

DRIVERS OF ADAPTIVE CAPACITY TO CLIMATE CHANGE AND ITS EFFECTS ON CROP PRODUCTION AMONG ARABLE CROP FARMERS IN OGUN STATE, NIGERIA

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Abstract

This study assessed drivers of climate change adaptive capacity and its effects on crop productivity among arable crop farmers in Ogun State. Multi-stage sampling techniques were used to select 196 farmers. Primary data were collected with the aid of structured questionnaires. Data were analyzed using descriptive statistics. The hypothesis of the study was evaluated using Pearson correlation analysis. The result showed that majority of the farmers were married (95.0%), male (74.7%) with an average age of 52 years. It was further revealed that 39.9% perceived that planting of trees could lead to adaptation to climate change. Those that perceived that mixed cropping and bush fallowing constitute 98 percent and 28.3 percent respectively. About 97 and 61% stated that crop rotation and use of cover cropping respectively, could drive adaptive capacity. About 56% of the respondents agreed that adaptive capacity lead among farmers leads to improvement in agricultural yield. None of the respondents disagree with this statement. More than half of the respondents (53.3) strongly disagree that the quality of harvested crops is reduced as farmers have capacity to adapt to climate change. It was revealed that there is positive and significant relationship between Land and crop management ($r = 0.191$, $p < 0.05$); Water management ($r = 0.116$, $p < 0.05$); Organic fertilizer management ($r = 0.128$, $p < 0.05$); Technological management ($r = 0.183$, $p < 0.05$). The study recommends a timely and reliable climate and weather information through radio, mobile technologies, extension agents, and community-based information systems should be accessible to farmers in order to facilitate informed farming decisions.

Keywords: Drivers, Climate change, Adaptive capacity, Arable crop farmers

Introduction

Climatic variability and food security are the two major inseparable twins causing major agricultural problems, affecting socio economic development and food availability around the globe. The change in the pattern of climate and its elements has significant effects on the indicators of food security such as

availability, affordability, accessibility and stability. (Oyewole *et al.*, 2022; Food and Agriculture Organization (FAO), 2023; Mohanty *et al.*, 2024). The Nigerian agricultural sector is highly susceptible to climate change due to heavy dependence on rain fed agriculture and the farmers adjust their practices to either mitigate or adapt to the deleterious effects of climate

change especially on food security. (Odelola *et al.*, 2025; Adeola *et al.*, 2012). Arable crop production involves producing different types of annual crops i.e. crops whose life cycle from planting to harvesting is a year. They are of different types be it grains (cereals e.g. wheat, maize, rice), pulse (e.g. beans, peas), oilseed crops (e.g. sunflower, soybean), Tuber crops (e.g. yam, cassava, potatoes), vegetables (tomatoes, amaranths, jute mallow) and forage crops (e.g. maize, sorghum, alfafa). (Agrifarming, 2024).

The success or failure of adaptation to the effects of climate change is determined by the system's adaptive capacity, which describes the ability of a system to mobilize resources to prepare for and respond to current or perceived stresses. This means adaptation practices are tied to adaptive capacity. (IPCC, 2022). Adaptive capacity is therefore defined as the ability of social-ecological systems to adapt to, navigate, and recover from environmental shocks (Vallury *et al.*, 2022). From several studies and literatures, two germane reasons exist for carrying out studies on adaptive capacity. Firstly, it is for identifying the hindrances and constraints to adaptation practices within groups of farmers and secondly for comparing the adaptive capacity across groups of farmers which is essential in making resource allocation decisions (Chapagain *et al.*, 2025).

The drivers of adaptive capacity to climate change can be simply defined as the socio-economic, technological, environmental and institutional factors that farmer make use of in order to prevent, cope or to adjust to the effects of the changing climate (IPCC, 2022). These factors either affect the capacity of individual positively or negatively. The effects of climate change on crops

productivity cannot be overemphasized. These effects are evidently revealed on the life cycles of crops, the crop yield and the quality of the crop harvested and or stored. Ahmad *et al.* (2021) in their study on the impacts of climate variability on crop yields at different spatial and temporal scales revealed that the vegetative and reproductive phases are the most sensitive phases to climate change. Also, increased temperatures, high evapotranspiration rates, intensified water evaporation lead to scarcity of water, dryness of the soil and eventually lead to reduction in crop yield. (Yuan *et al.*, 2024).

