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Climate change adaptation: Uncovering constraints to the use of adaptation strategies among food crop farmers in South-west, Nigeria using principal component analysis (PCA)

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Abstract: This study focused on the constraints to the use of climate variability/change adaptation strategies in South-west Nigeria. Multistage random technique was employed to select the location and the respondents. Descriptive statistics and principal component analysis (PCA) were the analytical tools engaged in this study. The constraints to climate variability and change examined before did not use PCA but generalized factor analysis. Hence, there is need to examine these constraints extensively using PCA. Uncovering the constraints to the use of climate variability/change adaptation strategies among crop framers is important to give a realistic direction in the development of farmer-inclusive climate policies in Nigeria. The PCA result showed that the principal constraints that the farmers faced in climate change adaptation were public, institutional and labour constraint; land, neighbourhood norms and religious beliefs constraint; high cost of inputs, technological and information constraint; farm distance, access to climate information, off-farm job and credit constraint; and poor agricultural programmes and service delivery constraint. These findings pointed out the need for both the government and non-government organizations to intensify efforts on institutional, technological and

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PUBLIC INTEREST STATEMENT

Climate change poses a serious threat to development and poverty reduction in the poorest and most vulnerable regions of the world, including Nigeria. The climate is changing and mitigation efforts to reduce sources or enhance the sinks of greenhouse gases will take time. Adaptation is therefore critical and of concern in Nigeria where vulnerability is high because the ability to adapt is low. Climate change adaptation through the modification of agricultural practices will be imperative to continue meeting the growing food demands of Nigerians. Farmers have been using different practices to adapt to climate change to keep on producing their annual expectation in yield, but never without challenges. Knowing these challenges can help in developing an environmentally and farmers friendly policies to reduce effect of changing climate on the vulnerable groups in the society. We empirically investigated the challenges of using adaptation strategies in food crop farming in South-west Nigeria.

farmers' friendly land tenure and information systems as effective measures to guide inclusive climate change adaptation policies and development in South-west Nigeria.

Subjects: Development Studies, Environment, Social Work, Urban Studies; Economics, Finance, Business & Industry; Geography

Keywords: climate change adaptation; constraints; South-west Nigeria

1. Introduction

Climate is the predominant natural factor that influences food crop production. Climate as defined by Oyekale, Bolaji, and Olowa (2009) is the state of atmosphere, which is created by weather events over a period of time. A slight change in the climate will affect agriculture. Climate change poses a serious threat to development and poverty reduction in the poorest and most vulnerable regions of the world (Khanal, 2009; Parliamentary Office of Science & Technology (POST), 2006). It is a major threat to the sustainable development of Nigeria (Oladipo, 2010). Literature have shown that for the past decades, anthropogenic factors like urbanization, deforestation, population explosion, industrialization and the release of green house gases (GHGs) are the major contributing factors to the depletion of the ozone layer and its associated global warming and climate change (Buba, 2004; Nigerian Environmental Study/Action Team, 2003; Odjugo, 2007). For example, unsustainable industrialization, which releases GHGs, is viewed as the main cause (Odjugo, 2009). The predominance of rain-fed agriculture, the scarcity of capital for adaptation measures, their warmer baseline climates and their heightened exposure to extreme events (Nnamchi & Ozor, 2009) in Africa made agriculture to be more vulnerable to climate change. Food crop is particularly sensitive to climate change because crop yields depend largely on prevailing climate conditions (temperature and rainfall patterns) (Palatnik & Roson, 2009), Southwestern Nigeria is not exempted. The principal food crops grown in South-west Nigeria are cassava, yams, maize and cocoyams, which are also sensitive to climate variability and climate change.

