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Gender differentials in the determinants of usage of climate change adaptation strategies in farming communities of Ekiti and Ogun States, Southwest Nigeria

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ABSTRACT

The use of adaptation strategies remains the only approach to reduce and combat the effects posed by climate change all over the world. We explored the extent of usage of adaptation strategies by farmers in Ekiti and Ogun States. 358 men and 222 women farmers were surveyed using multi-stage procedure. We employed semi-structured questionnaire and focus group discussions to collect data from the respondents. The data were analysed descriptively and presented in percentages and frequency counts. The data were further subjected to Chi-square, Pearson's Product Moment Correlation, t-test, multiple linear regression analysis and Explorative Factor Analysis (EFA). The findings revealed that the majority of men (99.7%) and women farmers (96.8%) perceived to adapt to climate change. Men (= 2.29) relative to women (= 2.33) used more on-farm adaptation strategies. The strongest determinant of usage of climate change adaptation strategies by men farmers was climate change adaptation barriers ($t = 5.13$, $p < 0.01$), while for women farmers, climate change experience ($t = 7.42$, $p < 0.01$) was the strongest determinant. The promotion of gender-sensitive approaches to climate change adaptation that cater for the needs of men and women farmers is highly essential to enhance adaptation among them.

Keywords: Agriculture; adaptation; change; strategies; climate

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Introduction

Climate change has been described by many researchers as the most serious environmental challenge impacting not only agriculture but on other sectors like water resources, health, forests and energy resources. In Africa, climate change has affected both the natural and social systems (Amsalu & Gebremichael, 2010). Nigeria like most parts of the world is experiencing climate change as asserted by Ajayi (2015). According to Falaki *et al*. (2013), agriculture is one of the sectors highly vulnerable to the impacts of climate change, especially in a country like Nigeria where agriculture is rain-fed and practised at the subsistence level.

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Climate change is the changes in the state of the climate, identified by changes in the mean and/or the variability of its properties, and that persists for an extended period typically decades or longer (Agbidye *et al*., 2015**).** As stated by Dasgupta *et al*. (2014), the increased concentration of greenhouse gases has raised the average temperature and altered the amount and distribution of rainfall globally. Climate variability is characterized by extremes of temperature and rainfall that ultimately bring about frequent floods which often alternate with droughts (Kalungu *et al*., 2013).

According to Azadi *et al*. (2019), adaptation to climate change is inevitable and critical in many developing countries that rely on agriculture as a source of income. In particular, farmers in developing countries need to adapt their agricultural practices to maintain yields and minimize their vulnerability to climate change. Also, Uddin *et al*. (2014) state that people who depend on farming activities will require a variety of adaptation strategies to mitigate the negative effects of climate change and maintain the livelihoods of farm families. Over time, farmers have been adapting to climate change by application of traditional methods, indigenous knowledge, and modern farming practices.

Adaptation to climate change is any activity that reduces the negative impacts observed i.e. anticipatory, and after impacts have been felt i.e. reactive (Ajayi, 2015). Adapting to climate change is a response to reduce the risks associated with farming (Arbuckle *et al*., 2013). Adaptation will soften the impacts of climate change, help protect farmers' livelihoods and lead to other potential advantages (Gandure *et al*., 2013). Farmers' ability to adapt to the impacts of climate variability depends on factors such as wealth, technology, education, information, infrastructure, access to resources and management abilities (Oluwasusi & Tijani, 2013).

Nzeadibe *et al*. (2011) identified the adaptation measures commonly used in Nigeria to include conservation of water and soil, use of organic manures, use of inorganic fertilizers, cover cropping, mulching, use of minimum tillage systems, increase in the number of weeding of cropland and use of early maturing crop varieties. It also entails reforestation/ afforestation, protection of the watershed, proper preservation of seeds and plant seedling used for planting, planting of the crops with early rainfall, and mixed farming practices.

According to Bryan & Behrman (2013), gender, in particular, is one user characteristic that may have profound impacts on individuals' ability to cope with climate change. Gender is a significant factor to consider when choosing an adaptation strategy to cope with the risk of climate change effects in crop farming (Ifeanyi-Obi *et al*., 2014). Female and male- households differ significantly in their ability to adapt to climate change because of major differences between them in terms of access to assets, education and other critical services such as credit, technology and input supply (Solar, 2010; Azadi *et al*., 2019). The social roles of women in many countries can limit their abilities to adapt to climate change (Mckinley *et al.,* 2015).

Also, awareness of climate change, as well as risk perception, is identified as the main motivators for adaptation behaviour (Barners & Toma, 2012; Mase*,* Gramig & Prokopy 2017). In order to achieve this, agricultural extension agents are saddled with the responsibility of passing across technologies and initiatives (Olorunfemi *et al*., 2020). Access to extension is positively and significantly related with adaptation options (Belay *et al*., 2017). In addition, more experienced farmers are more likely to adapt to climate change (Silvestri *et al*., 2012). Despite the significant farming experience, farmers may not be able to adjust

well without sufficient credit (Antwi-Agyei *et al*., 2021). Education level is generally observed to be a positive predictor of adaptation behaviour (Li *et al*., 2017). Also, the level of education of a farmer determines the probability of adopting an adaptation strategy (Antwi-Agyei *et al*., 2021).

Adaptation is an important strategy for reducing the negative impact of climate on agriculture (Jin & Wang, 2016). In that wise, it is pivotal to promote adaptation measures among farmers to help them protect their crops from extreme climate events (Obayelu *et al*., 2014). It is more important to consider gender differences while promoting adaptation to climate change to ensure gender balance while achieving sustainable development goals. Despite the extensive research conducted on adaptation to climate change, very little research had been done on the extent of usage of adaptation strategies by men and women farmers.

This study aims at ascertaining the determinants of men and women farmers' usage of adaptation strategies. The study hypothesized that 1) there is no significant difference in men and women farmers' adaptation strategies, 2) there is no significant difference in men and women farmers' adaptation barriers, and 3) socio-economics characteristics and production, climate change information sources, and climate change adaptation barriers are not the determinants of men and women farmers' use of climate change adaptation strategies.

Materials and Methods

Study area

The study was conducted in Ekiti and Ogun States, Southwest Nigeria. Geographically, Ekiti State is located between longitudes 4° 51` and 5° 45` E and latitudes 7° 15[1] and 8° 5[1]N. The temperature range is between 21° – 28°C with high humidity of 70% and a total annual rainfall of 1400mm. Topographically, Ekiti State is mainly on an upland zone rising above 250 metres above sea level. The area is characterized by 3 major vegetation types namely, rain forest and deciduous forest covering the southern part of the State while semi-grasslands i.e. guinea savannah covers the northern peripheries. The heavy downpour particularly during July, August and September encourages the growth of thick forests and also of cash crops like oil palm, cocoa and, coffee. The major occupation of Ekiti people includes farming, trading, tailoring, craftwork, blacksmith, and, civil services.

