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Farmers' Perception of Climate Variability and Adaptation Strategies in Akoko Southwest Local Government Area, Ondo State, Nigeria

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Abstract

The research assessed farmers of arable crops in Akoko southwest local government area of Ondo State, Nigeria on their adaptation strategies to perceived climatic unpredictability. Using a multistage sampling, cross-sectional data were collected from 150 farmers in rural areas of all the local governments using a standardized questionnaire. Descriptive and inferential statistics including chi-square, Pearson Product Moment Correlation (PPMC), and Ordinary Least Squares (OLS) were utilized to analyses the study's data. The study revealed a significant relationship between household size ($\chi 2$=179.3, $p<0.05$), farm size ($\chi 2$=136.4, $p<0.05$) and adaptation strategies. Also, there was a significant influence of gender (t=3.001), access to credit (t=2.459), and other sources of income (t=2.384) on adaptation strategies to be adopted by farmers at $p<0.05$. The findings indicate that the farmers are severely constrained by a lack of suitable irrigation infrastructure and insufficient government support, which has decreased production and may result in lower profits and more poverty. According to the results, farmers' perceptions of climatic unpredictability have a significant impact on their adaptation techniques. A better understanding of climatic variability would help farmers develop better adaptation strategies, which will enhance their livelihoods and lower poverty levels in rural regions. The government should launch awareness and sensitization programmers at all levels to create a community where farmers are well-versed in the causes and impacts of climatic variability.

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Introduction

Agriculture is an important human activity because it provides food, raw materials, shelter, clothing, fiber, and other byproducts (Tandzi and Mutengwa, 2020). It is thus impossible to overstate the significance of its connection with the environment because the climate is the main driver of agricultural output. Because of this, both farmers and the government have been gravely concerned about the possible consequences of climatic variability on agricultural productivity (Thompson and Oparinde, 2015). Climate variability-related pressures affect subsistence farmers in a variety of ways, including changes in rainfall, average temperature, and exposure to extreme climate variability events and circumstances, which have a significant influence on soil erosion (droughts, dry spells), changes in the growing season, and changes in sea level (Praveen and Sharma, 2019). Given that most rural populations still rely heavily on agricultural output for their food and income, climate change conditions like rising temperatures, decreasing rainfall, and increasing rainfall unpredictability are a serious threat to food security, crop productivity, and the fight against poverty (Gezie and Tegba, 2019). To maintain and enhance farmers' livelihoods and assure food security, it is crucial to adapt the agricultural industry to the negative consequences of climatic variability (Ayanlade *et al.,* 2018).

Beyond specific weather events, climate variability is the variance in the average condition and other statistics of the climate on all temporal and geographical dimensions (Ukhurebor and Siloko, 2020). When compared to long-term data for the same calendar time, the phrase "climate variability" is frequently used to describe deviations in climatic statistics during a specific period (e.g., month, season, or year). These deviations, which are typically referred to as anomalies, may be caused by either natural internal processes within the climate system (internal variability) or by fluctuations in natural or manmade external variables (external variability) (Rathoure and Patel, 2020; Zadawa and Omran, 2020).

Due to its potential to adversely influence components of several systems and sectors that endanger human health, climate variability has become a global issue (Somboonsuke *et al.,* 2018). The Intergovernmental Panel on Climate Change's fifth assessment report offered convincing proof that human activity is changing the climate (IPCC, 2013). Recent climate variability has clearly affected agriculture in several parts of Nigeria, especially in Ondo State, which includes Akoko Southwest. In order to create adaptation methods to deal with the challenges and risks of climate variability in the agricultural sector, farmers' awareness of climate variability is essential (Aryal *et al.,* 2021). Such knowledge is essential in Nigeria since the key predictor of how well agriculture can be carried out is climate, and changes in climate have significant effects not just on the agricultural sector but also on other sectors (Mashizha, 2019). Studies have revealed that the agricultural industry, food security, community health, natural resources, biodiversity, and water supply are all greatly threatened by climate variability and extreme weather events (Dube *et al.,* 2016; Muluneh, 2021). The implications of climatic variability would be stronger on socioeconomic development and agriculture, which play considerably more significant roles in food production in Africa, according to projections from the intergovernmental panels on climate change (IPCC, 2013).

