FACTOR ANALYSIS OF CONSTRAINTS TO CLIMATE CHANGE ADAPTATION AMONG FOOD CROP FARMING HOUSEHOLDS IN EKITI STATE, NIGERIA

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ABSTRACT
Impact of climate change has been noticed in several areas due to change in precipitation and temperature. The areas affected include agriculture, forestry, water resources, desertification and human health. Multistage randomised sampling technique was used to select 180 food crop farming households for the study. Data were analyzed using descriptive statistics and factor analysis. The result shows that 39.0% of the food crops farming households in Ekiti State were practicing mixed cropping. The constraints to climate change adaptation identified in the study area using factor analysis were; lack of access to weather information, inadequate public and private institutions; land, neighbour norms and religious belief; poor access to climate change adaptation information , lack of credit facilities; high cost of supporting facilities, illiteracy; poor agricultural extension service delivery and poor information on early warning systems. This accentuates that food crop farmers need to be provided with support from government, non-governmental organizations, and donor-assisted agencies on climate change adaptation especially on those measures that are input-based. Again, education, poverty and institutional problems have to be uncompromisingly addressed with tactical policies and programmes for enhancement of climate change adaptation at the farm-level in the study area.

INTRODUCTION
Climate change is already affecting people, their livelihoods and ecosystems and presents a great development challenge for the global community in general and for the poor people in developing countries in particular (Khanal, 2009). This also presents major challenges to scientists and policy makers. It is also important to note that rural people and agricultural production in Africa rely on rainfall for water supply with a little less than 4% of cultivated land under irrigation (IAC, 2004 and World Bank, 2008). The predominance of rain-fed agriculture, the scarcity of capital for adaptation measures, their warmer baseline climates and their heightened exposure to extreme events predisposes Africa agriculture to be more vulnerable to climate change (Nnamchi and Ozor, 2009). Food crop is particularly sensitive to climate change because crop yields depend largely on prevailing climate conditions (temperature and rainfall patterns) (Palatnik and Roson, 2009). The principal food crops grown in South-Western Nigeria are cassava, yams, maize, and cocoyams, which are also sensitive to climate variability and climate change. Subsistence crop production in South-Western Nigeria is traditional and rain-fed, with very limited areas under irrigation. Small-scale traditional irrigation has been practiced for decades in the areas, where small streams are diverted seasonally for limited dry season cropping. Medium and large-scale schemes are very few.

Nigerian agriculture is already under pressure to meet the demand of rising population using finite, often degraded soil and water resources, which are now further stressed by the impact of climate change (Awotoye and Mathew, 2010). As a result, it is of interest to stakeholders in the agricultural sector to understand the impact climate change will have on food and crop production. There will undoubtedly be shifts in agro-ecological conditions that will warrant changes in processes and practices in order to meet daily food requirements. In addition, climate change could become a significant constraint on economic development in developing countries that rely on agriculture for a substantial share of gross domestic production and employment (Rosegrant *et al.*,2008).

There are two central ideas for dealing with climate change, namely, mitigation and adaptation. Mitigation is a response strategy to global climate change, and can be explained as measures that reduce the amount of emissions (abatement) or enhance the absorption capacity of greenhouse gases (sequestration). Adaptation to climate change is an adjustment made to human, ecological or physical system in response to vulnerability (Adger *et al.*, 2007). 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).

Farmers especially food crop farmers can reduce the potential damage by making tactical responses to these changes. Jagtap (1995) identified crop diversification, mixed cropping, using different crop varieties, changing planting and harvesting dates, drought resistant varieties, while Enete *et al.* (2011) also identified multiple/intercropping, agro-forestry/afforestation, mulching, purchase/harvest of water for irrigation, among others

as some of the climate change adaptation strategies in South-Eastern Nigeria. Analyzing adaptation strategies is therefore important for finding ways to help food crop farmers adapt in the rural economies of Africa including Nigeria in general and Ekiti State in particular. There is also evidence of changes in agronomic and management practices in order to cope with climate change and variability across the agro-ecologies in the South-Western Nigeria (Adebayo *et al*., 2011). The extent food crop farming households in Ekiti state have used the various adaptation strategies to cope with climate change is essential to study. Available studies had examined constraints to climate change adaptation in other parts or states of the country among them are Ozor *et al.,* 2010 (Southern) and Enete and Onyekuru, 2011 (South-East). None has really examined these among the food crop farming households in Ekiti State, hence the aim for this study. The study attempted seeking empirical answers to the following questions; what are the farming systems practiced by the respondents in the study area and constraints facing the respondents in climate change adaptation.