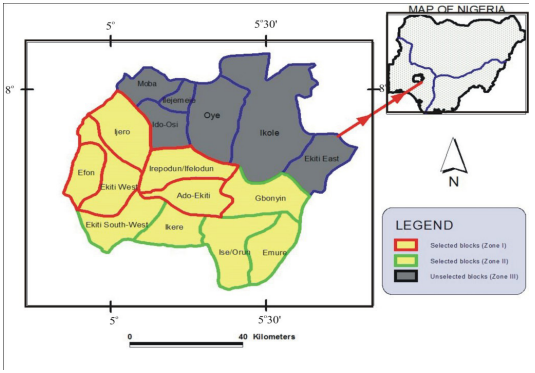

Fig. 1: Map of Ekiti State indicating selected locations

Geographically, Ogun State lies between longitudes 3° 0[1] and 5° 0[1] E and latitudes 6° 12[1] and 7° 47[1]N. The State is located in the moderately hot, humid tropical climatic zone of Southwest, Nigeria. Ogun State shares an international boundary with the Republic of Benin to the West and interstate boundaries with Oyo State to the north, Lagos and the Atlantic Ocean to the south, and Ondo State to the east. The climate of Ogun State follows a tropical pattern with the rainy season starting about March and ending in November followed by a dry season. The mean annual

rainfall varies from 128 cm in the southern parts of the State to 105 cm in the northern areas. The average monthly temperature ranges from 23°C in July to 32°C in February. There are two distinct seasons in the State, namely, the rainy season which lasts from March/ April to October/ November and the dry season experienced from December to March/ April. The temperature is relatively high during the dry season with the mean around 30°C. Low temperatures are experienced during the rainy season, especially between July and August when the temperatures could be as low as 24°C.

Ogun State has two main vegetation, namely, tropical rain forest and guinea savannah. The major food crops grown include rice, maize, cassava, yam, and banana while the main cash crops are cocoa, kola nut, rubber, cashew, coffee, oil palm, citrus, pawpaw, and pineapple. Timber and rubber are also produced on large scale. The main livelihood activities of the people of Ogun State include farming, hunting, fishing, trading, hired labour in other farms, artisanship, and non-timber forest exploitation.

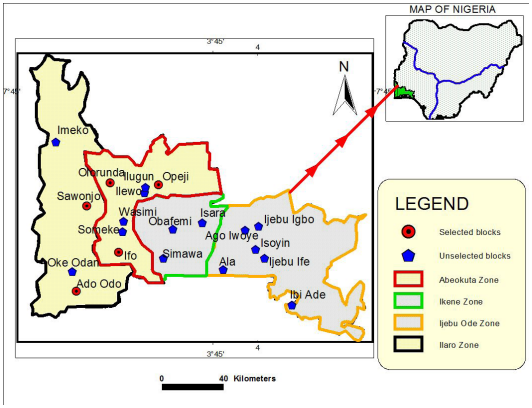

Fig. 2: Map of Ogun State indicating the study locations

Sampling procedure

This study employed a multi-stage procedure to select the respondents. At stage one: one-third of the states in Southwest Nigeria were randomly selected, namely, Ekiti and Ogun States. At stage two; two zones out of three zones were randomly selected from Ekiti State Agricultural Development Programme while two zones were randomly selected from the four zones in Ogun State Agricultural Development Programme. At stage three, six blocks were randomly chosen from the selected zones in Ekiti State (i.e. three blocks from each zone) while eight blocks were randomly selected in Ogun State. Finally, at stage four, the lists of National Agricultural Cooperative (NACOP) members in the selected blocks of the States were obtained from each of the State's NACOP headquarters.

As at the time of the study, there were 1400 registered NACOP members in the six selected blocks in Ekiti State while there were 1004 members in the eight selected blocks in Ogun State. The sample size was determined using Krejcie & Morgan (1970) method for determination of sample size. In all, the sample size for the study was 302 and 278 in Ekiti and Ogun States respectively. The respondents were randomly selected from the list of farmers obtained from each of the two States (Table 1).

Data collection and analysis

The study was both quantitative (questionnaire survey) and qualitative (focus group discussions) data collection (Neuman, 2005). The qualitative data at the community level was collected through Focus Group Discussions (FGDs). A Focus Group Discussion refers to a group of people who have been purposefully assembled at a place to take part in a discussion on a topic of relevance (Bhattacherjee, 2012). FGDs of this study were held with a separate group of men and women farmers comprising 8-12 individuals per group and the duration of the discussions varies between 30 and 90 minutes. FGD was conducted in each of the

selected blocks making a total of fourteen (14). The sessions were moderated by the researcher using a checklist and recorded with a video which was later transcribed.

For quantitative data, the instrument (questionnaire) was pre-tested using the test-retest method to check for validity and appropriateness. Data obtained at the interval of two weeks were correlated and obtained reliability coefficients of 0.81 and 0.95 for climate change adaptation strategies and barriers respectively. The source of knowledge of adaptation to climate change was measured as 'yes' or 'no' from the options provided. We rated the respondents' extent of usage of climate change adaptation strategies on a three-point Likert-type rating scale of 'Always Used (AU) = 3', 'Occasionally Used (OU) = 2', and 'Never Used (NU) =1', and climate change adaptation barriers on a 4 point Likert-type rating scale of 'Very serious (VS) = 4', 'Serious (S) = 3', 'Less Serious (LS) = 2', 'Not Serious = 1'.

The data were subjected to descriptive analyses such as frequency and percentage counts. They were further subjected to Pearson's Product Moment Correlation, Chi-square, t-test, Explorative Factor Analysis (EFA) and multiple linear regression analysis using Statistical Package for Social Sciences version 23 (IBM, 2015). The objective of multiple regression analysis is to use the independent variables to predict the value of the single dependent variable (usage of adaptation strategies by men and women farmers). Each predictor value is weighed, the weights denoting their relative contribution to the overall prediction. The multiple regression model is presented as:

$$Y = a + b1X1 + b2X2 + b3X3 + b4X4 \ldots + bnXn$$

Where Y is the dependent variable (Use of adaptation strategies), and X_1,…, X_n are the *n* independent variables such as age, family size, marital status, education, average annual income, farm size, religion, sources of knowledge of adaptation strategies such as extension agents, radio, television, newspapers, fellow farmers, indigenous knowledge, previous experience of climate change, information from Non-Governmental Organizations (NGOs) and Ministry of Environment (MoE), observations of weather phenomena over time, and climate change adaptation barriers.

In calculating the weights, a, b_1,…, b_n, regression analysis ensures maximal prediction of the dependent variable from the set of independent variables. This analysis presents the strength of any variable on the overall model. The selection of the hypothesized explanatory variables used in the regression model is based on theoretical behavioural hypotheses and a comprehensive review of the empirical literature on climate change adaptation (Hassan & Nhemachena, 2008; Deressa *et al*., 2009).

We determined the associations between men and socio-economic characteristics and production, sources of knowledge of adaptation strategies, climate change adaptation barriers and the extent of usage of adaptation strategies with Pearson's Product Moment correlation and Chi-square analysis. In addition, Using EFA, we extracted the dimensions of climate change adaptation strategies to obtain a more detailed representation of adaptation behaviour. In other words, EFA distinguishes common factors to account for most of the variations in the data and is performed by examining patterns of correlation among the adaptation strategies.

