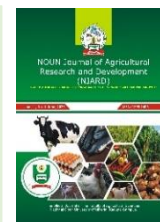




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Original Article

## Problem Confrontation Index to Farmers' Adoption of Climate Coping Strategies in Niger State, Nigeria



Abubakar, S.

Department of Agricultural Economics and Extension Services, Faculty of Agriculture, Ibrahim Badamasi Babangida University, Lapai, P.M.B. 11, Minna, Niger State, Nigeria

Email: [marafasulaiman3@gmail.com](mailto:marafasulaiman3@gmail.com); Phone number: +2347034797601

ORCID: 0009-0005-2096-3204

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### Abstract

The study examined factors constraining farmer's adoption of climate change coping strategies in Niger State, Nigeria. Multi-stage sampling procedure was used in selecting farmers for this study. Analysis of the socio-economic characteristics of farmers showed that about half (50.1%) of the farmers had primary, secondary or tertiary form of education. Majority (91.0%) of the farmers were male, 88.5% were married with the mean age 44 years. The mean household size was 11 persons in a household, while the average off-farm income and annual income from rice production was estimated to be ₦106,923.53 and ₦1,409,911.781 respectively. The average farm size is 2.5 hectares, implying that rice production is dominated by small-scale farmers. Farmers have observed an increase in the occurrence of erratic rainfall, rising temperature, occurrence of extreme winds, and increase in the duration and frequency of dry spells which influence negatively on rice production. This was indicated by 55.6%, 53.3%, 44.7%, and 56.4% of the farmers respectively. The highest constraints to the rice farmers' adoption of climate coping strategies are high cost of farm inputs, inadequate access to weather information, economic/financial constraints, and inadequate access to credit. Each had problem confrontation index (PCI) value of 1228, 1219, 1190, and 1183 indicating the severity of each constraint respectively. Stakeholders should make efforts towards subsidizing agricultural inputs to farmers in order to facilitate their adoption of climate coping strategies. Also, policy makers should introduce climate-risk insurance to protect farmers from losses caused by droughts, erratic rainfall and extreme winds event.

**Keywords:** Temperature, erratic rainfall, High cost of farm inputs, inadequate access to weather information

### INTRODUCTION

Climate change has affected many lives and properties in numerous farming communities of the underdeveloped countries of which Nigeria is inclusive. It has severely affected agricultural production through environmental degradation in many parts of Africa (Fadairo *et al.*, 2021). Climate change is projected to impact livestock and crop production, disrupts hydrologic cycles, alter input supply chains, and ultimately impacting rural living standards (Idris *et al.*, 2021). The negative impact of climate change on crop yield is

observable through irregular rainfall pattern and/or variability, changes in duration and frequency of drought spells, extreme winds occurrence, and rising temperature. The effects of changing climate comprise floods, droughts, and heat stress which can result in reduced agricultural production and scarcity of food for the populace (Abou *et al.*, 2023; Banjoko *et al.*, 2021; Ifabiyi *et al.*, 2022).

Nigeria is ranked 10<sup>th</sup> most vulnerable nation to climate variations and its proneness to climate



NJARD

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variability is noticeable by the country's largest population (Solaja *et al.*, 2024; Onyeneke, 2020). Farmers must put mitigation measures in place to reduce the risks associated with the effects of climate change in order to achieve food self-sufficiency through increased rice output. In order to mitigate the effects of climate change, adaptation is a practical strategy (Khan *et al.*, 2021). However, adopting practices to mitigate climate change presents challenges for rice growers. For example, Orifah *et al.*, (2021) found that the primary barriers to rice farmers' adoption of adaptive techniques were low weather knowledge, high labor costs, low farm finance, low capital, high raw material costs, and restricted land access. According to a study by Kolleh and Jones (2018), the main barriers preventing farmers from using climate coping methods were a lack of knowledge about climate change and difficulty obtaining loans. Furthermore, according to Ige *et al.*, (2021), the main obstacles to farmers implementing climate adaptation measures were a lack of labor, poor access to climate knowledge, a lack of agricultural input supply, and a lack of funding.

Pickson and He (2021) examined the barriers farmers in Chengdu experienced while implementing climate change adaptation techniques using estimations of the severity and problem confrontation indexes. They found that farmer's adoption of climate adaptive measures was hampered by a number of factors, including a lack of farm labor, growing input costs, a small farm, a lack of weather knowledge, unpredictable weather, and a shortage of water resources. Numerous factors, such as the low economic standing of farmers, a lack of extension services, a lack of credit facilities, a lack of knowledge about climate change, and a shortage of improved varieties, made it difficult for households in Benue State, Nigeria, to implement adaptation strategies (Kim *et al.*, 2017).

Similarly, the main barriers to farmers adopting climate change adaptation strategies were found to be limited access to extension services, inadequate weather information, a lack of financial resources, and limited access to technology required for climate change adaptation (Idrisa *et al.*, 2012). According to Adesiji and Obaniyi (2012), the main obstacles to climate change adaptation were restricted access to credit, restricted access to land, and insufficient meteorological information. Insufficient climate knowledge, a lack of labor, a lack of funding, a lack of expertise, and a lack of

land were the main obstacles to farmers' adoption of coping mechanisms for climate change (Destaw & Fenta, 2021).