In the studies of Janmohammadi and Sabaghnia, 2023, it was noted that increase in the temperature levels and concentration of CO₂ may lead to substantial decrease in protein content of crops and general decline in crop quality which then results in low demand of certain agricultural crops by the final consumers or processors and thereby leading to low income among crop farmers. It has been revealed from previous studies on climate change that any alteration in the climate has negative effects on agricultural productions in Nigeria and most especially in the drastic reduction of agricultural output (Ani *et al.*, 2021). It has been established that poor household will be affected by the negative effects of climate change. This is due to the fact that they depend on natural resources for their major activities and livelihood sustainability. (William *et al.*, 2019).

In Southwest Nigeria, farmers are experiencing significant negative impacts from climate change, including shifts in rainfall patterns, increased temperatures, and more frequent extreme weather events. These changes are affecting crop yields, leading to food insecurity and

economic hardship for farming communities. Farmers are also dealing with increased pest and disease infestations, which further exacerbate the challenges. (Ayanlade *et al.*, 2023). Ibrahim and Musa (2023) reported that smallholder farmers are the group exposed to the vagaries and effect of climate change due to the fact that their livelihood activities depend on climatic elements. Several studies focused on effect of climate change, coping strategies and as well as factors influencing coping measures adopted among farm households (Chukwuone and Amaechina, 2021; Adimassu and Kessler, 2016). Particularly in Nigeria, there are very few studies that focused on the adaptive capacity to climate change and these studies are limited in scope.

This study therefore intends to fill the gap by describing the socioeconomic characteristics, assessing the drivers of adaptive capacity to climate change and the effects of adaptive capacity to climate change on crop production in Ogun state.

Hypothesis:

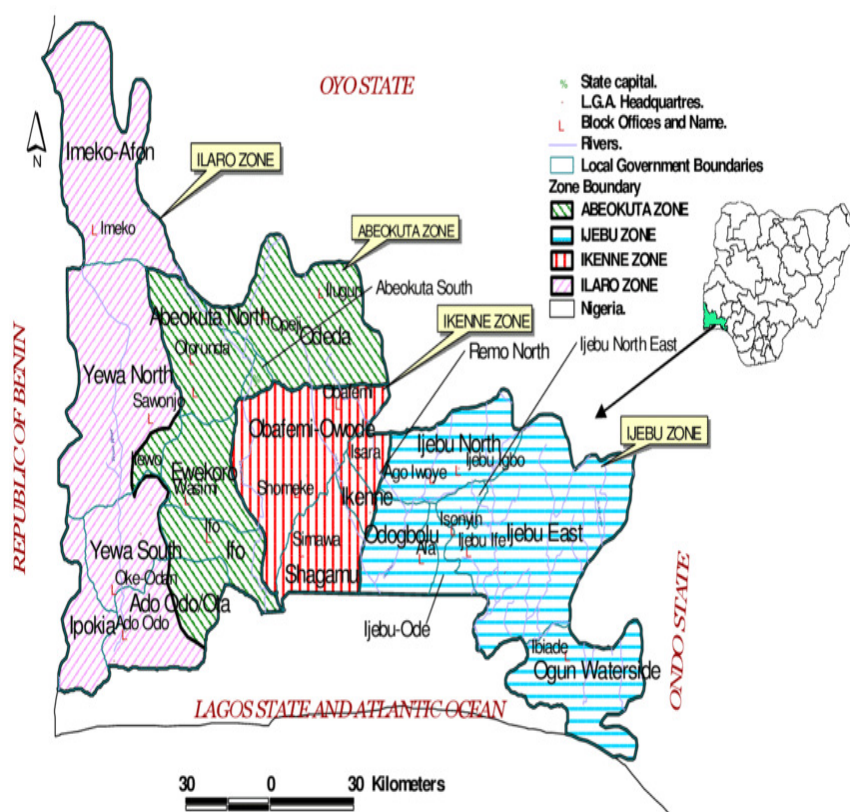
H₀₁: There is no significant relationship between the drivers of adaptive capacity and level of adaptive capacity to climate change.