Climate change adaptation through the modification or improvement of agricultural practices will be imperative to continue meeting the growing food demands of modern society (Rosegrant et al., 2008). The climate is changing and mitigation efforts to reduce sources or enhance the sinks of greenhouse gases will take time. More so, mitigation might only happen to a limited extent (Le Quéré et al., 2015). Adaptation is therefore critical and of concern in developing countries, particularly Africa (including Nigeria) where vulnerability is high because the ability to adapt is low. Climate change is expected to affect food and water resources critical to livelihood in Africa and much of the population, especially the poor, rely on local supply systems that are sensitive to climate variations. Disruptions of the existing food and water systems will have devastating implications for development and livelihoods and are expected to add to the challenge already posed by climate change for poverty eradication (de Wit & Stankiewicz, 2006; International Institute for Sustainable Development, 2007). Minimizing the impacts of climate change requires adaptation. Adaptation is a way of reducing vulnerability, increasing resilience, moderating the risk of climate impacts on lives and livelihoods, and taking advantage of opportunities posed by actual or expected climate change (POST, 2006). Adaptation helps farmers achieve their food, income and livelihood security objectives in the face of changing climatic and socio-economic conditions, including volatile short-term changes in local and large-scale markets (Kandlikar & Risbey, 2000). Farmers especially food crop farmers can reduce the potential damage by making tactical responses to these changes at the farm-level. In trying to cope with climate change there are constraints/factors that hinder food crop farmers in tackling this menace in order to be able to bridge the demand-supply gap which arise from the differentials in the population growth rate and food crop production growth rate in Nigeria even before the advent of pronounced change of climate, even when this differential could be made up by imports, but the policy thrust of Nigeria government seems to be discouraging the importation of some agricultural produce in order to encourage local farmers to produce more and diversify the economy which has been depending largely on crude oil for decades. This study attempts to identify the

farm-level adaptation strategies used by the food crop farmers and then uncovers the constraints to climate change adaptation in Southwestern Nigeria.

Studies on climate change had been conducted in Nigeria but none has used detailed principal component analysis (PCA) to examine the constraints in the use of climate variability/change adaptation strategies in South-west Nigeria. Notable among these studies are:

Enete and Amusa (2010) reviewed literature on the challenges of agricultural adaptation to climate change in Nigeria without any empirical evidence.

Enete et al. (2011) investigated indigenous agricultural adaptation to climate change: study of South-east Nigeria without thorough examination on the constraints.

Ozor et al. (2010) examined the barriers to climate change adaptation among farming households of Southern Nigeria using genaralized factor analysis (FA) without clear indication of the PCA with commonality of each factor or variable being put in focus.

Enete and Onyekuru (2011) investigated the challenges of agricultural adaptation to climate change in Southeast Nigeria but this is done in the region of the country and generalized the farmers without specifically targeting the food crop farmers.

Previous studies also used PCA to examine factors driving public perception of food biotechnology but not to examine constraints to climate change adaptation strategies among these are:

Hossain, Onyango, Adelaja, Schilling, and Hallman (2002) used the principal components FA to reduce the 34 questions exploring consumers' views on the public perceptions of food biotechnology to a smaller and more focused set of dimensions.

Onyango, Hossain, Hallman, Schilling, and Adelaja (2003) also used PCA to examine factors driving consumer acceptance of genetically modified food.

Hence, uncovering the challenges to the use of climate change adaptation strategies among food crop farmers empirically using specifically PCA is the central focus of this study as this is important in order to give a realistic direction in the development of farmer-inclusive climate policies in Nigeria. Climate variability and climate change programmes need not necessarily suffer set back, if the challenges affecting the use of farm-level strategies are investigated.

2. Methodology

The study area is the Southwestern Nigeria. There are six states in the zone namely, Ekiti, Ondo, Osun, Ogun, Oyo and Lagos. It is located in the coastal region of the Nigeria and is characterized by humid to sub-humid eco-climate. The vegetation ranges from forest to savanna woodland or forest-savanna transition zone (Adebayo et al., 2011). It is bounded in the north and east by Kwara and Kogi states of Nigeria; in the west by the Republic of Benin and in the south by the Atlantic Ocean. Adebayo et al. (2011) observed that crop production is the dominant agricultural enterprise that farmers in South-west Nigeria engage in. It is practiced by over 90% in the savanna and rainforest zone, but only 37.82% in the swamp regions where the primary agricultural enterprise is fishing/fish farming.