Many farmers are still facing numerous constraints that impede their adoption of climate coping measures. The doggedness nature of these challenges implies that the adoption level of climate change coping measures by farmers may be influenced by the severity of problems they face. Even though, several studies such as Kabir *et al.* (2019), Hoque *et al.* (2021), Pickson and He (2021), and Jahan *et al.* (2022) have utilized problem confrontation index (PCI) in examining the constraints affecting farmers adoption of climate coping strategies. There exists limited attention given to the use of the PCI in evaluating the degree of constraints affecting farmer's adoption of climate change coping strategies in Niger State. Therefore, it is against the backdrop, the study seeks to examine constraints to farmer's adoption of climate coping strategies in Niger State, Nigeria. The utilization of PCI offers a methodical and quantifiable approach for identifying and ranking the major constraints faced by farmers. This will aid agricultural planners, policy makers and development agencies to highlight the most persistent problems affecting farmers and appropriately allocate resources. Findings of the study will help the extension agents in better understanding of farmer's constraints which will enable them to provide more effective advisory services on climate-smart agricultural practices.

## MATERIALS AND METHODS

### The Study Area

The study was carried out in Niger State, Nigeria. Niger state has an estimated population of 5,556,247 people (National Bureau of Statistics, 2019). About 85% of the land in the state is arable; it covers a land mass of 74, 108.58 Square Kilometres (Niger State Bureau of Statistics (NSBS), 2014). Niger state lies between latitudes 11°30'N and Longitude 7°18'E with mean rainfall of 1,219mm annually (World data, 2022). The rainy season spans from April to October while dry season lasts from November to March. Riverine areas in Niger state experiences high relative humidity of between 70 – 85% during the rains (Niger Foods GIS, 2026). The two soil types in the state are; Ya soil and Ku soil. The Ya soil has a better water holding capacity while the Ku soil has little erosion hazards (NSBS, 2014).

Gbagyi, Hausa and Nupe form the major tribal group in the state while other ethnic groups



include – Bisan, Dukkawa, Kambari, Dibo, Pangu, Ingwai, Kamuku, Kadara, Gana-gana

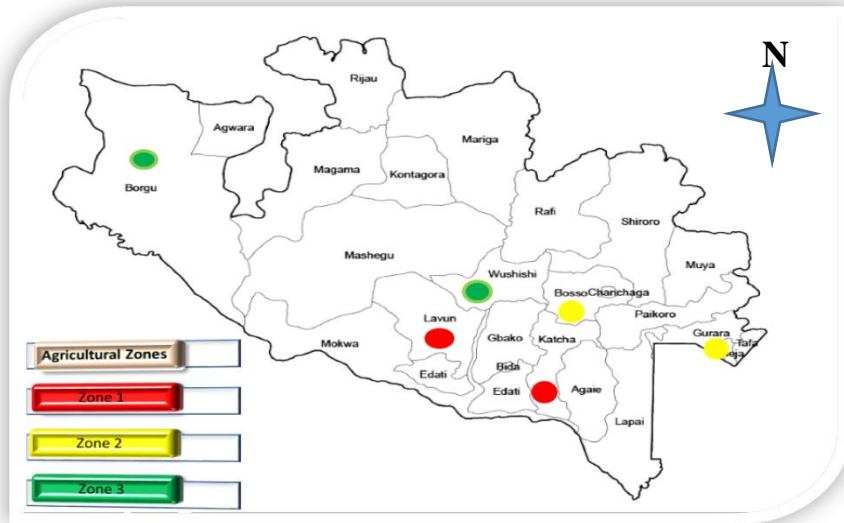


Figure 1: Map of Niger State showing study areas

Source: [www.nigerstats.ni.gov.ng](http://www.nigerstats.ni.gov.ng)

**Sampling procedure and Sample size**

Respondents and research locations were chosen using a multi-stage sampling procedure. In the first stage, two (2) Local Government Areas (LGAs) were randomly selected from each of the three Agricultural Zones I, II, and III, making a total of six (6) LGAs. Secondly, three (3) farming communities were

selected at random from each of the chosen LGAs, making a total of eighteen (18) farming communities. Thirdly, 365 rice farmers from the chosen farming communities were chosen at random. A 20% of the farmers were sampled from the sample frame (1,825) of the farming communities.