Long-term adaptation actions have been outlined in Nigeria's national statements to the United Nations Framework Convention on Climate Change, along with several other African nations. In their National Adaptation Programme of Actions (NAPAs), which emphasize agriculture, food security, and water resource management, several of these nations have specified emergency adaptation measures (Ayanlade *et al.,* 2018). Many of the measures have not yet been completely implemented, keeping many farmers in the dark about the difficulties that climatic unpredictability presents for agricultural productivity (Yohannes, 2016). This indicates that because of their abilities to adapt to climate change or fluctuation, African nations are likely to be more severely affected. However, it is clear from the research that farmers' comprehension of and adaptability to climatic fluctuation are essential to ensuring food security and preserving the poor's means of subsistence (Ajilogba and Walker, 2020).

In agriculture, factors such as culture, traditions, market, water availability, climate, soil quality, plot size, and distance from home affect what can be produced and how it can be produced (Akpenpuun and Busari, 2017). Given the aforementioned, it is clear that one of the key elements affecting agricultural yield and production is the climate. Given that agricultural yield and production are crucial to the economics and way of life of Nigerian farmers, the fluctuation of rainfall, temperature, and relative humidity has been a pressing concern in a sustainable environment (Olubanjo and Alade, 2018). For example, a substantial portion of the rural population depends on rain for agricultural operations, therefore farmers keep deeper relationships with nature and their natural resources serve as the foundation from which their fundamental needs are obtained (Amare *et al.,* 2018).

Methods for coping with or adapting to the ongoing series of adaptations in response to climate variability are known as "climate variability adaptation methods," since they are anticipated to provide increased risk, novel combinations of hazards, and possibly serious consequences as a result of current climate change (Amusa *et al.,* 2015). The negative impact of climatic variability on agricultural production has therefore been documented, and adaptation has been highlighted as a policy tool to minimize it (Ige *et al.,* 2020). When it comes to agriculture, adaptation enables farmers to meet their goals for securing their food, income, and livelihood despite deteriorating socioeconomic and climatic situations like floods and droughts (Muzamhindo *et al.,* 2015). According to farm-level study, when adaptation is completely adopted, there might be a significant decrease in the negative effects of climatic variability (Liu and Basso, 2020). Farmers may modify their agricultural output by using effective environmental resource management techniques include planting early-maturing crops, mulching, small-scale irrigation, choosing hardy types of crops, planting trees, and staking to prevent heat burns (Gweyi-Onyango *et al.,* 2021). The lack of knowledge about suitable adaptation choices, difficult market access, and a lack of farm labour were all identified as hurdles to adaptation by Mu *et al.* (2020). As a result, it can be claimed that knowledge, awareness, labour, and capital are key adaptation elements, and that their absence, along with the inability to select effective adaptation strategies, poses a serious threat to agricultural productivity.

Furthermore, due to its direct effects on agricultural output, climatic variability is likely the greatest environmental danger to Nigeria's efforts to combat hunger, malnutrition, illness, and poverty (Abdulkadir *et al.,* 2017). The research now available indicates that climatic variability is worldwide, as are its effects; however, the most detrimental effects will mostly be felt by poor nations, notably those in Africa like Nigeria, due to their low level of coping mechanisms or adaption techniques (Karienye and Macharia, 2020). In Nigeria, more than 70% of the food consumed is produced by the country's rural population, which is made up of 74 million people who are disproportionately impoverished, vulnerable to disease and hunger, and unable to satisfy their basic food demands (Matemilola and Elegbede, 2017). The farmers also take a long time to change traditional farming methods, such as bush burning, deforestation, and rain-fed agriculture, and they lack the training, education, and knowledge required to adjust to climatic unpredictability, which is a developing issue (Anabaraonye *et al.,* 2019). Destruction to farmlands, livelihoods, and biodiversity are some of the negative effects of climatic variability that have an irreparable impact on food production in poor nations like Nigeria that have a limited ability to deal with and adapt to these difficulties (Okon *et al.,* 2021).