METHODOLOGY

Data collection

Multistage sampling and simple random techniques were used in the selection of respondents (food crop farmers). In the first stage, the 2 agricultural zones (Zones A and B) in Ekiti State were selected for the study. In the second stage, 3 extension blocks were randomly selected from each agricultural zone, given 6 extension blocks. In the third stage, 2 farming villages/communities were randomly selected from each extension block given a total of 12 farming villages/communities. In the last stage, in each farming village/community, with the assistance of the local extension personnel, a list of food crop farming households was compiled and then 15 food crop farming households were randomly selected, given a sample size of 180 respondents.

Data Analysis

Factor Analysis Model

Principal component analysis model was used in estimating the factors constraining climate change adaptation among the respondents, which is specified as:

$P_1 = a_{11}X_1 + a_{12}X_2 + * \ * \ *+ a_{1n}X_n$
$P_2 = a_{21}X_1 + a_{22}X_2 + * \ * \ * + a_{2n}X_n$
$P_3 = a_{31}X_1 + a_{32}X_2 + * \ * \ * + a_{3n}X_n$
$* =$ *
$* =$ *
$* =$ *
$P_n = a_{n1}X_1 + a_{n2}X_2 + * \ * \ * + a_{nn}X_n$

Where:

$P_1, P_2 \ldots P_n$ = observed variables/constraints of food crop farming households to climate change adaptation.
$a_1 - a_n$ = factor loadings or correlation coefficients.
$X_1, X_2, \ldots X_n$ = unobserved underlying factors constraining food crop farming households in climate change adaptation were retained, the study selected factors with high factor loadings scores ±0.4 or greater.

Results and Discussion

Farming Systems Practiced by the Respondents

Table 1 shows that 39% of the respondents in the study area were practicing mixed cropping, 34.5% shifting cultivation, 15.6% mono cropping, 8.4% mixed farming and 1.7 strip cropping (Table 1). These farming systems were not practiced in isolation but usually in combination with one or more farming system(s). This may suggests that, the farmers diversify their production because of the risks and uncertainties involved in farming (Adegeye and Dittoh, 1985).

Table 1: Distribution of the respondents by farming systems practiced

Farming systems	Frequency	Percentage
Mono cropping	64	15.6
Mixed cropping	162	39.0
Shifting cultivation	143	34.5
Mixed farming	35	8.4
Strip cropping	7	1.7
Crop rotation	4	0.8
Total	**415***	**100.0**

* Multiple responses

Source: Computed from field data, 2011.

Constraints to climate change adaptation among food crop farming households in Ekiti State.

The result shows the varimax-rotated principal component analysis of major factors constraining food crop farming households in adapting to climate change in Ekiti State, Nigeria (Table 2). From the results in the table, 5 factors were extracted based on the response of the respondents. These include factor 1 (Lack of access to weather information, public and private institutions constraints); factor 2 (land, neighbourhood norms and religious beliefs); factor 3 (Poor access to climate change adaptation information and credit sourcing); factor 4 (High cost of supporting facilities and inputs and illiteracy constraints); and factor 5 (Poor agricultural extension service delivery and poor information on early warning systems constraints). The Kaiser criterion (1960) was used for selecting the number of underlying factors or principal components explaining the data. After rotation, the first factor accounted for 12.1% of the variance, the second factor accounted for 10.7%, the third factor accounted for 9.4%, the fourth factor accounted for 8.5%, and the fifth factor accounted for 7.8%. The true factors that were retained explained 48.5% of the variance in the 29 constraining factor or variable components.

The main constraints as perceived by the respondents (food crop farmers) limiting food crop farmers on climate change adaptation in the study area for factor 1 (Lack of access to weather information, inadequate public and private institutions) were; lack of access to weather forecast technologies (0.728), lack of access to supporting institutional facilities (0.712), lack of/or inadequate government policies to empower food crop farmers (0.703), lack of access to weather and climate forecast information (0.614), lack of collateral security required to secure loan to support food crop farming (0.504); and lack of access to and awareness about NGOs programme on climate change adaptation (0.503). Information problems could pose serious challenges to farmers' coping strategies as they may not be aware of recent developments regarding climate change adaptations and the necessary readjustments needed. The lack of adaptive capacity due to constraints on resources such as the lack of access to weather forecasts technologies and information creates serious gaps between the farmers and useful information that should help them in their farming activities. 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 and situations and hence become vulnerable to the impact of changes in the climate and weather. This result agrees with the findings of the study of Ozor *et al*. (2010) that identified lack of access to weather forecasts as a major barrier to climate change adaptation among households in Southern Nigeria.

For factor 2 (land, neighbourhood norms and religious belief) the constraining variables or factors that loaded high were; poor access to and control of land (0.799), high cost of farmland (0.778), inherited system of land ownership (0749), neighbourhood norms, customs, culture and traditional belief against adaptation (0.609); and religious belief of the farming household (0.578). Individual farmers in traditional and/or rural societies do not usually have title to farmland but enjoy user rights, which could be withdrawn at any time by the custodian of the communal land. Benhin (2006) noted that farm size and land tenure status are some of the major determinants of speed of adoption of adaptation measures to climate change.