**Table 1: Sampling size**

Agricultural zones	Local Government Areas	Farming communities	Sample frame	Number (20%)
<b>Zone I</b>	Katcha	i. Kpata	182	36
		ii. Tswadoyagi	110	22
		iii. Wunangi	73	14
	Lavun	i. Kologbako	131	26
		ii. Edotsu	115	23
		iii. Gbakogi	82	16
<b>Zone II</b>	Bosso	i. Shipadna	110	22
		ii. Pella Beji	96	19
		iii. Birghi	68	14
	Gurara	i. Gurara	97	19
		ii. Tufa	108	22
		iii. Gbalu	69	14
<b>Zone III</b>	Wushishi	i. Bankwagi	139	28
		ii. Maito	93	19
		iii. Wushishi	78	16
	Borgu	i. Dogon gari	78	16
		ii. Malale	96	19
		iii. Lumma	100	20
<b>Grand total</b>	<b>6 LGAs</b>	<b>18 communities</b>	<b>1825</b>	<b>365</b>

Source: Authors’ computation, 2023

## Methods of Data Analysis

### Descriptive statistics

Descriptive statistics such as frequency, charts, and percentages was used to describe the socio-economic characteristics of the respondents. A four point rating scale was used to assess farmers' perception on the adverse impacts of climate change on rice production. Farmers were asked to rate changes in climatic variables/indicators and their perception over the last 5–10 years.

### Problem confrontation index

Problem confrontation index (PCI) was used to identify and analyze the most critical constraints faced by rice farmers in the adoption of climate coping strategies in the study area. PCI applies the principle of weighted frequency scores that is used for ranking constraints faced by farmers. A five-point rating scale was used to calculate the problem score of rice farmers. Farmers were asked to specify the magnitude of difficulty for each constraint via responses as 'very high', 'high', 'medium', 'low' and 'if not a problem'. The PCI score was determined by adding weights of responses to the problems; each problem was assigned a score of 4, 3, 2, 1, and 0 indicating very high, high, medium, low and if not a problem respectively. The PCI of the rice farmers was computed using the formula adopted by Jahan *et al.*, (2022) and Saha *et al.*, (2021). The uniqueness of the formula is the inclusion of fifth item (very high) to make it a five-point rating scale. This is against the traditional four-point rating scale widely used by other researchers such as Ndamani and Watanabe (2015), Popoola *et al.*, (2020), and Uddin *et al.*, (2020). The PCI formula is expressed as:

$$PCI = (P_{vh} \times 4) + (P_h \times 3) + (P_m \times 2) + (P_l \times 1) + (P_n \times 0) \dots\dots\dots (1)$$

Where,

$P_{vh}$  = total number of rice farmers rated problem as very high;

$P_h$  = total number of rice farmers rated problem as high;

$P_m$  = total number of rice farmers rated problem as medium;

$P_l$  = total number of rice farmers rated problem as low; and

$P_n$  = total number of rice farmers rated problem as not a constraint.

## RESULTS AND DISCUSSION

### Socio-economic characteristics

The analyses of the socio-economic characteristics of rice farmers in Table 1 showed

that majority (91.0%) of rice farmers in the study area were male. This implies that rice is majorly cultivated by men. Similar findings of male farmers dominance in rice production was reported by Abou *et al.*, (2023) and Ologeh *et al.*, (2021). The marital status of farmers plays an important role in agricultural production especially when taking family labour source into consideration. Majority of the rice farmers (88.5%) were married. Similar finding was reported by Adekunmi (2022), who reported that 78.5% of the rice farmers in Ondo State were married. Farmers saddled with the obligation to carter for their families should diversify their portfolio as a way of mitigating against changing climate. The mean age of the rice farmers was 44 years, inferring that rice farmers in the study area are within their productive age. The age of the farmer is an essential factor in decision-making on the use of climate change adaptation practices because it often reflects the experience and knowledge gained over time (Yakubu & Oladele, 2021). Older farmers may have observed climatic patterns and changes over many years, allowing them to recognize trend and make informed decisions about adaptive measures.

Farm size is essential to expansion of rice production. This is because, through efficient production system, farmers with large hectares of land are anticipated to have optimum output as compared to their counterparts. Most of the farmers (60%) had farm size of between 0.5 to 2 hectares, only 4.9% of the rice farmers had farm size between 4.5 to 5.5 hectares of land. The average farm size is 2.5 hectares. Implying that rice production is dominated by small-scale farmers. A mean farm size of 3.3 hectares was reported by Adekunmi, (2022). The author further buttressed that rice farmers in Ondo state are operating on a small-scale below the recommended 5 hectares of land per households. About half (50.1%) of the farmers had primary, secondary or tertiary form of education. This is an indication that the farmers are literates and could have capability to make informed decisions on adoption of climate adaptation practices. Farmers' level of literacy can favour their use of climate change adaptation practices (Yakubu *et al.*, 2021). The mean household size of the rice farmers is 11 persons in a household. The result is in consonance with the finding of Yakubu *et al.*, (2021) who reported a mean of 11 household members in Kebbi state. Large family size is



assumed to make available cheap labour which will assist in farming practices that will lessen the impacts of changing climate (Yakubu *et al.*, 2021).