When these items are highly correlated, they are considered to be the same and thus are referred to as components (Field, 2009; Hyland *et al*., 2011). The extracted factors were subjected to Cronbach alpha reliability test (Cronbach, 1951). Cronbach's alpha obtained for the factors were 0.92 (Factor 1), 0.90 (Factor 2), 0.63 (Factor 3) and 0.83 (Factor

4). Cronbach's alpha >0.50 is considered acceptable as evidence of a common factor underlying the responses (Nunnally, 1967). An Independent t-test of mean was performed to determine the differences in men and women farmers' extent of usage of climate change adaptation strategies.

TABLE 1
Selection procedure for sample size in Ekiti and Ogun States

State/ADP Zones	No. of blocks	Selected blocks	No. of NACOP Members	No. of men farmers selected	No. of women farmers selected	Total
Ekiti State						
Aramoko	5	3	500	57	31	88
Ikere	5	3	900	118	97	215
Total	10	6	1400	174	128	302
%				57.8	42.2	
Ogun State						
Abeokuta	12	6	574	86	44	130
Ilaro	4	2	428	98	50	148
Total	16	8	1002	184	94	278
%				66.2	33.8	581

Results and Discussion

Socio-economic and production characteristics of respondents

The results in Table 2 show the descriptive analysis of the socio-economic and production characteristics of men and women farmers. The mean age of men farmers was 49 years and 45 years for women farmers. This could suggest that both categories of farmers could be active for the uptake of several adaptation measures. Also, men farmers were fairly older than women farmers. This finding is similar in trend to the assertion of Koyenikan & Anozie (2017) who reported mean age of 52 and 45 years for male and female farmers respectively in a study conducted on climate change adaptation in Nigeria. More men (61.7%) than women farmers (38.3%) were surveyed in this study. This could imply that more men farmers belong to the National Agricultural Cooperative in the study area.

Furthermore, the study shows that men and women farmers had an average of 23 years and 21 years of farming experience respectively. This indicates that the respondents had long been experiencing changes in climate and perceived to adapt to climate change. This finding is in line with Owombo *et al.* (2014) who reported 21.1 and 14.7 years as mean years of farming experience for men and women farmers respectively in their study on farmers' adaptation in Ondo State Nigeria. The majority of men (85%) and women farmers (82%) surveyed were married with a mean household size of six persons. This could imply that they had established families and therefore may have adequate familial labourers needed for the uptake of some adaptation measures. This result is in tandem with the reports of Koyenikan & Anozie (2017) and Ifeanyi-Obi *et al*. (2017) who reported an average of six for household size in a study carried out on climate change adaptation in Nigeria.

The result also reveals that men and women farmers cultivated an average of 4.2 hectares and 1.7 hectares respectively. This suggests that men farmers had more access to

land for farming than the women farmers. This result is similar to Owombo et *al*. (2014), who observed 3.8 hectares and 1.4 hectares for male and female farmers. Also, women farmers (24%) had no formal education as against 13.5% of men farmers (Fig. 3). The finding also indicated that women farmers had less access to the first stage of formal education and may be impossible for this category of farmers (women) to source information on climate change from print media such as newspapers. This is in tandem with Idoma *et al*. (2017), and Assan *et al*. (2018) where more male compared to female farmers had some forms of formal education. In addition, 43.3% and 42.8% of men and women farmers respectively earned less than 21,000 naira per annum (Fig. 4). This low income could have partly resulted from consequences of adverse effects of climate change on crop yields. This result is lower than the values reported by Idoma *et al.* (2017) where the average annual income was between 10,000 and 50,000 naira.

TABLE 2

Socio-economic and production characteristics of the respondents

Variables	Men farmers (n = 358)			Women farmers (n = 222)		
	Freq.	%	Mean ($\bar{x}$)	Freq.	%	Mean ($\bar{x}$)
Age (years)						
Below 20	1	0.03		1	0.05	
21-30	48	13.4		33	14.9	
31-40	54	15.1		45	20.3	
41-50	106	29.5	49	93	41.9	45
51-60	64	19.8		29	13.1	
Above 60	86	24.9		21	9.5	
Marital status						
Single	42	11.5		14	6.3	
Married	304	85.0		182	82.0	
Widow (er)	10	2.8		19	8.6	
Divorced/ separated	3	0.8		7	3.2	
Family size						
0-5	63	17.6		102	45.9	
6-10	263	73.5	6	116	52.3	6
11-15	27	7.5		4	1.8	
16-20	5	1.4		0	0	
>20	0	0		0	0	
Farming experience (years)						
0-5	47	13.1		44	19.8	
6-10	65	18.2		41	18.5	
11-15	49	13.7	23	20	9.0 19	
16-20	42	11.7		31	14.0	
Above 20	155	43.3		86	38.7	
Farm size (hectares)						
0-2	61	17.0	4.2	167	75.2	1.7
3-5	241	67.1		21	9.5	
6-8	30	8.4		16	7.2	
Above 8	25	7.0		18	0.1	

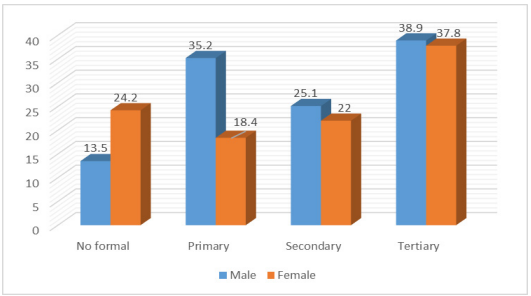

Fig. 3: Education of respondents (%).

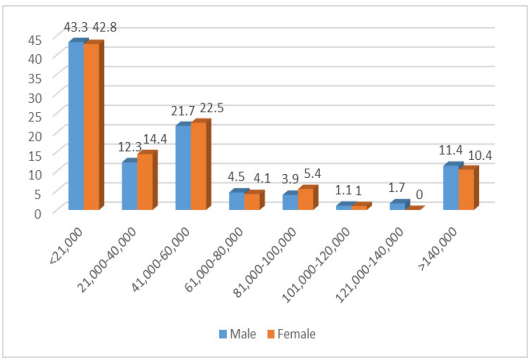

Fig. 4: Income distribution of men and women farmers from crops (%)

Men and women farmers' perceived adaptation to climate change

The results presented in Fig. 5 reveal that almost all of the respondents (men – 99.7%, women – 96.8%) were adapting to climate change, this implies that the respondents implemented some form of adaptation strategies although more men adapt to climate change than women. This suggests that men possess more adaptive capacity than women farmers. Idoma *et al.* (2017) and Assan *et al.* (2018) reported similar findings among men and women farmers.