There haven't been many researches done in Ondo State, Nigeria, to look at the influence of temperature, relative humidity, rainfall, and other factors on the yield of cassava, yam, pepper, and tomatoes. However, historical data indicates that relatively few of them have thoroughly investigated the connections between climatic variability and adaptation techniques appropriate for arable crops (Olubanjo and Alade, 2018). Recent research confirms that Africa is one of the continents with the lowest capacity for adaptation to climatic unpredictability and change (Fadina and Barjolle, 2018). There has been some adaptation to the current climatic fluctuation, but this may not be enough to prepare for future climate changes (Muller, 2021). However, it has been noted that the uncertainty brought on by climatic fluctuation discourages investment in and use of agricultural technology and market potential (Autio *et al.,* 2021). Climate variability is a developing issue that poses a danger to smallholder farmers, sustainable economic growth, and the entirety of human life (Adeagbo *et al.,* 2021). It is against this context that the study was carried out to examine farmers' perceptions of variations in climate and adaptation strategies in Akoko southwest local government area of Ondo State, Nigeria. The study objectives are to:

1. Describe the socio-economic characteristics of arable crop farmers in the study area.
2. Ascertain farmers' perception of climate variability on crop production.
3. Examine the adaptation strategies adopted by arable crop farmers in the study area.
4. Ascertain the factors that influence farmers' choice of adaptation strategies
5. Identify constraints to the adoption of adaptation strategies by arable crop farmers.

Hypotheses

1. There is no significant relationship between socio-economic characteristics and farmers' adaptation strategies
2. There is no significant relationship between farmers' perception of climate variability and the adaptation strategies adopted by the farmers.

Materials and Methods

Area of study: The study was carried out in Akoko South West Local Government Area of Ondo State, Nigeria. Akoko Southwest was created in 1996 (Ondo State Bureau of Statistics) with nine (9) communities and its headquarters area in the town of Oka Akoko. It is situated in the deciduous rainforest of southwestern Nigeria with a land area of 340.1 (km) square and a total population of 228,383 (NPC, 2006). The local government is bounded to the north by Akoko north-east local government area, to the south by Ose and Owo local government area, and to the west by Ekiti state. The climate of the study area is equatorial with two peaks of rainfall. The first peak comes up between April and July while the second peak falls between late August and October. These two peaks are marked by heavy rainfall with a mean annual rainfall of 1500mm-2000mm. It has a relative humidity of 75-95% which results in severe cold conditions with a mean annual temperature of 23˚c-26˚c (Olabode, 2014). The study area lies between the latitude 7.23' 51.6˚ north and longitude 5˚41' 40.7˚ east. This shows that the state lies in the rainforest and guinea savannah vegetation which is characterised by different plants and trees with a height of 5m and even more. The major form of occupation in the study area is agriculture, which is mainly of smallholder with the production of crops such as maize, yam, cassava, cocoa, cashew, rice, oil palm, timber, citrus, plantain, soya beans, cowpea, kola nut, and vegetables. It provides income and employment for over 75% of the population in the State. It also contributes over 70% of the State's Gross Domestic Product (GDP) (Rotowa *et al.*, 2019).

Study population: The population of the study consists of arable crop farmers in the Akoko Southwest local government area of Ondo State.