Off-farm income are proceeds received by the rice farmers from non-farm activities and/or businesses. These proceeds could be as a result of farmers' diversification to off-farm activities as a strategy of mitigating against the adverse impacts of climate change. The result in Table 1 shows that 35% of the farmers had income within the range of ₦50,000 to ₦89,000. Also, 34.2% had income of between ₦90,000 to ₦129,000 while 30.7% of the farmers had farm income of ₦130,000 and above. The average off-farm income was estimated to be ₦106,923.53. On the other hand, the annual income from rice production is the revenue generated by the farmers from rice cultivation which could be in form of cash or non-cash equivalent. Out of the 365 farmers sampled, only 15.9% of the respondents had annual income of between ₦500,000 to ₦999,999 as proceeds from rice cultivation. Furthermore, 26.8% of the rice farmers had annual income of ₦1,000,001 to ₦1,999,999 while 41.9% had income of ₦2,000,001 to ₦2,499,999 from rice production. Adekunmi (2022) reported that farmers in most cases fund their farming activities from personal savings and hardly obtain loans because of high interest rates.

### Farmer's perceived changes in climate condition

The result in Figure 1 presents rice farmers perception on the changes in climate in the last 5 to 10 years using climate variables as indicators. The result indicates that 55.6% of the rice farmers observed that there was a moderate change in the occurrence of erratic rainfall. The respondents (53.3%) noticed severe changes in temperature while 59.7% of the farmers perceived that there was moderate change and or increase in the duration of dry spells. Thus, it can be asserted that farmers in the last 5 to 10 years have noticed an increase in the negative climate factors. This

increase in the negative climate factors were increase in the occurrence of erratic rainfall, increase in temperature and duration of dry spells which impact negatively on rice production. Rice is a water-loving crop in nature and continuous increase in temperature could have negative impacts on the crop germination and yield potentials. Excessive temperatures may have adverse effect on crop productivity (Karienyne & Macharia, 2021). The finding is consistent with the findings of Kolleh and Jones (2018) who reported that rice farmers observed an irregular precipitation and increase in temperature. The increase in duration of dry spells is in line with the finding of Adekunmi (2022) who reported that rice farmers in Kwara state observed a prolonged dry season as part of the climate conditions affecting rice production.

Figure 1 further revealed that a slight majority (56.4%) of the rice farmer's perceived increase in the frequency of dry spells. There was a moderate changes in the occurrence of extreme winds as perceived by 44.7% of the respondents. Also, severe changes in the extreme rainfall events was observed by 48.5% of the farmers. Bichi *et al.*, (2023) reported that rice farmers observed increase in frequent occurrence of drought, extreme winds (which often damage cereals crop specifically at period of harvesting) and higher rainfall events. Implicitly, extreme rainfall events could lead to flooded rice field which could impedes adequate aeration of the soil and reduction of rice crop yield. Increased amount of rainfall can adversely affect rice production as it could lead to flooding causing damage to rice crop field (Yusuf & Barnabas, 2019). About 57.3% of the rice farmers affirmed that there was a moderate change in the duration of rainy season in the last 5 to 10 years. This indicates that there was decrease in the duration of rainy season which can affect late maturing crops. The result is in tandem with the finding of Yusuf and Barnabas (2019) who reported early stoppage of rains as rice farmers perceived climate change effect.

**Table 1:** Socio-economic Characteristics of the rice farmers (n=365)

Characteristics	Frequency	Percentage	Mean
<b>Sex</b>			
Male	332	91.0	
Female	33	9.0	
<b>Marital status</b>			
Single	27	7.4	
Married	323	88.5	
Widowed	12	3.3	
Divorced	3	0.8	
<b>Age (year)</b>			
≤20	2	0.6	44
21 – 30	54	14.8	
31 – 40	73	20.0	
41 – 50	126	34.5	
51 Above	110	30.1	
<b>Farm size</b>			
0.5 – 1.0	60	16.4	2.5
1.5 – 2.0	159	43.6	
2.5 – 3.0	101	27.7	
3.5 – 4.0	27	7.4	
4.5 – 5.0	14	3.8	
≥ 5.5	4	1.1	
<b>Level of Education</b>			
Non-formal	182	49.9	
Primary	39	10.7	
Secondary	111	30.4	
Tertiary	33	9.0	
<b>Household Size</b>			
1 – 5	53	14.5	11
6 – 10	133	36.4	
11 – 15	130	35.6	
16 – 20	41	11.2	
21 – 25	7	1.9	
≥ 26	1	0.3	
<b>Off-farm Income (₦)</b>			
₦50,000 – ₦69,999	97	26.5	₦106,923.53
₦70,000 – ₦89,000	31	8.5	
₦90,000 – ₦109,999	75	20.5	
₦110,000 – ₦129,999	50	13.7	
≥₦130,000	112	30.7	
<b>Annual income from rice (₦)</b>			
≤₦500,000	48	13.2	₦1,409,911.781
₦500,001 – ₦999,999	10	2.7	
₦1,000,001 – ₦1,499,999	41	11.2	
₦1,500,001 – ₦1,999,999	57	15.6	
₦2,000,001 – ₦2,499,999	153	41.9	
≥₦3,000,001	56	15.3	

Source: Field survey; 2023

### Rice Farmers' Constraints in adoption of Climate coping Strategies

The study utilized problem confrontation index in determining the severity of constraints faced by rice farmers in the adoption of climate coping strategies. The problem confrontation index

applies the principle of weighted frequency scores that was used for ranking constraints faced by farmers. A five-point rating scale was used in computing the problem score of rice farmers. Rice farmers were asked to specify the magnitude of difficulty for each constraint via responses as



‘very high’, ‘high’, ‘medium’, ‘low’, and ‘not a constraint’.