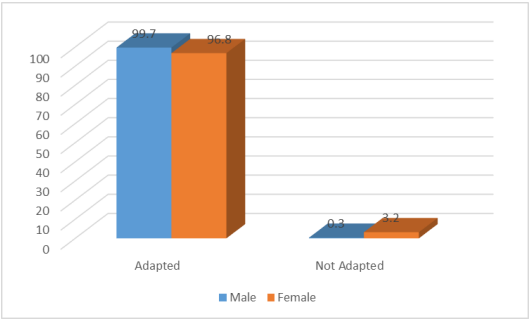

Fig. 5: Respondents' perceived adaptation to climate change (%)

Sources of knowledge of climate change adaptation strategies

The result shows that the major sources of knowledge of climate change adaptation strategies for men and women farmers were through fellow farmers (96.1% and 92.8%), personal experience (62.1% and 64%), and indigenous knowledge (55.2% and 56.8%). The participants in FGDs added that they gained knowledge of adaptation from their fathers/ parents. It should be noted that women respondents had less access to all sources of knowledge of adaptation reviewed under this study except 'indigenous knowledge and personal experience'. The role of extension agents in educating the farmers and transferring knowledge on adaptation to climate issues was not properly felt according to the findings of this study. This result is in accordance with the report of Kisuazi *et al.* (2012).

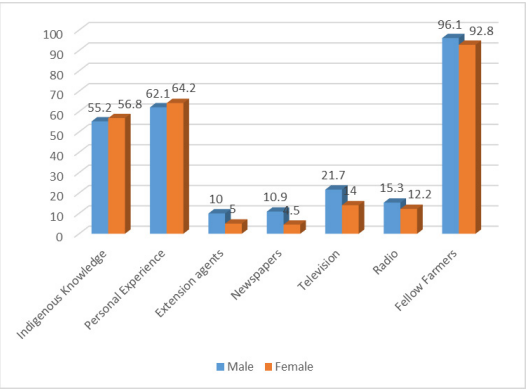

Fig. 6: Respondents' sources of climate change adaptation strategies (%)

Factor analysis

An Explorative Factor Analysis (EFA) was performed on items of adaptation strategies in order to identify dimensions. Bartlett's test of sphericity with a value of 19793.98 ($p <$ 0.0001) and the calculation of Kaiser-Meyer-Olkin (KMO) statistical test of sampling adequacy of 0.88, which can be classified as "meritorious', meaning that the data seemed suitable for factor analysis. The EFA with an Eigen values of one or greater was rotated by the varimax analysis, 39 items from the factor analysis resulted in 4-factor groupings and 67.52% of the total variance. The majority of the factor loadings are above 60%, showing a strong link between the items and the factor groupings they represent. The Cronbach's alpha test confirms the existence of a high level of internal consistency among factor groupings (Table 3).

TABLE 3

The results of EFA for adaptation strategies

Items	**Factor loading**	**Eigen-value**	**% of variance explained**	**Cron-bach's alpha**
Factor 1: On-farm adaptation		14.00	35.93	0.92
Planting of new crop varieties	0.78			
Multiple cropping	0.83			
Application of fertilizer	0.74			
Proper preservation of seeds	0.60			
Planting of short maturing crops	0.60			
Planting of crops in between the hedgerow of trees	0.46			
Varying of planting date	0.58			
Use of irrigation/ underground water	0.67			
Prevention of pest and diseases infestation	0.69			
Weather forecasts	0.74			
Increased mechanization	0.62			
Mulching/ use of cover crops	0.71			
Home gardening	0.60			
Change of harvesting dates	0.72			
Processing of crops	0.71			

Planting of drought-resistant crops	0.76			
Changing the quantity of land under cultivation	0.76			
Prompt weeding	0.63			
Lengthened crop fallow	0.59			
Culling of infected animals	0.47			
Construction of shed for plant seedlings	0.58			
Contour cropping	0.63			
Factor 2: Diversification of livelihood activities		6.87	17.61	0.90
Changing from production to marketing of agricultural produce.	0.60			
Seek monetary support to diversify farm-based activities	0.75			
Integration of farming activities with livestock production	0.47			
Shift to small scale animal husbandry	0.64			
Supplementary livelihood activities	0.63			
Changing of livelihood activities	0.63			
Factor 3: Soil and water conservation measures		4.91	0.63	0.63
Erection of contour bunds around farmlands	0.73			
Water management	0.46			
Water harvesting	0.71			
Construction of drainage channels	0.57			
Factor 4: General adaptation strategies		1.54	3.91	0.80
Distressed migration	0.63			
Tree planting	0.68			
Construction of strong farm structures	0.65			
Formation of self-help groups	0.61			
Prayer /ritual	0.71			
Abandonment of farmland	0.89			
Support of laws against deforestation	0.68			
Kaiser-Meyer-Olkin (KMO)	0.88			
Df	7.41			
P value	0.00			
Bartlett's test of sphericity	16793.98			

Respondents' extent of use of climate change adaptation strategies

The result shows that men and women farmers employed various strategies to adapt to climate change. Results in Table 4 show that the means ($\bar{x}$) of on-farm adaptation strategies used by the respondents ranged from 2.05 to 2.66 for men and 1.87 to 2.73 for women farmers. On farm-adaptation strategy always used by men ($\bar{x}$ = 2.66) and women farmers ($\bar{x}$ = 2.73) was prompt weeding. The least used on-farm adaptation measure by men ($\bar{x}$ = 2.05) and women farmers ($\bar{x}$ = 1.87) was planting crops in between hedgerows of trees. This is contrary to the findings of Belay *et al*. (2017) who reported crop diversification as the most practised adaptation strategy and Azadi *et al.* (2019) that observed a decrease in the size of cultivated land, crop rotation, seek help from others and the use of meteorological information.

The mean values of livelihood diversification activities employed by the respondents to adapt to climate change ranged from 1.93 – 2.28 for men, and 1.71 – 2.40 for women farmers. Also, the livelihood diversification adaptation strategy always used by men farmers was integration of farming activities with livestock production ($\bar{x}$ = 2.29) while for women farmers were integration of farming activities with livestock production as well as supplementary of livelihood activities ($\bar{x}$ = 2.40). The least livelihood diversification measures used by men ($\bar{x}$ = 2.07) was shifting to small-scale animal husbandry while that of women farmers was a change of livelihood ($\bar{x}$ = 1.71). The mean values ($\bar{x}$) of soil and water conservation measures employed by men and women farmers to adapt to climate change range from 2.07 – 2.34 and 2.14 – 2.33 respectively.

The soil and water conservation measures always used were water harvesting ($\bar{x}$ = 2.34) for men farmers, and water management ($\bar{x}$ = 2.33) for women farmers. This result is consistent with Assan *et al.* (2018) who reported that the majority of their male (87%) and women (69%) respondents used water and soil moisture conservation measures in their study conducted on coping with and adapting to climate change while male (35%) and female respondents (56.7%) of Egbule (2014) made use of water harvesting in his study on gender vulnerability and adaptation strategies to climate change impacts on agriculture in the Niger Delta region of Nigeria. The least used soil and water conservation strategy by men ($\bar{x}$ = 2.07) and women farmers ($\bar{x}$ = 2.14) was erection of contours. Furthermore, the general adaptation measures used by the respondents ranged from 1.84 – 2.58 for men farmers and 1.59 – 2.64 for women farmers. Men (x = 2.54) and women farmers ($\bar{x}$ = 2.60) always form self-help groups to assist themselves to adapt to climate change. The least used general adaptation strategies by men farmers was abandonment of farmlands ($\bar{x}$ = 1.84), and distress migration by women farmers ($\bar{x}$ = 1.59).