For the purpose of this study and to ensure that attributes that characterized the two agricultural zones and the respondents heterogeneity were properly considered, multistage sampling technique was used in the selection of respondents. Two states were randomly selected from five South-west states, considering the two dominant agro-ecological zones (i.e. savanna and rainforest) in the region. Ekiti and Ondo states were randomly selected from the savanna and the rainforest

agro-ecological zones, respectively. Four agricultural zones in the two states were selected. Three extension blocks were randomly selected from each agricultural zone, making 12 extension blocks in all. Two farming villages/communities were randomly selected from each extension blocks giving a total of 24 communities. In each farming community, 15 food crop farmers were randomly selected, making a sample size of 360 food crop farmers. Primary data were collected using structured interview schedule and/or questionnaire.

3. Method of data analysis

Descriptive statistics was used to describe the socio-economic characteristics of the respondents and the climate change adaptation strategies used by the food crop farmers while PCA was used to explain the constraints of food crop farmers on the use of climate change adaptation strategies.

4. Principal components analysis

The aim of the method of principal components is a special case of the more general FA. The aim of the method of principal components in the construction out of a set of variables, X_j's ($j = 1, 2,..., k$) of new variables (P_i) called *principal components*, which are linear combination of the X's:

$$P_1 = a_{11}X_1 + a_{12}X_2 + \cdots + a_{1k}X_k$$
$$P_2 = a_{21}X_1 + a_{22}X_2 + \cdots + a_{2k}X_k$$
$$\begin{array}{cccc} * & * & * & * \\ * & * & * & * \\ * & * & * & * \\ * & * & * & * \end{array}$$
$$P_k = a_{k1}X_1 + a_{k2}X_2 + \cdots + a_{kk}X_k$$

The a's, called *loadings*, are chosen so that the constructed principal components satisfy two conditions: (1) the principal components are uncorrelated (orthogonal), and (2) the first principal component P_1 absorbs and accounts for the maximum possible proportion of the total variation in the set of all X's, the second principal component absorbs the maximum of the remaining variation in the X's (after allowing for the variation accounted for by the first principal component and so on (Koutsoyiannis, 2001). A test based on the levels of significance (standard errors) of the Pearson correlation coefficients will be used to select the variable that its loading is significant. Since the sample size is greater than 50 ($n > 50$), a loading is significant at the 1% level if its value is greater than ±0.346 (Koutsoyiannis, 2001).

According to Johnson and Wichern (1992) and Hair, Anderson, Tatham, and Black (1995), the purpose of FA is to describe the covariance relationships among many variables (constraints) in terms of a few underlying, but unobservable, random quantities called factors, interpreted through weights of the variable called factor loadings organized in a matrix of factor loadings. The FA model is organized in such a way that all variables within a particular group are highly correlated among themselves, but have relatively small correlations with variables in another group (Makhura, Goode, & Coetzee, 1997). However, such a restriction can be relaxed when the results are just intended for understanding the pattern of relationships. Thus, FA using PCA is an appropriate method of answering the basic question of whether or not farmers encounter challenges in adapting to climate variability and change and may be they are located individually or in some cluster (combinations).