Sampling procedure and sample size: Multi-stage sampling techniques were used to select the total number of respondents for the study. In the first stage a purposive selection of five (5) communities under Akoko Southwest namely; Oke-Oka Akoko, Akungba Akoko, Supare Akoko, Ikun Akoko, and Oba Akoko. The second stage involved a simple random selection of two (2) wards from each community. The last stage consisted of a random selection of 15 farmers from each of the selected wards who are into arable crop farming, giving a total of one hundred and fifty (150) respondents.

Data collection and analysis: Data collection was carried out using primary and secondary sources. The primary data was collected through the use of a questionnaire consisting of well-structured open and close-ended questions supported by the interview schedule while the secondary data were collected from available literature. The questionnaire was distributed to 15 selected arable crop farmers from each of the wards selected based on the list collected from the Extension agents of the Agricultural Development Programme (ADP) in the study area. To test the stated hypotheses, the data were analyzed using descriptive and inferential statistics like Chi-Square, Correlation analysis, and Ordinary least square regression. The socio-economic characteristics of the respondents were presented using frequency counts, percentages, and means. A five-point Likert scale was used to elicit information on the adaptation strategies to climate variability among the respondents. The regression function postulated to isolate factors influencing adaptation strategies in the study was implicitly represented by the equation;

$$\mathbf{Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, _e)}$$

Y = Adaptation Strategies

X_1 = Sex

X_2 = Age

X_3 = Farm Size

X_4 = Level of education

X_5 = Extension agent visit

X_6 = Experience in farming

X_7 = Income of farmers

X_8 = Other sources of income

X_9 = Access to credit

The functional forms are as follows;

$$\mathbf{Y_1 = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + \mu_i}$$

a's and b's were parameters estimated while e represents the error term associated with data collected from the arable crop farmers. The error term was assumed to be normally distributed with zero mean value and constant variance. The essence of this regression analysis is to determine factors that influence adaptation strategies. The research hypothesis was tested using inferential statistics such as the Chi-square test and Pearson product-moment correlation analysis.

Results and Discussion

Socio-economic characteristics of respondents

According to Table 1, the average age of respondents in the research region is 48 years, with nearly half (42.0%) falling between the ages of 46 and 65 and 39.3% falling between the ages of 26 and 45. Only 16.0% and 2.7%, respectively, of them were

66 to 85 and 86 to 95 years old. This suggests that as people get older, their capacity to adapt to climate variability declines. Consequently, agricultural households with younger members tend to adapt to climate variability more so than farming households with older members. Only 37.3% of farmers were women, whereas more over half (62.7%) were men. This finding shows a greater proportion of males than females, which is in line with the research area's more heavily weighted male labour force in terms of agricultural output. Although, the higher percentage of male to female farmers is insignificant to climate variability as the gender-based perceptions of climate variability will have weight on both male and female farmers' but women's capacity to adapt to climate variability risk is also lower than men due to lack of access to financial services. According to Table1, a sizable portion of respondents have big households of 4–7 members (62.0%), with a mean household size of 5.1. If they are employed as farm labour, this may be advantageous. This is consistent with Awoyemi and Olajide (2020) and Adeagbo *et al.* (2021), who claimed that utilizing households with bigger sizes gives inexpensive labour to the families, increases the size of their farms, enhances agricultural productivity, and permits the adoption of various methods which can reduce the effects of climatic variability when compared to households with smaller family sizes.

Table 1 also reveals that the typical farmer earned ₦101,000 ($242.9) during a farming season, with half of them (50.0%) making more than ₦81,000 ($194.8) over the same period. This suggests that farmers' use of adaptation methods, interest in alternative adaptation strategies, and willingness to pay for access to such adaptation strategies are all strongly influenced by their income levels. The survey also discovered that farmers had 25.5 years of experience on average. The experience ranged from 1 to 10 years and 21 to 30 years for more than half (60.0%) of them, respectively. This shows that with more farm experience, there is a higher possibility of diversifying portfolios (adopting new crops or crop types, or employing mixed farming methods), altering planting dates, and altering the quantity of land in production. Furthermore, just 22.0% of farmers have completed basic school, 14.7% have no formal education, and 38.7% of farmers have completed secondary education. While only 24.6% of respondents had a bachelor's degree or less, this indicates a respectable level of literacy in western education, as seen in Table 1. Because educated individuals are better able to access information, they play a crucial role in raising awareness in rural areas. According to Eneji *et al.* (2020), education, regardless of its format, fosters the development of the proper awareness, knowledge, attitude, and capacity to alter the perception of farmers toward participating in various activities that can prevent or mitigate climate variability in extreme situations or circumstances.