Out of the four (4) categories of adaptation strategies identified in this study, it can be observed that on-farm adaptation was mostly practised by the men and women farmers. This result is in tandem with the report of Ifeanyi-Obi *et al.* (2017) who observed similar findings. Furthermore, more women farmers were dependent on formation of self-help groups to solicit for financial support from other associations for adaptation to climate change. Also, men respondents occasionally shift to small-scale animal husbandry or abandoned farmlands while the women farmers occasionally shift their livelihood or plant tree

to adapt climate change. This result suggests that inadequate knowledge of adaptation strategies is occasionally used and could be a reflection of ineffectiveness of extension service and other stakeholders on issues related to climate change adaptation.

This was buttressed by FGDs as inadequacy of extension personnel which increased extension agent-farmer ratio. These findings are similar to the assertion of Olorunfemi *et al*. (2020) who attribute ineffectiveness extension agents to the setting in of job-burnout and capacity diminishing return as a result of excess work load and stress which is a consequence of assigning an extension to too many communities. Overall, the top most adaptation measures always used by the respondents were prompt weeding (men: $\bar{x}$ = 2.66, women: $\bar{x}$ = 2.73), formation of self-helps (men: $\bar{x}$ = 2.54, women: $\bar{x}$ = 2.60), and proper preservation of seeds and seedlings (men: $\bar{x}$ = 2.52, women: $\bar{x}$ = 2.57).

Based on the results of the findings of this study, out of 39 adaptation strategies observed, there were significant differences in the means scores of 18 adaptation items, out of which men farmers had higher means in 11 adaptation items while the women farmers had higher means in 7 items. This could imply that more men farmers practised the listed adaptation strategies since higher mean values indicate how often the farmers implement a given strategy. It could therefore be inferred that significant differences existed in adaptation strategies used by the men and women farmers. This result confirms the observations of World Wildlife Fund (2012) and Azadi *et al*. (2019). Women respondents in FGDs added that they were able to adjust to climate change during crop processing by air drying, grinding of cassava instead of dicing and soaking in water, use of hot rock surfaces for drying produce and close watch for sudden change in weather. "*Due to irregular rainfall pattern, we plant in nursery in batches and do rotational planting until rain becomes regular". "The crops we normally plant during a dry spell include tomato, water melon, Bennie seed and cassava."*

The group totally disagreed with shifting from crop production to livestock production thus: *'are we not going to eat?* In addition, women and men farmers disagreed with abandonment of farmland when seriously affected by climate change: "*Instead of abandonment, it is better to uproot the crop and plant cassava."* They also justified the importance of crop insurance, though not prominent among rural folks and peasant farmers: *"Insurance can help to reduce losses, if we insure our crops."* Farmers in FGDs were familiar with lengthened fallow but the migrants among the respondents opined that *"it depends on availability of land."* Farmers in FGDs objected to 'distress migration' as an adaptation measure. "*We cannot migrate because the state of climate is the same all over."*

TABLE 4

Male and female farmers' extent of usage of adaptation strategies of climate change

Adaptation strategies	**Men farmers (n= 358)**				**Women farmers (n=222)**				
	AU	**OU**	**NU**	**Mean ($\bar{x}$)**	**AU**	**OU**	**NU**	**Mean ($\bar{x}$)**	**t value**
On farm production activities									
1.Planting of new crop varieties	51.0	32.3	16.7	2.34	60.4	25.2	14.4	3.46	1.74**
2.Multiple cropping	47.6	33.7	16.4	2.33	56.8	32.9	10.3	3.45	2.15*
3.Application of fertilizer	40.4	30.6	29.0	2.11	33.3	23.0	43.7	1.90	2.99*
4.Proper preservation of seeds and plants seedlings	63.8	24.0	12.3	2.52	70.3	16.7	13.0	2.57	0.93
5.Planting of short maturing crop varieties	47.6	39.9	16.4	2.32	57.2	31.1	11.7	2.45	2.30*
6.By planting crops in between the hedgerow of trees	39.0	25.6	34.8	2.05	29.7	27.0	43.2	1.87	2.48*
7.Varying of planting periods /date	45.4	42.1	12.5	2.33	54.5	32.9	12.6	2.42	1.42
8.Use of irrigation/ ground water	34.5	37.3	28.1	2.06	31.1	22.7	39.2	1.91	2.14
9.Prevention of pest, diseases and infestation	55.2	26.7	18.1	2.38	61.3	16.7	22.1	2.39	0.31
10.Use of weather forecasts	39.3	39.6	21.2	2.19	33.8	50.0	16.2	2.18	1.80
11.Increased mechanization of agricultural production	23.7	31.2	45.1	2.21	24.2	22.5	53.2	2.30	1.17
12.Mulching/ use of cover crops	54.6	32.9	12.5	2.42	42.3	46.9	10.8	2.32	1.85
13.Home gardening	38.4	46.2	15.3	2.23	27.5	59.0	9.01	2.14	1.63
14.Changes in harvesting dates	53.8	25.7	21.2	2.33	55.9	24.5	16.7	2.38	0.85
15.Processing of crops to reduce post-harvest losses	54.0	33.2	12.8	2.41	63.1	27.9	9.0	2.54	2.22
16.Planting of drought-resistant crops	54.1	27.6	20.3	2.32	65.3	20.7	14.0	2.51	2.95
17.Changing quantity of land under cultivation	43.2	37.9	19.0	2.24	57.7	21.2	21.2	2.37	1.92
18. Prompt weeding	72.7	20.6	6.7	2.66	78.8	15.3	5.9	2.73	1.46
19. Lengthened crop fallow	0.6	29.8	22.6	2.26	61.3	18.5	20.3	2.41	2.23*
20. Culling of infected animals	63.5	21.7	14.8	2.46	68.0	19.8	12.2	2.56	1.15

21. Construction of shield for plant seedlings	38.2	37.0	24.8	2.23	39.6	41.5	18.9	2.33	1.34
22. Contour cropping across hills slope	42.1	34.3	23.7	2.18	39.6	18.9	41.4	1.98	2.75*
Mean ($\overline{x}$)				2.29				2.33	