5. Result and discussion

5.1. Socio-economic characteristics of the respondents

Majority (70%) of all the food crop farmers fell within 20–60 years age bracket. The average age of the respondents was 53 years in Southwestern Nigeria (Table 1). This result implies that food crop farmers in the area were above the dependent age i.e. not within the economically active age range, which means that food crop production is tending towards the declining productivity class of greater

than 50 years. This further implies that if the occupation does not witness the injection of young able men from now, food crop production may suffer set back. These findings agree with the study of Chavanapoonphol, Battese, and Chang (2005) that found out that Thailand rice farmers were quite old of average age of 51 years, and also agrees with the study of Nwaru and Onuoha (2010) that the respondents were a bit old with average age of about 52 and 55 years for smallholder food crop farmers using credit and those not using credit, respectively, in Imo State, Nigeria. Majority (about 86%) of the respondents were male (Table 1). This implies that food crop production in Southwestern Nigeria is mainly dominated by male.

It is shown that 17% of the food crop farmers never attended school, that is, they had no formal education while about 83% of the respondents had formal education. Out of the 83% of the respondents that had formal education, about 32% of them only attended primary school, 30% attended secondary school while about 20% attended higher institution at various levels (Table 1). The average years of schooling of the respondents as estimated by this study was about eight. This implies that majority of them only attempted secondary schools or its equivalents. This agrees with the finding of Nwaru and Onuoha (2010) that found out that a greater parentage of smallholder food crop farmers (both credit using farmers and non-credit farmers) in Imo state, Nigeria, only attempted secondary school or its equivalent with average years of schooling of about 10 years and also agrees with the findings of Ogundari (2008) that rain-fed rice farmers in Nigeria had the average age of schooling of 10 years. This suggests that majority of the food crop farmers in the study area were at least lettered (they could read and write).

Family labour is recognized as a major source of labour supply in smallholder food crop production in most parts of Africa, Nigeria included. This comprises the labour of all males, females and children in a household, who contribute their mental and physical efforts to the household holdings. Majority of the respondents (47.8%) fell within the household size of 6–10, followed by 33% of the respondents which fell within the range of 1–5 household size (Table 1). The average household size was 7.40 (about 7) for the respondents. This result agrees with the finding of Otitoju and Arene (2010) that majority of the respondents (medium-scale soybean farmers in Benue State Nigeria) had the average family size of about seven people. And this also agrees with the finding of Abdulai and Huffman (2000) that the rice farmers in Northern Ghana had the average household size of about 8 (8.4). The result shows that 0.8% of the sampled food crop farmers were single. About 92% were married while 7% were divorced and none was widowed.

Majority of the respondents (about 29%) had no contact with extension services in the study area. About 27% of the respondents had contact with extension services within the range of 11 to 15 times in the cropping season. About 17% of the respondents had at least six contacts with extension services in the cropping season while about 13% of the respondents had contact with extension personnel and services for at least 16 and at most 20 times in the cropping season. The average extension contact the respondents had in the cropping season was about nine times. It is established in the literature that the more number of contact farmers have with extension personnel and services the better their production, productivity, and the more efficient the farmers in the use of resources, and invariably the more the profits.

5.2. Climate change adaptation strategies used by food crop farmers

This section deals with the farm-level climate change adaptation strategies used by the respondents during 2010 cropping year. About 14% of the respondents used multiple crop types/varieties as a crop management practice to adapt to climate change among the respondents. Mulching as a crop and soil management practice was used by about 12% of them. Multiple planting dates as an adaptation strategy was used by about 11% of the respondents. About 11% of the respondents used farm plots fragmentation as a land management practice to adapt to climate change, while about 10% of them used cover cropping as a soil management practice for coping with climate change. Fertilizer application was used by the food crop farmers as a climate change coping strategy by about 8% of the respondents (Figure 1).