The variables or factors that loaded high for factor 3 (Poor access to climate change adaptation information and credit) include; involvement of the food crop farmers in some off-farm jobs (0.668), poor access to climate change adaptation strategies information by food crop farming household (0.512); and insufficient knowledge of credit source to support farm work (0.499). Under factor 4 (High cost of supporting facilities and inputs and illiteracy constraints) the constraining variables or factors that loaded high were; high cost of improved crop varieties (0.613), traditional beliefs/ practices e.g. on the commencement of the farming season, crop festival period, etc. (0.611), non-availability of storage facilities (0.607), illiteracy of the food crop farmers (0.527); and high cost of irrigation facilities (0.439). Kassahun (2009) noted that poor potential for irrigation as a major constraint on adapting to climate change in Nile basin of Ethiopia.

The variables or factors that loaded high for factor 5 (Poor agricultural extension service delivery and poor information on early warning systems constraints) include; poor agricultural extension service delivery (0.739), lack of/or inadequate extension programmes directed to meet the climate change adaptation strategies in food crop production (0.729), far distance of household food crop farms to the farm household residential areas (-0.508), poor information on early warning systems (0.433); and tedious nature of climate change adaptation strategies (-0.402). Amusa (2010) noted lack of agricultural extension programme as a major constraint among cocoa agroforestry households in Ekiti State, Nigeria.

CONCLUSION

The study shows that majority of the food crop farming households in Ekiti State were practicing mixed cropping. The study identified the following factors as the constraints to climate change adaptation in the study area; lack of access to weather information, inadequate public and private institutions; land, neighbour norms and religious beliefs constraints; poor access to climate change adaptation information and credit, high cost of supporting facilities and illiteracy constraints; and poor agricultural extension service delivery and poor information on early warning systems. This accentuates that food crop farmers need to be provided with support from government, non-governmental organizations, and donor-assisted agencies on climate change adaptation especially those measures that are input-based. Again, education, poverty and institutional problems have to be uncompromisingly addressed

with tactical policies and programmes for enhancement of climate change adaptation at the farm-level in the study area.

Table 2: Varimax Rotated Factors/ Variables Constraining Food Crop Farmers on Climate Change adaptation in Ekiti State, Nigeria

Constraints	Components*					
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Communality
1. Lack of access to weather forecast technologies	**0.728**					0.648
2. Lack of access to supporting institutional facilities	**0.712**					0.625
3. Lack of /or inadequate government policies to empower food crop farmers	**0.703**					0.635
4. Lack of access to weather and climate forecast information	**0.614**					0.481
5. Lack of collateral security required to secure loan to support food crop farming	**0.504**					0.503
6. Lack of access to and awareness about NGOs programme on climate change adaptation	**0.503**					0.369
7. Poor access to and control of land		**0.799**				0.691
8. High cost of farmland		**0.778**				0.693
9. Inherited system of land ownership		**0.749**				0.625
10. Neighbourhood norms, customs, culture and traditional belief against adaptation		**0.609**				0.491
11. Religious belief of the farming household		**0.578**				0.453
12. Involvement of the food crop farmers in some off farm jobs, e.g. trading, artisans etc			**0.668**			0.493
13. Poor access to climate change adaptation strategies information by food crop farmers			**0.585**			0.461
14. Small scale production of some of the food crop farming household			**0.512**			0.414
15. Insufficient knowledge of credit source to support farm work			**0.499**			0.305
16. High cost of improved crop varieties				**0.613**		0.572
17. Traditional beliefs/practices e.g. on the commencement of farming season, crop festival period, etc				**0.611**		0.530
18. Non-availability of storage facilities				**0.607**		0.615
19. Illiteracy of the food crop farmers				**0.527**		0.332
20. High cost of irrigation facilities				**0.439**		0.305
21. Poor agricultural extension service delivery					**0.739**	0.573
22. Lack of /or inadequate extension programmes directed to meet the climate change adaptation strategies in food crop production					**0.729**	0.625
23. Far distance of household food crop farms to their homesteads					**-0.508**	0.563
24. Poor information on early warning systems					**0.433**	0.432
25. Tedious nature of climate change adaptation strategies					**-0.402**	0.350
26. **Non-availability of farm labour	0.419			0.417		0.447
Percentage (%) of total variance	**12.1**	**10.7**	**9.4**	**8.5**	**7.8**	

* factor 1 = Lack of access to weather information, public and private institution constraints; factor 2 = Land, neighbourhood norms and religious beliefs constraints; Factor 3= Poor access to climate change adaptation information and credit sourcing constraints; Factor 4= High cost of supporting facilities and inputs and illiteracy

constraints; and Factor 5= Poor agricultural extension service delivery and Poor information on early warning systems constraints.
** Constraints that loaded under more than one factor.
Source: Computed from field data, 2011.

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