AU- Always Used, OU- Occasionally Used, Never Used- NU

Adaptation strategies	**Men farmers (n= 358)**				**Women farmers (n=222)**				
Diversification of livelihood activities									
	AU	OU	NU	Mean ($\overline{x}$)	AU	OU	NU	Mean ($\overline{x}$)	t value
23. Changing from production to marketing of agricultural products.	34.0	30.8	39.9	1.99	50.9	27.5	21.6	2.29	3.93
24. Seeking monetary support to diversify farm based activities	39.6	30.1	30.4	2.10	61.3	22.5	9.0	2.54	5.22**
25.Integration of farming activities with livestock raising	43.5	41.2	15.3	2.28	54.1	32.0	14.0	2.40	1.88
26.Shift to small scale animal husbandry	29.3	33.7	37.1	1.93	23.9	27.0	49.1	1.75	2.57*
27.Supplementary of livelihood activities	39.6	37.0	23.4	2.17	53.2	32.4	14.4	2.40	3.49**
28.Changing of livelihood activities	43.2	20.6	36.2	2.07	23.4	24.3	52.3	1.71	4.92**
Mean **($\overline{x}$)**				2.09				2.08	
Soil and water conservation									
29.Erection of contour bunds around farmlands	32.9	41.5	25.6	2.07	35.6	42.3	20.1	2.14	0.96
30.Water management to prevent water logging and erosion	49.3	29.8	20.9	2.28	52.7	27.5	19.8	2.33	0.66
31.Water harvesting	47.1	40.4	12.5	2.34	47.3	41.0	11.7	2.36	0.84
32.Construction of drainage channels	45.7	39.6	14.8	2.31	51.4	41.9	6.8	2.45	2.44*
Mean ($\overline{x}$)				2.25				2.25	
General adaptation strategies									
33. Distressed migration	31.8	25.1	43.2	1.89	20.7	17.6	61.7	1.59	4.16**
34.Tree planting	40.1	28.7	31.2	2.09	27.5	25.1	16.9	1.81	3.91**
35.Construction of strong farm structures	39.0	37.1	24.0	2.16	39.6	41.4	18.9	2.21	0.86

36.Formation of self-help groups	64.4	25.1	10.6	2.54	71.6	17.1	11.3	2.60	1.13
37.Spiritual exercise/ritual	42.6	31.2	26.2	2.16	53.6	19.0	27.5	2.26	1.34
38.Abandonment of farmland	36.2	33.4	30.4	1.84	32.0	20.3	47.7	2.06	2.96*
39.Support of laws against deforestation	69.1	18.5	11.4	2.58	75.2	14.0	10.8	2.59	1.16
Mean ($\bar{x}$)				2.18				2.16	

AU- Always Used, OU- Occasionally Used, Never Used- NU; *$p < 0.05$ **$p < 0.01$

Respondents climate change adaptation barriers

The results in Table 5 show that the first three highly ranked and common climate change adaptation barriers reported by men and women farmers respectively were inadequate credit opportunity ($\bar{x}$ = 3.52 and $\bar{x}$ = 3.64), lack of current knowledge of adaptation measures ($\bar{x}$ = 3.36 and $\bar{x}$ = 3.11) and inadequate information on modern adaptation strategies ($\bar{x}$ = 3.28 and $\bar{x}$ = 3.07). This result denote that higher means is an indication of the degree in which a respondent encounters a barrier. The results suggest that women farmers were hindered by credit opportunity than their men counterparts, this could have been their reason for forming self-help groups for sourcing fund for adaptation to climate change. This is in tandem with the report of Ajetumobi *et al.* 2013) and Antwi-Agyei *et al*. (2012) who asserted that their respondents rely on friends and family for support on the use of off-farm adaptation practice. Men farmers ranked limited extension agents' training on adaptation and inadequate meteorological advice as 4th and 5th respectively while women farmers ranked each of 'inability to access information on adaptation and limited availability of improved seeds' as 4th barriers. Furthermore, limited extension agents' training on adaptation and meteorological advice were considered as serious barriers by men and women farmers respectively.

The three least barriers of adaptation to climate change encountered by men farmers were; inadequate market access ($\bar{x}$ = 2.35) and inadequate input from the government ($\bar{x}$ = 2.33) while women farmers' least barriers, lack of supportive policy for adaptation to climate change ($\bar{x}$ = 2.54), inadequate meteorological advice ($\bar{x}$ = 2.51) and inadequate and reluctance to adopt new farming methods (men : $\bar{x}$ = 2.13, women : $\bar{x}$ = 2.55). This shows that the respondents had been adapting to climate change with personal efforts. The result contradicts the reports of Ajayi (2016) and Falaki *et al.* (2013). The probable difference in our findings from that of previous studies could be that the respondents adhered more to other adaptation strategies. Other barriers encountered in adapting to climate change were inability to access information on adaptation. Inaccessibility of farmers to resources like information, cash and skill could be a serious impediment for easy uptake of adaptation measures. This result is in line with the reports of Arimi (2014), Schuenemann *et al.* (2018), and Antwi-Agyei *et al*. (2021).

The means of barriers encountered by the respondents ranged from $\bar{x}$ = 2.18 – 3.52 for men, and women respondents ($\bar{x}$ = 2.37 – 3.64). The result of this study discovered 11 significant differences in the means scores of barriers encountered by the respondents, of

which women farmers had higher means in seven barriers while men farmers had higher means in four barriers. This could suggest that men farmers encountered lesser barriers when compared to women farmers. Based on these results, there is significant difference in barriers encountered by men and women farmers, the null hypothesis is rejected.

Farmers in FGDs buttressed that: *"We do not see anyone to borrow us money for farming"; "Lack of meteorological information and training from extension agents were not barriers because we can survive climate change without their advice"; "Weather forecast is adding to the problem, they want to expose what God has hidden"; "No genuine information from meteorologists, their forecasts are general and not specific"*. In addition, participants in FGDs added that they cannot afford irrigation facility: "*How many farm lands can we irrigate? There is nothing like rain, irrigation can only wet nursery plants".* Participants in FGDs also added that *"poor communication network is a critical barrier in accessing information on adaptation to climate change."*

TABLE 5

Respondents' reported climate change adaptation barriers

Barriers of adaptation	**Male farmers (n= 358)**						**Female farmers (n= 222)**						
	VS	**S**	**LS**	**NS**	**Mean $\bar{x}$**	**Rank**	**VS**	**S**	**LS**	**NS**	**Mean $\bar{x}$**	**Rank**	**t- value**
1.Inadequate knowledge of climate change	54.3	32.3	8.6	4.7	3.36	2nd	31.	53.6	9.5	5.4	3.11	2nd	3.64**
2.Inadequate information on adaptation strategies	47.4	36.5	12.5	3.6	3.28	3rd	32.0	52.3	6.3	9.5	3.07	3rd	2.86**
3.Limited extension agents' training on adaptation	6.2	23.4	20.3	49.9	3.14	4th	38.2	20.6	6.4	34.8	2.88	7th	3.03**
4.Inadequate meteorological advice	17.8	9.5	24.0	49.3	3.05	5th	21.7	29.5	11.4	37.3	2.51	15th	5.29**
5. Inadequate credit opportunity	71.0	14.5	9.8	4.7	3.52	1st	25.6	20.3	17.6	36.5	3.64	1st	1.71
6.Limited availability of improved seed varieties	40.7	33.4	14.8	11.1	3.03	6th	31.2	19.2	15.9	33.7	3.05	4th	0.18
7.Inability to access information on adaptation	38.4	34.0	19.5	8.1	3.03	6th	28.4	16.7	14.9	40.4	3.05	4th	0.23
8.Limited financial resources	42.3	17.8	5.6	34.3	2.68	8th	55.9	12.6	6.8	24.8	3.00	6th	2.83**