Study Area

The study was conducted in Ogun state. Ogun State came into existence around 1830. Ogun State is one of the six states that make up Nigeria's South-West geopolitical zone. It shares an

international boundary with the Republic of Benin to the West and has interstate boundaries with Oyo State to the North, Lagos State to the South, and Ondo and Osun States to the East. The state capital is Abeokuta. Ogun State has a total land area of 16,409.26 km². It lies approximately between latitude 3° N and 4° N and longitude 6°E and 7°E and with an estimated population of 5304445 people as at 2017 and a population growth rate of 3.2% (Ambali *et al.*, 2012; NPC, 2006).

Ogun State has a tropical pattern of climate. The raining season starts about March and ends in November, followed by dry season. The mean annual rainfall varies from 128cm in the southern parts of the State to 105cm in the northern areas. The average monthly temperature ranges from 23°C in July to 32°C in February. The mean daily sunshine hours range between 3.8 and 6.8. Relative humidity ranges between 76.0% and 95.0% coinciding with dry and wet season. The northern part of the State is mainly of derived Savannah vegetation, while the Central part falls in the rain forest belt. The southern part of the State has mangrove swamp (Ambali *et al.*, 2012). The key agricultural resources include cocoa, kola nut, rice, maize, cassava, yam, banana, timber, rubber, livestock and palm oil. Ogun State's mineral resources include limestone, gypsum, kaolin, gemstone, feldspar, phosphate, mica, glass, clay, granite, and bitumen.



Caption?

Methodology

Sampling Procedure and Sample size

A multi-stage sampling procedure was employed to select 198 respondents for the study. Ogun state has four (4) agricultural zones namely; Abeokuta, Ilaro, Ikenne and Ijebu. Out of these agricultural zones, Abeokuta and Ilaro zones were selected randomly. The second stage involved the random selection of one (1) agricultural block from each of the zones. Ilugun and Oke- Odan were selected from Abeokuta and Ilaro zones respectively. The third stage involved the random selection of four (4) cells from each block. The selected cells were Kila, Odeda, Olodo and Ilugun from Ilugun and Ilase, Oke- Odan, Ipokia and Ihunbo from Oke- Odan.

A simplified formula provided by Kabatesi and Mbabazi (2016) was used to determine the sample size (n) considered

adequate from the population. This is given by

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

$$n = \frac{2570}{1 + 2570(0.05)^2} n = 198$$

Where:

n = is the sample size; N is the population i.e. total number of registered arable crop farmers in Ogun State; e = 0.05 is the level of significance defined to determine the required sample size at 95% confidence level. The selection of 198 respondents was done in proportion to the number of registered farmers

Data Collection and Data Analysis

Primary data were collected for this study through the use of structured questionnaire with interview schedule. Some parameters were listed on the drivers of adaptive capacity to climate

change and farmers' selection was graded on 5point Likert scale. 5=Strongly agree; 4= Agree; 3 = Undecided; 2 =Disagree and 1 = Strongly disagree.

Also, some effects of climate change were stated for farmers and was graded on 5point Likert scale. 5=Strongly agree; 4= Agree; 3 = Undecided; 2 =Disagree and 1 = Strongly disagree.

The data collected were analyzed using both descriptive and inferential statistics. Descriptive statistics such as frequency counts, means, percentages. Inferential statistics such as Likert Rating Scale and Chi Square was used in testing the hypothesis.