Table 1. Frequency distribution of respondents by their socio-economic characteristics

	Frequency	Percentage
Age (years)	*Mean = 52.98*	
20–40	70	20.0
41–60	180	50.0
61–80	104	28.9
>80	4	1.1
Total	**360**	**100**
Sex		
Male	311	86.4
Female	49	13.6
Total	**360**	**100**
Level of education	*Mean = 8.38*	
No formal education	61	17.0
Primary	116	32.2
Secondary	108	30.0
Tertiary	75	20.8
Total	**360**	**100**
Household size	*Mean = 7.41*	
1–5	119	33.0
6–10	172	47.8
11–15	59	16.4
>15	10	2.8
Marital status		
Single	3	0.8
Married	332	92.2
Widow/widower	25	7.0
Divorced	0	0.0
Total	**360**	**100**
Extension contact	*Means = 9.12*	
1–5	33	9.2
6–10	60	16.6
11–15	97	26.9
16–20	46	12.8
>20	20	5.6
No contact	104	28.9
Total	**360**	**100**

Source: Computed from survey data, 2011.

5.3. PCA on constraints of food crop farmers to climate variability and change adaptation strategies

Table 2 shows the varimax-rotated PCA of major constraints of food crop farmers in adapting to climate variability and change in Southwestern Nigeria. From the result, five factors were extracted based on the responses of the respondents (food crop farmers). The Kaiser criterion (1960) was used for selecting the number of underlying factors or principal components explaining the data. In this study, the number was decided by leaving out components with corresponding Eigen values (a measure of explained variance) of less than one. Only variables with factor loadings of ±0.346 and above at 10% overlapping variance were used in naming the factors and significant at 1% level of

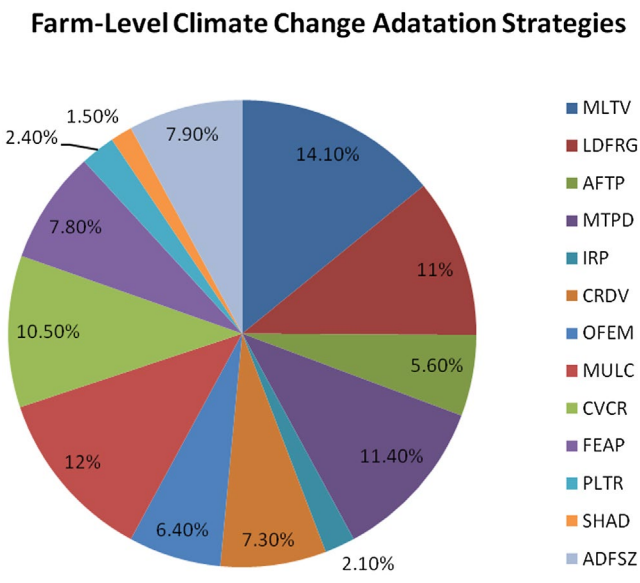

Figure 1. Farm-level climate change adaptation strategies used by food crop farmers in Southwestern Nigeria.

Notes: MLTV means Multiple crop types/varieties; LDFRG means Farm plots fragmentation; AFTP means Alternative fallow/ tillage practices; MTPD means Multiple planting dates; IRP means Irrigation practice; CRDV means Crop Diversification; OFEM means Off-farm employment; MULC means Mulching; CVCR means Cover Cropping; FEAP means Fertilizer application; PLTR means planting of trees; SHAD means Shading/sheltering; and ADFSZ means adjustment in farm size. Source: Computed from survey data, 2011.

probability. Variables that have factor loading of less than ±0.346 were not used while variables that loaded in more than one constraint were also discarded (Madukwe, 2004). The communalities represent the relation between the variable and all other variables (i.e. the squared multiple correlation between the item and all other items). These factors are; factor 1 (Public, institutional and labour constraints), factor 2 (Land, neighbourhood norms and religious beliefs constraints), factor 3 (High cost of inputs, technological and poor information on early warning systems constraints), factor 4 (Far farm distance, poor access to climate change adaptation information, off-farm job and credit constraints) and factor 5 (Poor agricultural extension programmes and service delivery constraints).

After rotation, factor 1 accounted for 11.9% of the variance, factor 2 accounted for 11.5%, factor 3 accounted for 8.8%, factor 4 accounted for 8.7% and factor 5 accounted for 7.6%. The true factors that were retained explained 48.5% of the variance in the 29 constraining factor or variable components.