The average size of the farms the respondents operated was 2.2 acres, which means that more than half (68%) of the farmers operated smaller farms, making them more susceptible to the negative effects of climatic variability and less equipped to handle them. This outcome supports the research of Danso-Abbeam *et al.* (2021) and Adekunmi (2022), who discovered that families with bigger plots of land set aside for farming are more likely to apply a range of adaptation techniques. Table 1 further demonstrates that the majority of farmers (70.0%) have access to extension agents, whereas 30.0% do not. This suggests that farmers' access to knowledge on production activities and the implementation of innovations depends on their interaction with extension agents, whose advice and demonstrations may affect how well farmers are able to adjust to changing weather conditions. Eta *et al.*

(2022) and Jha and Gupta (2021), found that information obtained through extension service delivery is beneficial to farmers in that it can help them create coping mechanisms for the effects of bad weather on their crops, livestock, and even themselves.

Table 1. Distribution of respondents based on their socio-economic characteristics

Socio-economic Variable	Frequency (n= 150)	Percentage	Mean
Gender			
Male	94	62.7	
Female	56	37.3	
Age			
26-45	59	39.3	
46-65	63	42.0	
66-85	24	16.0	
86-95	4	2.7	48.0
Household Size			
1-3	39	26.0	
4-7	93	62.0	
8-11	14	9.3	
12-14	4	2.7	5.1
Income on Farming			
10000-40000	26	17.3	
41000-80000	49	32.6	
Above 81000	75	50.0	101000
Other source of income			
No other sources	59	39.3	
10000-40000	40	26.6	
41000-80000	32	21.4	
Above 81000	19	12.6	35015
Level of education			
No formal education	22	14.7	
Primary education	33	22.0	
Secondary Education	58	38.7	
NCE/OND	20	13.3	
HND/B.Sc.	17	11.3	
Farm size			
Less than 1 Acre	34	22.7	
1-2.5	68	45.3	
2.5-4.0	32	21.3	
4.1-6.0	16	10.7	2.2
Access to extension			
Yes	45	30.0	
No	105	70.0	
Farm experience			
1-10	45	30.0	
11-20	31	20.7	
21-30	45	30.0	
Above 31	29	19.3	25.5

Source: Field Survey (2021).

Farmers' perception of climate variability on crop production

The distribution of responses regarding farmers' perceptions of climatic variability is shown in Table 2. Farmers stated that rainfall does not begin and stop at the typical times of the year owing to climate changes, which has contributed to crop failure over time (mean=4.1), and that they saw a decline in crop yields as a consequence of the influence of climate variability (mean=4.3). Farmers said that a combination of temperature rise and drought had reduced soil fertility, which had an impact on crop output (mean=4.0). The Table also reveals that more than half of the farmers (52.0%) fully agreed that excessive rainfall rarely promotes agricultural output (mean=3.9) and that 50.0% said that recent extreme temperatures had impacted crop productivity (mean=3.8). The implication is that the majority of respondents had strong opinions on how climatic variability affects crop productivity in the research area, which may be because they have extensive agricultural experience. As they make decisions about agricultural planning and management, their perceptions of climatic unpredictability are crucial for adaptation. The findings are in line with those of Fadina and Barjolle (2018), who found that education level and farming experience had a favorable impact on adaption choices made while planning and managing their agricultural operations.