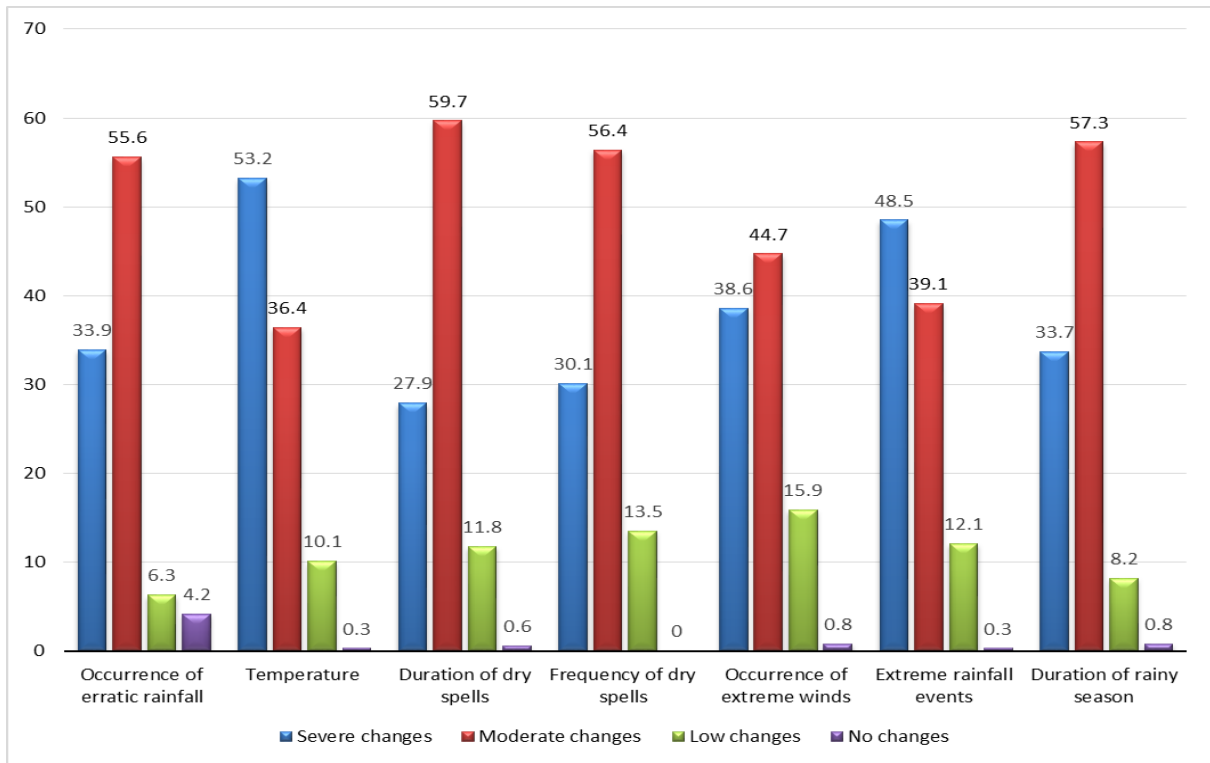


Figure 1: Farmer’s perceived changes in climate condition; Source: field survey, 2023

Farmer’s adoption of climate coping strategies is constrained by high cost of farm inputs, inadequate access to weather information, economic/financial constraints, and inadequate access to credit. Also, it is constrained by scarcity of improved variety, complexity of adaptation strategies, farm labour shortage, and inadequate awareness on climate. However, the four (4) highest constraints to rice farmers’ adoption of climate coping strategies are high cost of farm inputs, inadequate access to weather information, economic/financial constraints, and scarcity of improved variety. Furthermore, each had PCI value of 1228, 1219, 1190, and 1183 indicating the severity of each constraint respectively. Farmers’ inadequate access to weather information could be an indication that agencies saddled with tasks of providing weather information may have not totally discovered the sources of information available to the farmers (Orifah *et al.*, 2021). The economic/financial constraints in the adoption of climate coping

strategies may perhaps be an indicative of farmers’ inadequate financial viability to implement coping or management measures to changing climate. The findings of the study is corroborated by the findings of Yusuf and Barnabas (2019), Pickson and He (2021), Orifah *et al.* (2021), Destaw and Fenta (2021), and Sertse *et al.* (2020). They reported high cost of farm inputs, inadequate access to weather information, economic/financial constraints, and scarcity of improved variety as major constraints to the farmers’ adoption of climate coping strategies.

Table 2 further revealed that constraints to the farmers’ adoption of climate coping measures include complexity of adaptation strategies (1182), and farm labour shortage (1137). The result is in consonant with the findings of Pickson and He (2021), Arifah *et al.* (2021) and Kolleh and Jones (2018). Also, Ige *et al.*, (2021) found that scarcity of labour was among the major constraints farmers faced in the adoption of climate change adaptation strategies.