Results and Discussion

Socio-Economic Characteristics of Respondents

The results in table 1 showed the age distribution of respondents in Ogun state. It was revealed that 2.0% of the respondents were within the age of 21-30 years, 10.6% were 31-40 years, 29.8%, 37.4% of the respondents were within the age range of 41-50, 51-60 years respectively and 20.2% were above 60 years of age with the mean age of 52 years. This suggests that farmers involved in arable crop production in the study area were still within the working age. However, the average age of 52 years indicate that the farmers were old. This result aligns with the findings of Ayinla *et al.*, 2024 who also reported the high involvement of older farmers in arable crop farming in their related study conducted in two states in southwestern, Nigeria. Their study suggests that older farmers are involved in arable crop production due to factors such as land tenure system, financial problems denying youth involvement in agriculture, also cultural norms favoring older individuals'

participation in farming; technological barriers and limited educational accessibility may prevent younger individuals from pursuing agricultural endeavors.

The results in table 1 revealed the marital status distribution of respondents in the study area. It shows that most of the farmers (95.0%) were married, 1.5%, 2.5% and 1.0% of the respondents were single, widowed and divorced respectively. This result shows that majority of the respondents were married and this is very crucial in agricultural production especially among the small scale arable crop farmers. This result is in line with the findings of Ntasimda *et al.*, (2025) in their studies on assessment of socioeconomic determinants of crop productivity and challenges faced by rural women in agricultural production in Northeast Nigeria. It was revealed that on average, being married is mostly associated with increased level of crop productivity compared to being single and having more people within a household would be able to have high possibility of farm management leading to increased productivity and household income. The sex distribution of the respondents in the study area revealed that majority (74.7%) of the respondents were males while 25.3% were females. This implies that more men were involved in arable crop production from the sampled farmers in the study area. This could also be due to no or low access to land for agricultural production among women as a result of land tenure system, financial incapacibilities among others. This is in line with the report of FAO that continuous inequalities in accessibility to land, credit facilities, extension services among other factors contributes to women's full participation in agricultural production

and value chains. (FAO, 2023). The mean household size was 7 members. This means that farm labour will be available though household welfare may be jeopardized especially if members are unproductive and may lead to food insecurity and low household income. This study is in line with the findings of Oladeji *et al.*, 2024 that having larger households could positively lead to having access to family labour supply which in turn negatively leads to household's increased food and income needs especially if the farm yield and income are low.

The results presented in Table 1 also show that in the study area, 13.1% of the respondents had no formal education, 31.8%, 25.8% and 12.6% of the respondents completed their primary, secondary and tertiary education respectively. This result implies that most of the respondents had one form of education or the other. Most of the respondents were literate and this may be due to various educational opportunities present in Southwestern, Nigeria which help the farmers to understand the effects, know ways to adjust, cope and be productive even under changing climatic condition. This result corroborates the Intergovernmental Panel on Climate Change (IPCC, 2022), that higher

educational levels in Southwestern, Nigeria, help to fortify the coping capacity to climate change through improvement in the level of awareness, acceptance of innovation, membership of cooperative societies and social organizations, and participation in collective adaptation methods to cope with the effects of climate change.

As shown in Table 1, the annual income distribution of the respondents in Ogun state. It was revealed that 32.3% of the farmers had income between #1-#1,000,000, 32.3% of the respondents' annual income was between #1,000,001 – #2,000,000, 19.2% of the respondents had their annual income to be between #2,000,001- #3,000,000 and 16.2% of the respondents' annual income was greater than #3,000,000. Income is very important in agricultural production for the procurement of land, inputs, farm and household supplies and to cope better with the changing climate. This is in line with the findings of Sallawu *et al.*, 2022 that as the farmers' annual income increases, adoption of the climate smart agricultural practices also increases and livelihood diversification would also be possible. So also, when farmers' income reduces, farmers would be exposed to climatic shocks.