Table 2. Farmers' perception of climate variability on crop production

Farmers' perception of climate variability	**SA**	**A**	**UD**	**D**	**SD**	**M**	**RK**
	F (%)	**F (%)**	**F (%)**	**F (%)**	**F (%)**		
Temperature is not normal in recent time	75 (50.0)	27 (18.0)	14 (9.3)	23 (15.3)	11 (7.3)	3.8	9th
Temperature is not normal in recent time	75 (50.0)	27 (18.0)	14 (9.3)	23 (15.3)	11 (7.3)	3.8	9th
Rainfall does not start and end at the normal period	84 (56.0)	28 (18.7)	17 (11.3)	11 (7.3)	10 (6.7)	4.1	2nd
There is an increase in temperature and drought	80 (53.3)	30 (20.0)	18 (12.0)	12 (8.0)	10 (6.7)	4.0	4th
There has been an increase in the intensity and frequency of weather events	59 (39.3)	43 (28.7)	29 (19.3)	6 (4.0)	13 (8.7)	3.8	9th
There has been noticeable drying of streams and river	72 (48.0)	33 (22.0)	23 (15.3)	9 (6.0)	13 (8.7)	3.9	7th
All your crops have been failing due to the variations in climates	81 (54.0)	39 (26.0)	17 (11.3)	4 (2.7)	9 (6.0)	4.1	2nd
Vegetation has been dried	71 (47.3)	40 (26.7)	20 (13.3)	10 (6.7)	9 (6.0)	4.0	4th
There has been decrease in crop yields	96 (64.0)	30 (20.0)	8 (5.3)	6 (4.0)	10 (6.7)	4.3	1st
There has been noticeable land degradation in the community	44 (29.3)	64 (42.7)	27 (18.0)	8 (5.3)	7 (4.7)	3.8	9th
There has been reduced soil fertility	77 (51.3)	33 (22.0)	15 (10.0)	14 (9.3)	11 (7.3)	4.0	4th
Excessive rain hardly supports crops production	78 (52.0)	38 (25.3)	7 (4.7)	8 (5.3)	19 (12.7)	3.9	7th

SA=Strongly Agreed, A=Agreed, UD=Undecided, D=Disagree, SD=Strongly Disagree, M=Mean, RK=Rank

Source: Field survey (2021).

Hypotheses testing

The results presented in Table 4 clearly made known that there was no significant relationship between gender ($\chi 2=46.5$, $p>0.05$), age ($\chi 2=199.5$, $p>0.05$), education ($\chi 2=247.6$, $p>0.05$) and experience ($\chi 2=299.4$, $p>0.05$). There was, however, a significant relationship between household size ($\chi 2=179.3$, $p<0.05$), farm size ($\chi 2=136.4$, $p<0.05$), and farmers' adaptation strategies. The implication is that the rural farmers with larger households have a potentially higher labour force and are more likely to implement adaptation strategies. This is in line with the findings of Ikuemonisan and Ajibefun (2021), who contend that bigger households are a good predictor of household agricultural income and may increase their capacity to adjust to changes in climatic circumstances. A big farm size gives farmers room to use more adaptation techniques, according to the association between farm size and adaptation strategies that were projected (Chete, 2019). Nor Diana *et al.* (2022) confirmed the significance of farm size in affecting farmers' adaptation strategies in a comparable research. According to the findings in Table 5, there is a substantial correlation between farmers' perceptions of climatic unpredictability and their techniques for adapting to it ($r=0.591$, $p<0.05$). The research demonstrates that farmers' perceptions are crucial to the effective use of adaptation methods to lessen the effects of climate variability on agricultural activities (Gedefaw *et al.*, 2018). The outcome supported the results of Asrat and Simane (2018), who noted that any farmers who lack perception will suffer a serious setback by having to deal with serious difficulties for failing to adjust to climatic unpredictability.