**Table 2:** Constraints to adoption of climate coping strategies

Constraints	VH	H	M	L	IN C	PCI	Ran k
High cost of farm inputs	207	92	58	8	0	1228	1 <sup>st</sup>
Inadequate access to weather information	229	69	35	26	6	1219	2 <sup>nd</sup>
Economic/financial constraints	174	120	63	08	0	1190	3 <sup>rd</sup>
Scarcity of improved variety	177	114	61	11	6	1183	4 <sup>th</sup>
Complexity of adaptation strategies	101	177	107	33	7	1182	5 <sup>th</sup>
Farm labour shortage	149	135	60	16	5	1137	6 <sup>th</sup>
Inadequate access to timely weather information	157	107	73	27	1	1122	7 <sup>th</sup>
High labour involvement	149	126	65	18	7	1122	7 <sup>th</sup>
Poor access to extension services	165	109	60	9	22	1116	8 <sup>th</sup>
Limited access to improved crop variety	118	138	84	23	2	1077	9 <sup>th</sup>
Inadequate knowledge of adaptation options	122	109	86	44	4	1031	10 <sup>th</sup>
Poor technical know-how in implementing adaptation strategies	116	108	100	36	5	1024	11 <sup>th</sup>
Shortage of water for irrigation	85	131	89	54	6	965	12 <sup>th</sup>

VH=Very high; H=high, M=Medium, L = Low, INC = if Not a constraint, PCI = Problem Confrontation Index

**Note:** The computation of PCI value for the problem of high cost of farm inputs is as follows:  $PCI = (229 \times 4) + (69 \times 3) + (35 \times 2) + (26 \times 1) + (6 \times 0) = 1128$ . The PCI scores for the rest of the problems were computed in that order

Farmer's access to timely weather information could give farmers a prior insight to prepare to adapt to climatic changes in rice production. The result in Table 9 shows that rice farmers in the study area are constrained by the inadequate access to timely weather information (PCI = 1122) which hinder their adoption of climate change coping measures. Also rice farmers' adoption of climate coping measures is hindered by poor access to extension services (PCI = 1116), limited access to improved crop variety (PCI = 1077). Idrisa *et al.*, (2012) found that rice farmers experienced poor access to extension services as a constraint to the farmers' adoption of coping measures to climate change. Further, Gameda *et al.*, (2023) reported that rice farmers' lack of access to improved crop varieties. The least ranked constraints to adoption of coping strategies to climate change among rice farmers in the study area are; inadequate knowledge of adaptation options (PCI = 1031), poor technical know-how in implementing adaptation strategies (PCI = 1024), and shortage of water for irrigation (PCI = 965). The result is in tandem with the findings of Kolleh and Jones (2018) and Adekunmi (2022).

## CONCLUSION

Farmers have observed an increase in the negative climate factors as increase in the occurrence of erratic rainfall, rising temperature, occurrence of extreme winds, and increase in the duration and frequency of dry spells impact negatively on rice production. The four (4) highest constraints to the rice farmers' adoption of climate coping strategies were high cost of farm inputs, inadequate access to weather information, economic/financial constraints, and inadequate access to credit. Each had PCI value of 1228, 1219, 1190, and 1183 indicating the severity of each constraint respectively.

## RECOMMENDATION

The following recommendations were made;

- i. Stakeholders should make efforts towards subsidizing agricultural inputs to farmers in order to facilitate their adoption of climate coping strategies.
- ii. Stakeholders such as private, NGOs and/or government should provide real-time weather forecasts and



seasonal climate updates through radio, extension officers and mobile alerts.

- iii. Relevant stakeholders should introduce climate-risk insurance to protect farmers from losses caused by as droughts, erratic rainfall and extreme winds event.
- iv. Policy makers and/or stakeholders should partner with banks and microfinance institutions to create low-interest loan programs specifically for rice farmers in order to lessen their economic/financial constraints in adoption of climate coping strategies.