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

Variables	Frequency	Percent
Age		
21-30	4	2.0
31-40	21	10.6
41-50	59	29.8
51-60	74	37.4
>60	40	20.2
Average	52	
Marital status		
Divorced	2	1.0
Married	188	95.0
Single	3	1.5
Widowed	5	2.5
Sex		
Male	148	74.7
Female	50	25.3
Education		
No formal education	26	13.1
Primary school attempted	10	5.1
Primary school completed	63	31.8
Secondary school attempted	23	11.6
Secondary school completed	51	25.8
Tertiary education	25	12.6
Annual Income		
1-1000,000	64	32.3
1,000,001-2,000,000	64	32.3
2,000,001-3,000,000	38	19.2
>3,000,000	32	16.2
Household size		
1-5	35	17.7
6-10	141	71.2
11-15	22	11.1
Average	7	
Household size		
1-5	35	17.7
6-10	141	71.2
11-15	22	11.1
Average	7	

Drivers of Adaptive Capacity to Climate Change in Ogun state

The result presented in Table 2 indicates that in Ogun, 39.9% perceived that planting of trees could lead to adaptation to climate change. Those that perceived that mixed cropping and bush fallowing constitute 98% and 28.3% respectively. About 97 and 61% stated that crop rotation and use of cover cropping could drive adaptive capacity. About one third (31.3%) of the respondents identified mulching as one of the drivers of climate change adaptive capacity. Planting of resistance varieties was identified by 37.4% while majority of the respondents (98.0) stated that climate change adaptation capacity among farmers could be influenced by changing the planting dates. Only 37.4% stated that planting of early maturing crops could influence climate change adaptive capacity among farmers.

Among the respondents in Ogun, planting of trees, use of cover cropping and crop rotation were identified by 45.3%, 97% and 96.5% respectively. Those that indicate cover cropping as one of the drivers of climate change adaptive capacity were 67.7%. More so, about 41% mentioned mulching as the driver of adaptive capacity. Majority (97.6%) included changing the planting dates as one of the options. About half (51.5%) stated that planting resistant varieties could improve adaptive capacity to climate change. The result from both states indicated that mixed cropping, crop rotation, planting of early maturing crops were identified as the major driver of adaptive capacity under land and crop management. These were stated by 97.5% of the respondents. Those that identified planting of cover crops constitute about 65%.

It could be deduced that mixed cropping, use of crop rotation, changes in planting date, planting of cover crops, integration of trees with crops among others were the major drivers of climate change adaptive capacity under land and crop management strategies among smallholder farmers. According to Bijarniya *et al.* (2020), use of crop management practices such as mixed cropping, crop rotation and integration of trees with crops whether individually or in combination could play a crucial role in climate change adaptation and reduction in climate risks. Omotoso and Omotayo (2026) retreated that crop rotation contributes to soil fertility, complementing both mixed cropping and mulching by creating healthier soil environments. Ngoma *et al* (2021) added that mulching is a low-cost practice that conserves moisture and suppresses weeds, though it may compete with agroforestry for biomass resources. Integration of crops with trees will help farmers to diversify income and improves microclimates, complementing rotations and mixed systems but potentially substituting for mulching where land or labour constraints exist. In the study conducted by Ikpe and Omede (2025) on climate change adaptation strategies among maize farmers in Benue State, mixed cropping was ranked first among the adaptation strategies used by farmers, followed by early planting, the use of organic/inorganic manure, and the planting of pest- and disease-resistant crops. To enhance food security and promote climate resilience.

Under water management strategies, majority (72.7%) of the respondents in Ogun State identified use of irrigation as one of the drivers of climate change adaptive capacity. Almost all the

respondents (98.5%) stated that storing water in dams, ponds, trenches etc. for non-rainy periods could facilitate adaptation to climate change. Similarly, more than half (60%) of the respondents mentioned use of irrigation as part of the drivers of climate change adaptive capacity among farmers in Ogun State. Those that identified water harvesting constituted 65.3% of the respondents. Unfavourable rainfall pattern is one of the climate change variables that is affecting crop productivity in recent times. Ogunbode *et al.* (2022), in their study, on rainfall trend and its implications for sustainable crop production stated that rainfall variability has major impact on water resources and it is affecting both the surface and subsurface water availability hence affecting water supply for crop and human uses. Awazi (2025), in his study on the role of irrigation as an adaptive measure to climate change stated that water scarcity is caused by climate change hence most farmers adopt different irrigation practices as an adaptation measure to the adverse climatic condition.