9.Lack of skill and resources needed to adopt irrigation	25.1	26.2	9.8	39.0	2.37	11th	46.4	13.5	11.3	28.8	2.78	10th	3.76**
10.Limited storage facilities	38.3	20.6	6.2	34.9	2.64	9th	46.4	19.4	9.5	24.8	2.87	8th	2.11*
11.Lack of supportive policy for adaptation	21.8	29.6	11.2	37.4	2.36	12th	20.7	40.5	10.4	28.4	2.54	14th	1.84
12.Limited market access	25.7	20.1	17.6	36.6	2.35	13th	46.0	11.3	16.2	26.6	2.77	11th	3.94**
13.Lack of security on property rights such as land	31.3	19.3	15.6	33.8	2.48	10th	51.9	12.6	5.4	30.2	2.86	9th	3.49**
14.Inadequate farm inputs from government	28.5	16.8	14.8	40.5	2.33	14th	45.5	13.1	13.)	27.9	2.76	12th	3.95**
15.Inability and reluctance to adopt new farming strategies	20.4	21.5	4.5	43.3	2.18	15th	37.8	9.9	21.6	30.6	2.55	13th	3.44**

VS- Very Serious, S-Serious, LS-Less Serious, NS-Not Serious; *$p < 0.05$ **$p < 0.01$

Chi-square test of relationship between independent variables and use of adaptation strategies

Results in Table 6 show that significant associations ($p < 0.01$) existed between usage of climate change adaptation strategies and the respondents' marital status (χ^2 = men – 290.52, women – 330.61), religion (χ^2 = men – 284.58, women – 260.31), observation (χ^2 = men – 578.28, women – 444.87), education (χ^2 = men – 935.62, women – 759.15), membership of farmers' association (χ^2 = men – 143.81, women – 127.79), extension agent (χ^2 = men – 157.04, women – 134.04), television (χ^2 = men – 163.95, women – 106.71), radio (χ^2 = men – 120.54, women – 125.96), newspaper (χ^2 = men – 151.08, women – 191.00), fellow farmers (χ^2 = men – 447.55, women – 435.02), indigenous knowledge (χ^2 = men – 496.39, women – 525.76), previous experience of climate change (χ^2 = men – 506.10, women – 441.89), non-governmental organisation (χ^2 = men – 400.78, women – 477.21), and information from ministry of environment (χ^2 = men – 500.67, women – 527.62). Chi-square analysis shows that independent variables were associated with the use of adaptation strategies. This is an indication that the independent variables could impact respondents' extent of use of adaptation strategies for climate change adaptation. These observations agree with previous studies by Silvestri *et al.* (2012), Tumbo*, et al.* (2013), Opiyo *et al*. (2016), and Li *et al*. 2017), who report similar findings.

In addition, the study suggests that the selected socio-demographic characteristics and sources of information of climate change and adaptation to climate change have strong association with men and women farmers' extent of use of adaptation strategies and thus important in the designing of climate change adaptation strategies and uptake. For marital status, married men and women could have opportunity for family labour thus access to funds which could have been used on labour for the procurement of inputs and other resources

for climate change adaptation strategies. Religion is also fundamental to adaptation to climate change due to faith-based belief that men and women farmers expressed during FGDs and that *"climatic phenomena are from God and as such they need to pray to God."*

As experienced farmers, observations of weather for possible rainfall and drought is common, and they could predict the type of adaptation strategies to use accurately. Men and women membership of farmers' association could provide opportunity for adequate information on adaptation strategies to use. In addition, constant and unfettered access to information from extension agents, television, radio, newspapers, fellow farmers, and indigenous knowledge, particularly climate change information by men and women farmers is valuable for their adaptation to climate change. This could suggest that men and women farmers that have access to information could adapt better than those farmers with limited information.

TABLE 6
Chi-square test of association between independent variables and use of adaptation strategies

Variables	Men farmers		Women farmers	
	χ^2 value	P value	χ^2 value	P value
Marital status	290.52	0.001**	330.61	0.001**
Religion	284.58	0.001**	260.31	0.001**
Observation of weather phenomenon	578.28	0.001**	444.87	0.001**
Education	935.62	0.001**	759.15	0.001**
Membership of farmers' association	143.81	0.001**	127.79	0.001**
Extension agents	157.04	0.001**	134.04	0.001**
Television	163.95	0.001**	106.71	0.001**
Radio	120.54	0.001**	125.96	0.001**
Newspaper	157.08	0.001**	191.00	0.001**
Fellow farmers	447.55	0.001**	435.02	0.001**
Indigenous knowledge	496.39	0.001**	525.78	0.001**
Previous experience of climate change	506.10	0.001**	441.89	0.001**
Non- governmental organisation	400.78	0.001**	477.21	0.001**
Information from ministry of environment	500.67	0.001**	527.62	0.001**

**$p < 0.01$

Correlation between independent variables and respondents' use of climate change adaptation strategies

Results in Table 7 show significant relationships ($p<0.00$) between men farmers' age ($r = 0.29$), average annual income ($r = -0.25$), farming experience ($r = 0.37$), and the use of climate change adaptation strategies while farm size ($r = -0.09$), climate change adaptation barriers ($r = 0.06$), and the use of climate change adaptation strategies yielded no significance. This shows that an increase in men farmers' age, average annual income and farming experience could translate to the use of more adaptation strategies irrespective of their farm size. This finding was buttressed by FGDs. This finding is consistent with *Belay et al.* (2019). Furthermore, significant relationship ($p < 0.00$) also existed between women farmers' age ($r = 0.35$), farming experience ($r = 0.46$), and the

use of climate change adaptation strategies. However, no significant relationship existed between average annual income (r = 0.17), farm size (r = 0.06), adaptation barriers (r = 0.22), and the use of climate change adaptation strategies.

For women farmers, age and farming experience played significant roles in the use of adaptation strategies. The results suggest that as men and women advance in age, they will use varieties of adaptation strategies. The use of climate change adaptation strategies may be influenced by income because some of the adaptation strategies require a level of funding which may not be affordable to peasant farmers. In addition, farming experience could guide men and women farmers on the use of appropriate adaptation strategies. Female have more constraints in the use of climate change adaptation strategies due to barriers such as limited access and control of agricultural production resources.

TABLE 7
Correlation between independent variables and use of adaptation strategies

Variables	Men farmers		women farmers	
	***r* value**	**Significance**	***r* value**	***P* value**
Age	0.29	0.001**	0.35	0.001**
Annual average income	-0.25	0.001**	0.17	0.010**
Farming experience	0.37	0.001**	0.46	0.000**
Farm size	-0.08	0.140	0.06	0.400
Climate change adaptation barriers	0.05	2.72	0.22	0.001**

**$p < 0.01$

Determinants of men and women farmers' usage of adaptation strategies

Results in Table 8 show each process of regression analysis are reported with standardized regression coefficients, t-statistical values, values of constant, R square and adjusted R^2 values. The coefficients of determination (R^2 and Adjusted R^2) for men farmers were 0.60 and 0.57 and, 0.73 and 0.70 for women farmers. This means that the model accounts for 57% of the variance in dependent variable for men farmers and 73% variance could be attributed to all the independent variables examined under this study for women farmers.