Table 4. Chi-Square analysis of the relationship between selected socio-economic characteristics of respondents and the adaptation strategies

Socio-economic characteristics	χ^2	P-value	Decision
Gender	46.5	0.161	Not Significant
Age	199.5	0.913	Not Significant
Household size	179.3	0.034**	Significant
Farm size	136.4	0.020**	Significant
Level of education	247.6	.117	Not Significant
Years of experience	299.4	.563	Not Significant

*significant: $p<0.05$; χ^2: Chi-square value; p-value: asymptotic significance value.

Table 5. Pearson Product Moment Correlation showing the relationship between perception of climate variability and adaptation strategies by the respondents

Variable	r-value	p-value	Decision	Remark
Perception of climate variability	0.591	0.000*	Significant	Ho rejected

*Significant: $p < 0.05$

Factors influencing farmer's choice of adaptation strategies

The factors impacting farmers' decisions about their adaptation techniques to climatic variability are shown in Table 6. The ordinary least square regression model was significant at a 5% level, indicating that certain socio-economic factors may have impacted the farmers' decision about their adaption strategy. Gender ($t=3.001$, $p<0.05$), credit availability ($t=2.459$, $p<0.05$), and other income sources ($t=2.384$, $p<0.05$) all had a favourable impact on the farmers' decision to adopt a particular adaptation strategy to the climatic variability in the research area The conclusion is that because of gender barriers and differences in decision-making between men and women, adaptation is not gender neutral in the sense that there are no differences in gender climate adaptation (Adzawla *et al.,* 2019). Additionally, it has been discovered that having access to finance increases farmers' income and increases the possibility that a household may choose to grow a variety of crops as a climate adaptation measure (Mwinkom *et al.,* 2021). Furthermore, Danso-Abbeam *et al.* (2021) found that farmers with other sources of income, such as non-farm income, had greater adaptive skills than farmers without additional sources of income.

The R-square for the regression analysis performed in this study was.442. These results suggest that gender, loan availability, and other income sources account for around 44.2% of the variation in the factors influencing farmers' adaptation strategy selection. The following Table 4 lists the significant variables. The p-value is less than 0.05, indicating a strong correlation between gender, loan availability, other income sources, and adaptability options.

Table 6. Regression estimation of socio-economic factors that influence farmers' adaptation strategies

Variables	Co-efficient	t-value	p-value
Gender	3.630	3.001	0.003*
Age	0.058	0.127	0.899
Farm size	-0.987	-1.295	0.197
Level of education	-0.293	-0.766	0.445
Extension agent visit	0.497	0.387	0.700
Experience in farming	0.190	0.554	0.580
Income of farmers	-0.106	-0.252	0.802
Access to credit	10.196	2.459	0.015*
Other sources of income	0.732	2.384	0.018*

*significant: $p<0.05$; R-square=0.442; Adjusted R^2=0.402; F-ratio=11.029.

Constraints to adoption of adaptation strategies

According to Table 7, the absence of proper irrigation facilities affects 64.0% of countries negatively and 10.0% negatively. Only 7.3% of respondents consider the insufficient government support to be a minor limitation, despite the fact that it was a severe burden (74.7%). This suggests that the farmers experienced issues with the availability of irrigation systems and government assistance. When these are unavailable or insufficient, crops wither and die, limiting output, which might result in a decrease in the amount of money that can be made and an increase in poverty (Zwane, 2019). Farmers were faced with 10.0% of negligible constraints and 64.0% of severe constraints due to lack of adequate irrigation facilities. Also, farmers were faced with 10.7% of negligible constraints and 56.0% of severe constraints due to insufficient extension officers. Farmers faced a substantial limitation of 8.0%, while the lack of credit and lending services was severe (54.0%). Despite being a substantial limitation for certain farmers (9.3%), the scarcity and high cost of farm inputs were a severe constraint (50.7%). This view is supported by Osei (2017) and Fagariba *et al.* (2018), whose investigation experimentally demonstrated that insufficient extension officers, a dearth of credit and loan services, a scarcity of agricultural supplies, and the high cost of those inputs might adversely influence farmers' capacity to adapt to climate change when faced with problems that required rapid attention.