5.3.1. Public, institutional and labour constraints (Factor 1)

These include, lack of access to weather forecast technologies (0.755), lack of/or inadequate government policies to empower food crop farmers (0.753), lack of or inadequate access to supporting institutional facilities (e.g. cooperative, adult education programme) (0.655), lack of/or inadequate access to and awareness about NGOs programme on climate change adaptation (0.568), lack of access to weather and climate forecast information (0.561), non-availability of farm labour (0.485) and limited government irresponsiveness to climate risk management (0.417). In the present information age, information problems could pose serious challenges to farmers' coping or adaptation strategies as they may not be aware of recent developments regarding climate variability/change adaptations and the necessary readjustments needed. The lack of adaptive capacity due to constraints on resources such as the lack of/inadequate access to weather forecasts creates serious gaps between the farmers and useful information that should help them in their farm work. Weather forecasts are supposed to guide farmers on climate variability so that they can make informed decisions and useful farm plans. However, the absence of this facility will undoubtedly make the farmers become ignorant of the weather situations and hence become vulnerable to the impact of changes

Table 2. PCA on constraints of food crop farmers to climate change adaptation strategies in Southwestern Nigeria

	Constraints	Components*					Communality
		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	
1.	Lack of access to weather forecast technologies	0.755					0.643
2.	Lack of or inadequate government policies to empower food crop farmers	0.753					0.612
3.	Lack of access to supporting institutional facilities	0.655					0.591
4.	Lack of access to and awareness about NGOs programme on climate change adaptation	0.568					0.452
5.	Lack of access to weather and climate forecast information	0.561					0.440
6.	Non-availability of farm labour	0.485					0.490
7.	Limited government irresponsiveness to climate risk management	0.417					0.285
8.	High cost of farmland		0.791				0.691
9.	Poor access to and control of land		0.783				0.645
10.	Inherited system of land ownership		0.743				0.636
11.	Neighbourhood norms, customs, culture and traditional belief against adaptation		0.655				0.488
12.	Religious belief of the farming household		0.591				0.441
13.	Lack of collateral security required to secure loan to support food crop farming		0.400				0.481
14.	High cost of improved crop varieties			0.669			0.560
15.	Traditional beliefs/practices e.g. on the commencement of farming season, crop festival period, etc.			0.504			0.509
16.	High cost of irrigation facilities			0.488			0.426
17.	Illiteracy of the food crop farmers			0.487			0.365
18.	Poor information on early warning systems			0.427			0.461
19.	Far distance of household food crop farms to their homesteads				0.613		0.549
20.	Involvement of the food crop farmers in some off farm jobs				0.580		0.412
21.	Small-scale production of some of the food crop farming household				0.536		0.369
22.	Poor access to climate change adaptation strategies information by food crop farmers				0.516		0.404

(*Continued*)

Table 2. (*Continued*)

	Constraints	Components*					Communality
		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	
23.	Insufficient knowledge of credit source to support farm work				0.469		0.333
24.	Tedious nature of climate change adaptation strategies				0.451		0.315
25.	Lack of /or inadequate extension programmes directed to meet the climate change adaptation strategies in food crop production					0.774	0.620
26.	Poor agricultural extension service delivery					0.746	0.653
27.	Non-availability of storage facilities**			0.630	0.404		0.643
	Percentage (%) of total variance	**11.9**	**11.5**	**8.8**	**8.7**	**7.6**	

Source: Computed from survey data, 2011.

*Factor 1 = Public, institutional and labour constraints; Factor 2 = Land, neighbourhood norms and religious beliefs constraints; Factor 3 = High cost of inputs, technological and poor information on early warning systems constraints; Factor 4 = Far farm distance, poor access to climate change adaptation information, off-farm job and credit source constraints; Factor 5 = Poor agricultural extension programmes and service delivery constraints.

