue State (n=90)		Nasarawa State (n=90)		Niger State (n=90)		Pooled Sample (n=270)	
	Freq	%	Freq	%	Freq	%	Freq	%
Personal constraints								
Low literacy level	53	58.9	29	32.2	47	52.2	129	47.8
Farm size	47	52.2	22	24.4	48	53.3	117	43.3
Land ownership	26	28.9	21	23.3	28	31.1	75	27.8
Cultural incompatibility	15	16.7	7	7.8	22	24.4	44	16.3
Inadequate knowledge of climate change	44	48.9	37	41.1	76	84.4	157	58.2
Non-farm job	10	11.1	10	11.1	16	17.8	36	13.3
Farm distance	67	74.4	20	22.2	43	47.8	130	48.2
Poor soil fertility	38	42.2	57	63.3	38	42.2	133	39.3
Overgrazing	8	8.9	6	6.7	47	52.2	61	22.6
Urbanization	6	6.7	6	6.7	42	46.7	54	20.0

Variable	Benue State (n=90)		Nasarawa State (n=90)		Niger State (n=90)		Pooled Sample (n=270)	
	Freq	%	Freq	%	Freq	%	Freq	%
Scarcity of farm labour	40	44.4	14	15.6	52	57.8	106	39.3
Migration	6	6.7	2	2.2	25	27.8	33	12.2
Lack of coping strategies	28	31.1	15	16.7	66	73.3	109	40.4
Institutional constraints								
Poor access to information relevant to adaptation	55	61.1	20	22.2	61	67.8	136	50.4
Poor social network	45	50.0	27	30.0	43	47.8	115	42.6
Inconsistent government policies	44	48.9	21	23.3	48	53.3	113	41.9
Poor agricultural programmes								
Poor service delivery	50	55.6	15	16.7	42	46.7	107	39.6
Poor response to crises related to climate change	31	34.4	10	11.1	34	38.9	75	27.8
Inaccurate agro meteorological information	31	34.4	19	21.1	59	65.6	109	40.4
Poor dissemination of weather information	16	17.8	7	7.8	39	43.3	62	23.0
Inadequate finance and credit facilities	36	40.0	18	20.0	50	55.6	104	38.5
Poor extension services	42	46.7	38	42.2	56	62.2	136	50.4
Lack of training on climate change adaptation strategies	36	40.0	22	24.4	56	62.2	114	42.2
	32	35.6	49	54.4	69	76.7	150	55.6
Technical constraints								
Lack of irrigation facilities	49	54.4	27	30.0	34	37.8	110	40.7
High cost of farm inputs	60	66.7	44	48.9	76	84.4	180	66.7
Pest and diseases attack	34	37.8	18	20.0	42	46.7	94	34.8
Non-availability of improved rice varieties	32	35.6	23	25.6	29	32.2	84	31.1
High cost of improve varieties	66	73.3	50	55.6	57	63.3	173	64.1
Poor storage facilities	43	47.8	11	12.2	47	52.2	101	37.4
Poor processing facilities	36	40.0	11	12.2	23	25.6	70	26.0
High cost of farm operations	34	37.8	19	21.1	77	85.6	130	48.2

Source: Field survey, 2024

Results in Table 4 showed the most significant institutional constraints were lack of training on climate change adaptation strategies (55.6%), poor access to information relevant to adaptation (50.4%), inadequate finance and credit facilities (50.4%) and poor social network (42.6%). This implies that the rice farmers in the study areas had various constraints related to personal constraints to climate change adaptation strategies that hindered the maximum of rice production. According to Georgieva *et al.*, (2022) Lack of

training, poor access to information and inadequate finance significantly hinder climate change adaptation strategies, particularly in smallholder agriculture.

Table 4 revealed the most significant technical constraints were high cost of farm inputs (66.7%), high cost of improves varieties(64.1%), high cost of farm operations (48.2%) and lack of irrigation facilities(40.7%). poor storage facilities; high cost of farm operations and non-availability of improved rice varieties. Technical constraints hindered the farmers from using technology in farming.

Conclusion

The study's findings showed that smallholder rice farmers in the zone were married, with moderate household size, young and energetic. The results of the study further highlighted the resourcefulness and adaptability of rice farmers in responding to climate change challenges through a combination of soil and land management, crop specific innovation, water linked management, information services, access to finance and livelihood diversification. The study identified three categories of constraints that hindered farmers' ability to adapt to climate change strategies namely: Personal constraints, Institutional constraints and Technical constraints.

Recommendations

Based on the study's findings, the following recommendations were proposed:

1. Consider socioeconomic factors: Policymakers and development initiatives should consider socioeconomic Factors, such as age, occupation, and education, when promoting climate change adaptation strategies.
2. Build on Existing Knowledge: Develop climate change adaptation strategies that build on farmers' existing knowledge and understanding of climate change
3. Access to Finance: Improve access to financial services, including credit and insurance, to enable farmers to invest in their farms and manage climate-related risks.
4. Livelihood Diversification: Support livelihood diversification initiatives that enhance farmers' resilience to climate change and improve their overall well-being.

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