Table 7. Constraints to adoption of adaptation strategies

Constraints	SVC	MJC	MDC	MNC	IFC	M	RK
	F (%)	F (%)	F (%)	F (%)	F (%)		
Lack of adequate irrigation facilities	96 (64.0)	25 (16.7)	6 (4.0)	8 (5.3)	15 (10.0)	1.8	9th
Lack of own land	21 (14.0)	15 (10.0)	23 (15.3)	18 (12.0)	73 (48.7)	3.7	1st
Unpredictable weather condition	72 (48.0)	42 (28.0)	15 (10.0)	8 (5.3)	13 (8.7)	1.9	8th
Lack of credit and loan services	78 (52.0)	28 (18.7)	22 (14.7)	10 (6.7)	12 (8.0)	2.0	6th
Lack of market access	66 (44.0)	34 (22.7)	23 (15.3)	9 (6.0)	18 (12.0)	2.9	2nd
Lack of information about potential climate variability	69 (46.0)	26 (17.3)	23 (15.3)	11 (7.3)	21 (14.0)	2.3	3rd
Lack of knowledge on appropriate adaptation strategies	66 (44.0)	32 (21.3)	23 (23)	8 (5.3)	21 (14.0)	2.2	4th
Shortage and high cost of acquired farm inputs	76 (50.7)	22 (14.7)	21 (14.0)	17 (11.3)	14 (9.3)	2.1	5th
Inadequate extension officers	84 (56.0)	21 (14.0)	14 (9.3)	15 (10.0)	16 (10.7)	2.0	6th
Inadequate government support	112 (74.7)	14 (9.3)	7 (4.7)	6 (4.0)	11 (7.3)	1.6	10th

SVC=Severe Constraint, MJC=Major Constraint, MDC=Moderate Constraint, MNC=Minor Constraint, IFC=Insignificant Constraint, M=Mean, RK=Rank
Source: Field survey (2021).

Conclusion

It is possible to conclude that farmers' perceptions of climatic variability have a significant impact on their adaption strategies. Based on the study's findings, we could have inferred that a better understanding of climate variability will help farmers develop better adaptation strategies, which will increase the value of their products, prevent the destruction of crops and farmland, and generally improve the farmers' quality of life, give them more power, have a positive impact on productivity, and lower the level of poverty in rural areas. Additionally, the results have demonstrated how farmers' productivity has been significantly impacted by the severe constraints they face, including inadequate irrigation facilities, a lack of own land, a lack of credit and loan services, a lack of market access, and a lack of knowledge about effective adaptation strategies. Based on the study's findings, the following recommendations are made;

* Community where the farmers are adeptly aware of the causes and impacts of climatic variability, climate variability awareness and sensitization should be put in place at the local, state, and federal government levels. Once in place, such understanding ought to alter how people currently perceive climate change and spur the development of beneficial adaptation strategies that are fit for the unique arable crops found in the study area.
* Awareness, knowledge, and insight on appropriate and affordable adaptation strategies that are suitable and relevant to their situation and circumstances

should be increased; farmers should be exposed to more training and visits from extension agents and all other relevant organizations and personnel.

* Farmers in the area should also be informed about new and innovative adaption strategies from research centers that have been shown via study to be successful for arable crops.
* In order to effectively communicate knowledge to farmers, extension agents must also be provided with knowledge and skills in adaptation and coping mechanisms through frequent training programmes.
* Federal, state, and local governments in Nigeria should make every effort to ease the difficulties faced by farmers by offering loans, irrigation systems, and more extension agents on the ground.

Conflict of interests

The authors declare no conflict of interest.

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