**Constraints that loaded under more than one factor.

in the climate and weather. Ozor et al. (2010) noted that poor climate change information and farmers' lack of access to weather forecast technologies as major barriers to climate change adaptation among farming households in Southern Nigeria.

5.3.2. Land, neighbourhood norms and religious beliefs constraints (Factor 2)

The variables or factors that loaded high were; high cost of farmland (0.791), poor access to and control of land (0.783), inherited system of land ownership (0.743), neighbourhood norms, customs, culture and traditional belief against adaptation (0.655), religious belief of the farming household (0.591), lack of collateral security required to secure loan to support food crop farming (0.400). Kassahun (2009) noted that shortage of land is a major constraint on adapting to climate change in Nile basin of Ethiopia. This result agrees with the findings of Enete et al. (2011) which noted that land tenure is a major challenge of agricultural adaptation to climate change in South-east Nigeria.

5.3.3. High cost of inputs, technological and poor information on early warning systems constraints (Factor 3)

Variables that loaded under include high cost of improved varieties (0.669), traditional beliefs/ practices (e.g. commencement of farming season, crop festival) (0.504), high cost of irrigation facilities (0.488), illiteracy of the food crop farmers (0.487) and poor information on early warning systems (0.427). Benhin (2006) noted that farmers' level of education is a major determinant of speed of adoption of adaptation measures to climate change. This result agrees with that of Ozor et al. (2010) which discovered that high cost of inputs is also a major barrier to climate change adaptation among farming households in Southern Nigeria.

5.3.4. Far farm distance, poor access to climate change adaptation information, off-farm job and credit constraints (Factor 4)

It under includes far distance of household food crop farms to their homesteads (0.613), involvement of the food crop farmers in some off-farm jobs (e.g. artisans, trading, civil service) (0.580), small-scale production of some of the food crop farming household (0.536), poor access to climate change adaptation strategies information by food crop farmers (0.516), insufficient knowledge of credit source to support farm work (0.469) and tedious nature of climate change adaptation strategies (0.451). Benhin (2006) reported that lack of access to credit or saving and lack of adequate information about climate change are some of the major constraints encountered by farmers in

adapting to climate change in Africa. Kassahun (2009) further confirmed that lack of access to credit and lack of information as major constraints on adapting to climate change in Ethiopia.

5.3.5. Poor agricultural extension programmes and services delivery constraints (Factor 5)
The variables that loaded high include lack of/or inadequate extension programmes directed to meet the climate change adaptation strategies in food crop production (0.774) and poor agricultural extension delivery (0.746). The results of lack of/or inadequate extension programmes directed to meet the climate change adaptation strategies in food crop production and that of poor agricultural extension delivery agree with the study of Amusa (2010) that noted lack of agricultural extension programme as a major constraint among cocoa agroforestry households in Ekiti State, Nigeria. Benhin (2006) noted further that farmers' access to extension service is a major determinant of speed of adoption of adaptation measures to climate change.

6. Conclusion and policy implication

This study revealed that the climate change adaptation strategies used in food crop production were multiple crop types/varieties, mulching, multiple planting dates, land fragmentation, cover cropping and fertilizer application. The principal constraints that the farmers faced in climate change adaptation were public, institutional and labour constraint; land, neighbourhood norms and religious beliefs constraint; high cost of inputs, technological and information constraint; farm distance, access to climate information, off-farm job and credit constraint; and poor agricultural programmes and service delivery constraint. There is absolute need to know the constraints farmers face in adapting to climate variability and/or change as this will go a long way to help policy-makers make informed decisions that will make the annual food crop production projection to be realizable. This implies that both government and non-government organizations are to intensify efforts on institutional, technological and farmers' friendly land tenure and information systems as effective measures to guide climate variability/change adaptation policies and development in Southwestern Nigeria.

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