## REFERENCES

- Abuo, T.N., Rashid, S.A., Ifabiyi J.O., Mubarak O.A. & Kehinde L.O. (2023). Perceived Effects of Climate Variability on the Rice Farmers in Niger State, Nigeria. *Diyala Agricultural Sciences Journal*, 2023, Vol. (15) No. 2: 90-97
- Adekunmi, A.O. (2022). Rice Farmers' Awareness and Perception of Climate Change in Ondo State, Nigeria. *European Journal of Agriculture and Food Sciences*, Vol 4, Issue 1, February 2022, pp. 81-85. DOI: <http://dx.doi.org/10.24018/ejfood.2022.4.1.355>
- Adesiji G. B. & Obaniyi, K. S. (2012). Indigenous knowledge in climate change adaptation strategies among farmers in Kwara State, Nigeria. *Agricultural Extension Society of Nigeria. 17<sup>th</sup> Annual National Conference "Nsukka"*. Pp. 81 – 88.
- Arifah, D., Salman, A., Yassi, & Demmallino, E.B. (2021). Farmer's Perception of Climate Change and the Impacts on Livelihood in South Sulawesi. *Sriwijaya International Conference on Earth Science and Environmental Issue, Conf. Series: Earth and Environmental Science* 810 (2021) 012010 IOP Publishing doi:10.1088/1755-1315/810/1/012010.
- Banjoko, I. K., Ifabiyi, J. O., Komolafe, S. E., and Opeyemi, G. (2021). Goat farmers' adaptation strategies to climate change in Ilorin East Local Government Area of Kwara State, Nigeria. *Journal of Research in Forestry, Wildlife and Environment*, 13(4), 36-45.
- Bichi, A.A., Abdulkadir, M., Hassan, M.B., Kanoma, M. I., Haliru, S.L. & Muhammad, A. S. (2023). Rice Farmers' Perception of Climate Change and its Effects on Rice Production and Livelihoods in Kura Local Government Area of Kano State, Nigeria. *Gusau International Journal of Management and Social Sciences*, 6(2), 190 – 202.
- Destaw, F. & Fenta, M.M., (2021) Climate change adaptation strategies and their predictors amongst rural farmers in Ambassel district, Northern Ethiopia, Jàmba: *Journal of Disaster Risk Studies* 13(1), 1 – 11. <https://doi.org/10.4102/jamba.v13i1.974>
- Fadairo, O., Adelakun, O., Olutegbe, S., Adeleke, O., Olajuyigbe, S., Osayomi, T. & Olaniyan, O. (2021). Climate Change, Rural Livelihoods, and Ecosystem Nexus: Forest Communities in Agroecological zones of Nigeria. W. Leal Filho et al. (eds.), *African Handbook of Climate Change Adaptation*, [https://doi.org/10.1007/978-3-030-45106-6\\_155](https://doi.org/10.1007/978-3-030-45106-6_155)
- Gemeda, D.O, Korecha, D., & Garedew, W. (2023). Determinants of climate change adaptation strategies and existing barriers in Southwestern parts of Ethiopia. *Climate Services* 2023, 11 (183) 2 – 19; <https://doi.org/10.3390/cli11090183>.
- Hoque, M.J., Hossain, M.I., Sarker, M.A. & Mithun, N.A. (2021). Problem Confrontation of Sugarcane Farmers in Natore District of Bangladesh. *Int. J. Agril. Res. Innov. Tech.* 11(1): 101-108. <https://doi.org/10.3329/ijar.v11i1.54472>
- Idris, A. A., Suleiman, M. S., Abdullahi, A. & Nasiru, A. (2021). Analysis of Gender Vulnerabilities to Climate Change among Farmers in Kano State, Nigeria. *Journal of Agripreneurship and Sustainable Development (JASD)* 4(1):194 – 202.
- Idu, E. E., Fadiji, T. O., & Chimdi, A. (2023). Effect of Climate Variability on Rice Production in North-Central, Nigeria from 1980– 2020. *Direct Research Journal of Agriculture and Food Science*, 11(4), 78-89, DOI: <https://doi.org/10.26765/DRJAFS10759523>
- Ifabiyi, J. O., Opeyemi, G., and Banjoko, I. K. (2022). Status of Climate Smart Small Ruminant Production Practices in Kwara State, Nigeria. *Diyala Agricultural Sciences Journal*, 14(2), 87-99. <https://doi.org/10.52951/dasj.22140209>