Under organic fertilizer management, the use of compost and organic manure were mentioned by 39.3% among the respondents in Ogun state. Those that mentioned the use of organic manure among the respondents in Ogun were 93.2% which implied that the use of organic manure was popular among the farmers as part of the organic fertilizer management in their effort to cope with climate change variability.

Under the technological management, about 72% of the farmers in Ogun indicate accessibility to weather forecast as part of the drivers of climate change adaptive capacity. This result shows the importance of weather forecast to crop farmers in the study area. According to Abdulrahman *et*

al. (2025), weather forecasting and weather warning communication can help reduce the impact of extreme weather. Similarly, Parsi and Maleksaeidi (2021) retreated that weather forecasts have potential for improving adaptation and resilience of agricultural systems to climate changes. The result also revealed that the use of automated irrigated was not popular with less than one quarter of the respondents in Ogun mentioned this as an option for climate change adaptation strategy. Majority of the respondents in Ogun (78.3%) stated that education and training were very important to climate change adaptation among farmers. About 82% of the respondents noted that education and training are importance variable that is essential for climate change adaptation. Tammi *et al.* (2025) in their work on the effects of climate change adaptation strategies on food crop production in North East Nigeria submitted that education plays a crucial role in farming, particularly when farmers receive training on specific aspects and apply that knowledge. It was envisaged that farmers who are educated and have access to training are more likely to seek and disseminate information to others. The relatively high literacy rate among respondents may facilitate better adoption of improved farm practices and the ability to apply new knowledge and skills effectively (Tammi *et al.*, 2025).

As part of the financial management variables, majority of the respondents in Ogun (90.4%) mentioned livelihood diversification as one of the drivers of climate change adaptive capacity. Livelihood diversification could assist farmers to build resilience against income shock and assist farmers to adopt improved farm practices such as the use of drought tolerant species, changing

planting dates and the use of early maturing varieties. Beyene *et al.* (2023) in his study on the impact of livelihood diversification as a climate change adaptation strategy revealed that the adoption of livelihood diversification as an adaptation strategy to climate change cannot be overemphasized as it enables farmers to cope with the effects of climate change on crop production. Similarly, Jacqueline (2020), concluded that diversification of income through diversified livelihoods would help smallholder farmers enhance their resilience in the face of changed climatic conditions. He submitted that on-farm livelihoods should not always be the main income source for farmers.

Furthermore, about half (51.6%) of the respondents in Ogun indicated that government support is one of the factors that can enhance climate change adaptive capacity. Those that mentioned access to climate information as the driver of climate change adaptive capacity were 91.9% in Ogun. Access to timely climate information is critical for farmers to adopt adaptation measures like adjusting planting dates, using drought-resistant crops, and improving irrigation. It

enhances productivity, reduces risk, and increases income, though limited access in developing nations remains a major barrier (Ogundeji *et al.*, 2022; Adeola *et al.*, 2012). The findings also revealed that 95.8% of the respondents in Ogun reiterated that access to extension and advocacy services could enhance adaptive capacity to climate change. This is not surprising because the importance of agricultural extension services in the adoption of improved farm practices cannot be over-emphasized. Priya *et al.* (2025) noted that well-functioning extension services can enhance climate risk preparedness, and reduce yield losses through improved resource management. About 55% of the respondents in Ogun mentioned the use of indigenous knowledge as one of the drivers of climate change adaptive capacity. Nakashima *et al.* (2018) submitted that local and indigenous knowledge is therefore a source of invaluable information for climate change assessment and adaptation. Ciocco, (2024) noted that there are increasing calls to incorporate indigenous knowledge (IK) into climate adaptation planning.