Based on this study, it can be observed that eight (8) independent variables had statistic significant beta coefficient for men , these include radio (t = -2.68, $p < 0.05$), television (t = -2.79, $p < 0.05$), indigenous knowledge (t = 3.08, $p < 0.00$), previous experience of climate change (t = -4.17, $p < 0.00$), observation of weather phenomena (t = -3.66, $p < 0.00$), age (t = 2.04, $p < 0.05$), education (t = -2.92, $p < 0.00$), climate change adaptation barriers (t = 5.13, $p < 0.00$) and are thus the determinants of men farmers' use of climate change adaptation strategies. The result of regression analysis showed that the three strongest determinants of men farmers' extent of use of adaptation strategies were climate change adaptation barriers, experience of climate change, and observations of weather phenomena.

These results suggest that these three factors exerted most significantly on men farmers' usage of adaptation strategies. Results from this study further indicate that 10 independent variables had statistic significant

beta coefficient for women farmers, these include age (t = -2.75, $p < 0.05$), family size (t = 2.42, $p < 0.05$), marital status (t = 3.16, $p < 0.00$), religion (t = 2.41, $p < 0.05$), farming experience (t = 6.25, $p < 0.00$), membership of association (t = -2.69, $p < 0.05$), climate change adaptation barriers (t = 3.65, $p < 0.00$), extension agents (t = 5.51, $p < 0.00$), radio (t = 2.81, $p < 0.05$), and observation of weather phenomena (t = 5.55, $p < 0.00$). These 10 independent variables are thus the determinants of women farmers' use of adaptation strategies.

Also, the three strongest determinants of women farmers' extent of use of climate change adaptation strategies were 'experience of climate change, farming experience, and observation of weather phenomena'. Male farmers are 3.83 times more likely to observe the weather phenomenon as a climate change adaptation measure at a statistically significant value of $p < 0.05$, female farmers would on average be 4.53 times more likely to depend on climate change experience as a climate change adaptation measure at a statistically significant value of $p < 0.05$. Also, female farmers are 0.37 times more likely to encounter adaptation barriers at a statistically significant value of $p < 0.05$. This implies that experience of climate change, farming experience, and observation of weather phenomena were the significant predictors of women farmers' use of adaptation measures.

These results are consistent with Solomon & Edet (2018), and Ume *et al.* (2019), who affirmed the significance of experience in determining the extent of use of adaptation strategies. Findings imply that these independent variables have a joint impact on climate change adaptation strategies and indicate that they are important determinants of the use of climate change adaptation measures. For men, age, information from radio, television, climate change experience, observations of climatic phenomena, and barriers are very important in determining climate change adaptation strategies to be used. However, age, farm size, marital status, farming experience, religion, information from extension agents, radio, indigenous knowledge, climate change experience, observations of climatic phenomena, membership of farmers' association and barriers are significant to men and women choice of climate change adaptation strategies.

TABLE 8
Determinants of men and women use of climate change adaptation strategies

	Men farmers		**Women farmers**	
Independent variables	B	**t value**	B	**t value**
Age	0.15	2.04*	-0.22	-2.75*
Family size	-0.06	-0.19	0.81	2.42*
Marital status	-2.75	-1.55	4.57	3.16**
Education	-2.04	-2.92**	-0.42	-0.75
Average annual income (~~N~~)	-8.56	-0.35	5.93	0.60
Farming experience	0.77	1.09	0.49	6.25**
Farm size (hectare)	0.02	0.13	-0.02	-0.26
Religion	0.42	0.31	2.74	2.44*
Information from extension agent	2.38	0.89	0.49	5.51**
Information from radio	-6.27	-2.68*	-5.63	-2.81*

Information from television	-5.30	-2.79*	-1.59	-0.82
Information from newspaper	0.15	0.06	6.25	1.69
Information from fellow farmers	0.49	0.22	0.70	0.33
Indigenous knowledge	5.11	3.08**	-1.00	-0.64
Climate change experience	-6.92	-4.17**	4.53	7.42**
Non- governmental organization	-0.88	-0.51	0.41	0.23
Information from the Ministry of environment	1.10	0.45	0.32	1.22
Observation of weather phenomenon	3.83	3.66**	2.41	5.55**
Membership of farmers' association	-1.76	-1.00	-4.30	-2.69*
Climate change adaptation barriers	0.57	5.13**	0.37	3.65**
Constant	16.107	0.11	-14.65	0.10
R		0.77		0.86
R^2		0.60		0.73
Adjusted R^2		0.57		0.70
Standard Error		12.41		7.16
F change		21.70		23.68
P value		0.000		0.000

Conclusion and Recommendation

This paper analysed the use of adaptation strategies in Ekiti and Ogun States Nigeria. The major sources of farmers' knowledge of adaptation to climate change were fellow farmers, indigenous knowledge and personal experience. Men farmers were able to adapt to climate change better than women farmers. The disparity in male and female adaptation behaviour could be due to more climate change adaptation barriers being faced by women especially, limited access and control of production resources such as lands, limited financial resources, and inadequate farm inputs when compared with the men farmers. This study thus suggests that women could better adapt to climate change with access and control of production resources like men.

The main adaptation strategy mostly used out of the four categories of adaptation strategies deployed in this study was on-farm production activities. Adaptation strategies always used by the respondents were prompt weeding, formation of self-help groups, and proper preservation of seeds and seedlings. The main climate change adaptation barriers reported by the respondents in this study were inadequate credit opportunity, lack of current knowledge of adaptation and inadequate information on modern adaptation strategies. This study also reveals that the respondents encountered barriers of adaptation to climate change but were felt more by the women farmers.

Men and women farmers differently adapted to climate change, used different adaptation strategies and encountered different and/ or the same barriers differently. Barriers generally reduce the chance and ability of farmers to take up adaptation measures and consequently enable farmers to become vulnerable to the effects of climate change. The findings from this study show that adaptation barriers, observations of weather

and climate change experience were the strongest determinants of men farmers' extent of use of adaptation strategies and observations of weather, experience of climate change, and farming experience for women farmers. The study thus indicates that the independent variables are important in addressing men and women uptake of climate change adaptation strategies.

There is a need for the government through extension agents to provide farmers with information on current knowledge of adaptation to climate change, introduce and encourage farmers to practise more and modern adaptation strategies such as climate-smart agricultural practices and insurance. Financial institutions such as agricultural banks should assist women farmers with soft loans with minimum collateral requirements to diversify livelihoods for better adaptation to climate change. Also, the Government should formulate climate change adaptation policies and programmes that can improve respondents' adaptive capacity through input subsidy, especially among women farmers. Furthermore, Nigerian Meteorological Agency should be improved in their task of dissemination of climate-related information such as weather forecasts. Extension agents should educate men farmers on giving their women access to resources needed for adaptation because what goes around comes around. The concepts of gender equity should also be introduced into the school curriculum right from the elementary stage to enable gender equality in rights, access and control over resources at all levels to avoid deprivation of rights.

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