- Ige, G.O., Akinagbe, O. M., Odefadehan, O.O, Ogunbusuyi, O.P. & W.F., Leal (eds.) (2021). *African Handbook of Climate Change Adaptation*. Switzerland AG: Springer Nature. [https://doi.org/10.1007/978-3-030-45106-6\\_103](https://doi.org/10.1007/978-3-030-45106-6_103)
- Jahan, H., Rahman, W., Islam, S., Abu, R., Tuhin, M. & Emran, H. (2022). Adoption of agroforestry practices in Bangladesh as a climate change mitigation option: Investment, drivers, and SWOT analysis perspectives. *Environmental Challenges* 7 (2022) 100509, <https://doi.org/10.1016/j.envc.2022.100509>
- Kabir, S., Mirjana, R.M. & Dejan, R. (2019). The Determinants of Income of Rural Women in Bangladesh. *Sustainability* 2019, 11, 5842; doi:10.3390/su11205842
- Karienyne, D., Macharia, J. & Leal F.W. (eds.). (2021). *African Handbook of Climate Change Adaptation*. Switzerland AG: Springer Nature. [https://doi.org/10.1007/978-3-030-45106-6\\_57](https://doi.org/10.1007/978-3-030-45106-6_57)
- Khan, N. A., Qiao, J., Abid, M., & Gao, Q. (2021). Understanding farm-level cognition of and autonomous adaptation to climate variability and associated factors: Evidence from the rice growing zone of Pakistan. *Land Use Policy* 105, 105427. doi:10.1016/j.landusepol.2021.105427
- Kim, I., Elisha, I., Lawrence, E., & Moses, M. (2017). Farmers Adaptation Strategies to the Effect of Climate Variation on Rice Production: Insight from Benue State, Nigeria. *Environment and Ecology Research* 5(4): 289-301, 2017, DOI: 10.13189/eer.2017.050406
- Kolleh, J.B. & Jones, M.T., (2018). Rice farmers' perception of climate change and adaptation strategies in the Ketu North District, Volta Region of Ghana. *African Journal of Agricultural Research*, 13(15), 782-791, DOI: 10.5897/AJAR2017.12904
- National Bureau of Statistics (2019). Population projection. Available at [www.nigerianstats.gov.ng/sgfn.xls](http://www.nigerianstats.gov.ng/sgfn.xls), accessed January 21, 2025.
- Ndamani, F. & Watanabe, T. (2015). Farmers' perceptions about adaptation practices to climate change and barriers to adaptation: A micro-level study in Ghana. *Water (Switzerland)* 7(9), 4593–4604.
- Niger State Bureau of Statistics (2014). Socio-economic Survey. Available at [www.nigerstats.ni.gov.ng](http://www.nigerstats.ni.gov.ng).
- Niger Foods GIS (2026). Niger state general analytics at National scale. Available at, <https://nigerfoodsgis.com.ng/climatic-property-of-niger-state-in-nigeria/>
- Ologeh, I., Adesina, F., and Sobanke, V. (2021). Assessment of farmers' indigenous technology adoptions for climate change adaptation in Nigeria. In *African Handbook of Climate Change Adaptation* (pp. 117-129). Cham: Springer International Publishing. [https://doi.org/10.1007/978\\_3-030-45106-6\\_28](https://doi.org/10.1007/978_3-030-45106-6_28)
- Onyeneke, R. U. (2020). Does climate change adaptation lead to increased productivity of rice production? Lessons from Ebonyi state, Nigeria, *Renewable Agriculture and Food System*, 36(1). 1–15, <https://doi.org/10.1017/S1742170519000486>.
- Orifah M. O., Sani M. H., Nasiru M. & Ibrahim A. A. (2021). Perceived effectiveness of adaptation strategies to climate change among rice farmers in Jigawa State, Nigeria: Implication for rice production. *Agricultura Tropica Et Subtropica*, 54, 122–135, 2021. DOI: 10.2478/ats-2021-0013
- Pickson, R.B. and He, G. (2021). Smallholder Farmers' Perceptions, Adaptation Constraints, and Determinants of Adaptive Capacity to Climate Change in Chengdu. *Sage Open*, 11(3) (2021): 1–16. <https://doi.org/10.1177/21582440211032638>
- Popoola, O.O., Shehu, F.G. & Nomakhaya, M. (2020). Information Sources and Constraints to Climate Change Adaptation amongst Smallholder Farmers in Amathole District Municipality, Eastern Cape Province, South Africa. *Sustainability* 2020, 12, 1-23; doi:10.3390/su12145846.
- Saha, S.M., Pranty, S.A., Rana, M.J., Islam, M.J. & Hossain, M.E. (2021). Teaching during a pandemic: do university teachers prefer online teaching? *Heliyon* e08663.
- Sertse, S. F., Khan, N. A., Shah, A. A., Liu, Y., & Naqvi, S. A. A. (2021). Farm households' perceptions and adaptation strategies to climate change risks and their determinants: Evidence from Raya Azebo district, Ethiopia. *International Journal of Disaster Risk Reduction*. 60, 102255: 1–10, doi:10.1016/j.ijdrr.2021.102255
- Solaja, S., Ayorinde, K., Toluwalase, A., Opeyemi, O., Wale, A., Ibukun, O., Gideon, N., Ruth, A., Stephen, E., Faithfulness, O., Oluwatosin, A. & Isibietmfon, N. (2024).



- Assessment of smallholder rice farmers' adaptation strategies to climate change in Kebbi state, Nigeria. *Heliyon* 10 (2024) e35384, <https://doi.org/10.1016/j.heliyon.2024.e35384>
- Uddin, M.N., Kabir, K.H., Roy, D., Hasan, M.T., Sarker, M.A. & Dunn, E.S. (2020). Understanding the constraints and its related factors in tilapia (*Oreochromis* sp.) fish culture at farm level: A case from Bangladesh. *Aqua*. 530: 735927. <https://doi.org/10.1016/j.aquaculture.2020.735927>
- World data (2022). Climate: Niger state, Nigeria. Accessed January 21, 2025.
- Yakubu, D.H. & Oladele, O.I. (2021). Determinants of Use of Climate Change Adaptation Practices by Rice Farmers in Kebbi State, North-West Nigeria. *Problems of World Agriculture*, 21(1), 52–69; DOI: 10.22630/PRS.2021.21.1.4
- Yakubu, D.H., Akpoko, J.G., Akinola, M.O. & Abdulsalam, Z. (2021). Assessment of perceived effects of climate change on rice production among farmers in North-west zone, Nigeria. *Ghana Jnl Agric. Sci.* 56 (1), 48 – 64: <https://dx.doi.org/10.4314/gjas.v56i1.484>
- Yusuf, A. O. & Barnabas, T. M. (2019). Farmers' Perception on Climate Change and Constraints on Rice Production in Kwara State. *Adamawa State University Journal of Scientific Research* 7 (2), 161 – 168. <http://www.adsujsr.com>.