Table 2: Drivers of adaptive capacity to climate change

STATEMENTS	Ogun*
1. Use of adaptation strategies	154(77.8)
a. Land and crop management	
Planting of trees	79(39.9)
Mixed cropping	194(98.0)
Bush fallowing	56(28.3)
Crop rotation	191(96.5)
Planting of cover crops	121(61.1)
Mulching	62(31.3)
Planting of flood/ drought/ diseases resistant varieties	84(37.4)
Change in planting dates	194(98.0)
Planting of early maturing crops	74(37.4)
b. Water management	
Irrigation activities	144(72.7)
Water harvesting (storing water in dams, ponds, trenches etc for non-rainy periods)	195(98.5)
c. Organic fertilizer management	
Use of organic fertilizers	51(25.8)
Use of compost	185(93.4)
Use of manure	198(100.0)
d. Technological management	
Greenhouse	142(71.7)
Access to weather forecasts	38(19.2)
Automated irrigation system	38(19.2)
Education and training	155(78.3)
e. Financial management	
Livelihood diversification	179(90.4)
Credit schemes	35(17.7)
Government support	114(57.6)
2. Access to climatic and agricultural information	182(91.9)
3. Membership of social organizations	119(60.1)
4. Utilization of mitigation strategies	100(50.5)
5. Access to extension and advisory services	150(75.8)
6. Use and application of indigenous knowledge	108(54.5)

Effects of adaptive capacity to climate change on arable crop farmers' productivity in Ogun state

The result in Table 3 showed that 56.1% of the respondents agreed that adaptive capacity lead among farmers leads to improvement in agricultural yield. None of the respondents disagree with this statement. Only 6.1% were neutral to the statement. More than half of the respondents disagree that adaptive capacity result to reduction in the size of

farm cultivated for crop. About 12% strongly disagreed with the fact that adaptive capacity to climate change reduces the size of the farm cultivated. The weighted mean score for this statement was less than 3 which implied that those that disagree were more compared to those that agree. More so, more than half of the respondents (53.3) strongly disagree that the quality of harvested crops is reduced as farmers have capacity to adapt to climate change. The

weighted mean score of 2.8 further corroborate that majority supported that adaptive capacity increased the quality of crops harvested by the farmers. About 49% strongly disagreed that climate change adaptive capacity decreased pest and diseases invasion on both crops on the farm and store. The weighted means score 2.8 was less than 3 indicating that majority disagreed that adaptive capacity to climate decrease pest and diseases invasion on both crops on the farm and in store. This implies that pests and diseases infestation on the farm and in store has nothing to do with adaptive capacity to climate change. The result also showed that 31.8% agreed that adaptive capacity improve irrigation practices those that strongly disagree with this statement constitute 42.9%. Majority (62.6) of the respondents strongly agreed that adaptive capacity to climate change

led to changes in planting and harvesting dates. None of the respondents disagree with this statement. The higher means score of 4.6 indicates that most of the respondents submitted that adaptive capacity leads to changes in planting and harvesting time. This implies that having the capacity to cope with the effects of climate change enable the farmers to plant on time and harvest their farm produce as at when due.

Furthermore, majority (61.6%) of the respondents agree that adaptive capacity encourages farmers' income diversification while only 10.6% strongly disagree with this statement. In terms of farmers' welfare, majority of the respondents (75.3) agreed while 61.6% agreed that adaptive capacity to climate change reduce farmers' vulnerability to climate change.

Table 3: Effects of adaptive capacity to climate change on crop productivity in Ogun state

Effects	Strongly Agree	Agree	Undecided	Strongly Disagree	Disagree	WMS
Improvement in agricultural yield	42(21.2)	111(56.1)	12(6.1)	33(16.7)	-	3.8
Reduction in the size of farm cultivated for crop	8(4.0)	72(36.4)	12(6.1)	23(11.6)	102(51.57)	2.9
The quality of harvested crops reduced	5(2.5)	63(31.8)	23(11.6)	106(53.3)	1(0.5)	2.8
Decreased pests and diseases invasion on both crops on the farm and in store	5(2.5)	57(28.8)	33(16.7)	96(48.5)	7(3.3)	2.8
Improved irrigation practices	1(0.5)	63(31.8)	24(12.1)	85(42.9)	25(12.6)	2.6
Changes in planting and harvesting dates	124(62.61)	67(33.8)	7(3.5)	-	-	4.6
Encourages farmers' income diversification (more sources of income)	23(11.6)	121(61.6)	33(16.7)	21(10.6)	-	3.7
Improvement in farmers' welfare	19(9.6)	149(75.3)	24(12.1)	6(3.0)	-	3.9
Reduction in farmers' vulnerability to climate change	6(3.0)	122(61.6)	46(23.2)	24(12.1)	-	3.6

H₀₁: There is no significant relationship between the drivers of adaptive capacity and level of adaptive capacity to climate change

The result in Table 4 presents the relationship between the drivers of adaptive capacity and level of adaptive capacity to climate change. It was revealed that there is positive and significant relationship between Land and crop management ($r = 0.191$, $p < 0.05$); Water management ($r = 0.116$, $p < 0.05$); Organic fertilizer management ($r = 0.128$, $p < 0.05$); Technological management ($r = 0.183$, $p < 0.05$); Financial management ($r = 0.285$, $p < 0.05$); Access to climatic and agricultural information ($r = 0.266$,

$p < 0.05$); Membership of social organizations ($r = 0.465$, $p < 0.05$); Use and application of indigenous knowledge ($r = 0.328$, $p < 0.05$) of the arable crop farmers. The implication of this is that most of the drivers of adaptive capacity identified in this study are important to farmers' level of adaptive capacity. The null hypothesis which states that there is no significant relationship between the drivers of adaptive capacity and farmers' adaptive capacity will be rejected.

Table 4: Summary of Pearson Correlation analysis showing relationship between the drivers of adaptive capacity and adaptive capacity to climate change

Drivers of adaptive capacity	r-value	p-value	Remark
Land and crop management	0.191	0.00	S
Water management	0.116	0.026	S
Organic fertilizer management	0.128	0.014	S
Technological management	0.183	0.000	S
Financial management	0.285	0.000	S
Access to climatic and agricultural information	0.266	0.000	S
Membership of social organizations	0.465	0.000	S
Utilization of mitigation strategies	0.052	0.319	NS
Access to extension and advisory services	0.135	0.090	NS
Use and application of indigenous knowledge	0.328	0.000	S

Conclusion

The study concluded that adaptive capacity among farmers is largely driven by climate-smart agricultural practices such as mixed cropping, crop rotation, changing planting dates, water harvesting, irrigation, use of organic manure, and livelihood diversification. Other drivers that enhance farmers' adaptive capacity include extension services, access to climate information, education and training, and use and application of indigenous knowledge. Furthermore, adaptive capacity was found to have a positive influence agricultural productivity through improving yields, facilitating timely farming operations, and promoting income diversification among

farmers. The study equally established that the drivers of adaptive capacity such as use of adaptation strategies, access to climatic and agricultural information, membership of social organization and the use and application of indigenous knowledge have significant relationship with adaptive capacity to climate change. The study therefore concluded that strengthening farmers' adaptive capacity through improved access to information, extension services, and the use of adaptation strategies is very important in enhancing resilience, coping with the effects of climate change and sustaining agricultural productivity under changing climatic conditions.

Recommendations

Based on the findings of the study, the following recommendations are made:

1. Timely and reliable climate and weather information through radio, mobile technologies, extension agents, and community-based information systems should be accessible to farmers in order to facilitate informed farming decisions.
2. Indigenous knowledge systems relating to climate adaptation should be integrated with scientific knowledge in developing climate adaptation programmes for farmers.
3. Government should improve support for agricultural development programmes that promote resilience, sustainable production, and food security among smallholder farmers

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