DETERMINANTS OF CLIMATE RISK MANAGEMENT STRATEGIES AMONG RURAL COMMUNITIES IN EKITI STATE, NIGERIA

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ABSTRACT

As part of the major effort to addressing climate risk in Nigeria, a study on climate risk management strategies has been carried out in Ekiti State, Nigeria. This study employed a multistage sampling techniques in selecting respondents from the population in the study area.Data were collected with a structured questionnaire.A total of 110 respondents were sampled for this study.The collected data were analysed using descriptive and inferential statistics (multinomial logit model). The analysis revealed that the average age of the farmers in the area is 46years and are relatively educated. The percentage of the farmers that used one or more of risk management strategies were 95%, while only 5% of the farmers do not use any in the area of study. The result of the multinomial logit regression revealed that household size, level of education, age of farmers, farm size and farming experience were the various factors that were significant determinants of the choice of various management strategies used. There is therefore the need to put in place a proactive policies and programs that will encourage farmers to be more educated by acquiring formal education and enhanced farming experience that will enable them to manage climate risk more effectively. This would go a long way in reducing the negative impact of climate on their productivity which will in turn improve their income and thus ensures a better livelihood.

Keywords: Climate risk factors, management strategies, multinomial logit regression.

INTRODUCTION

Agriculture remains an important economic sector in many developing countries; the process of producing food requires resources, which could be natural or man-made resources. Natural resources include all the materials and forces that are supplied by nature. Those that are most essential for agricultural production are land, water, sunshine, air, temperature and soil conditions. Man-made resources (include labour, capital or entrepreneurship) are supplied and influenced by man (Oyekale *et al*., 2009).However, among the natural resources, climate is the predominant factor that influences agricultural production. Climate as defined by Oyekale *et al*., (2009) is the state of atmosphere, which is created by weather events over a period. A slight change in the climate will affect agriculture. Climate, as defined by Intergovernmental Panel on Climate Change report (IPCC), (2001), is a change in general weather conditions which is attributed directly or indirectly to human activity that alters the composition of the global and/or regional atmosphere and which is in addition to natural climate variability observed over comparable time periods. It is obvious from this definition that change is an inherent attribute of climate, which is caused by both human activities (anthropogenic) and natural processes (bio-geographical) (Odjugo, 2007, 2009).

Climate change can be exacerbated by human induced actions such as the widespread use of land, the broad scale deforestation, the major technological and socioeconomic shifts with reduced reliance on organic fuel, and the accelerated uptake of fossil fuels (Millennium Ecosystem Assessment, 2005). The most devastating adverse

impacts of climate change in Africa includes: frequent drought, increased environmental damage, increased infestation of crop by pests and diseases, depletion of household assets, increased rural-urban migration, increased biodiversity loss, depletion of wildlife and other natural resource base, changes in the vegetation type, decline in forest resources, decline in soil conditions (soil moisture and nutrients), increased health risks and the spread of infectious diseases, changing livelihood systems, etc. (Reilly, 1999).

Anyanwu (2008) identified the significant effects of climate change on crop production as low yield of crop, stunted growth of crop, ease spread of pest and disease attack on crops, drying of seedling after germination and ineffectiveness of agricultural chemicals due to delay of rainfall.

Adoption to climate change and climate variability at the farm-level by the farmers especially through the modification of agricultural practices and farming systems have been recognized as the main coping strategies. It is believed that these strategies are supposed to help the farmers improve their personal productivity and efficiency in food crop production and raise their returns to farming as a business. (Adebayo et al., 2011).

However, effective adaptation requires an awareness of the risks posed by climate change and, importantly, an understanding of the relative significance of those risks. Thus, there is a need for adaptation methods, which are those strategies that enable the individual or the community to cope with or adjust to the impacts of the climate in the local areas. As with disaster risk management, policies and measures concerned with climate change represent a risk management approach (Chikaire, 2011).

Farmers can reduce the potential damage by making tactical response (good risk management strategies) to the prevailing climate change effect on their production. Approaches toward the management of climate change impacts have to consider the reduction of human vulnerability under changing levels of risk. A key challenge and opportunity therefore lies in building a bridge between current disaster risk management efforts aimed at reducing vulnerabilities to extreme events and efforts to promote climate change adaptation (Olorunfemi, 2008; Few et al., 2006). Analysing the climatic risk management strategies is therefore important to help the farmers improve ways and strategies of adaptations in the rural communities of Nigeria.

METHODOLOGY

Area of Study

The study was carried out in Ekiti State, Southwest Nigeria. The state falls on Longitude 4^0 50' and 5^0 45' east of the Greenwich meridian and Latitudes 7^0 15' and 8^0 5' north of the equator and has sixteen (16) Local Government Areas (LGAs). It lies south of Kwara and Kogi State, East of Osun State and bounded by Ondo State in the East and in the south, with a total land Area of 5887.890sq km.

Sampling Techniques and data collection

Primary data were used for the study. A multistage sampling technique was used for data collection. The first stage involves the purposive selection of the two zones namely, derived savannah and rain forest zone. Second stage involves random selection of three local government areas in each zone. The third stage involves the random selection of two villages in each of the three local government areas. The fourth and final stage involves the random selection of ten (10) farmers in each village making a total of 120 respondents in all. The data were collected using structured questionnaires. Data collected include farmers' demographic and socioeconomic characteristics such as age, sex, farm size, farming experience, family size; climate risk management strategies, such as indigenous practices, crop diversification, mulching, multiple planting date, and multiple crop types and varieties.

Analytical Technique

Data collected were analysed using descriptive (frequency distribution and percentages, and multinomial logit model. The data were used to identify the most common management strategies employed and factors that influenced the choices of the strategies. For instance, Festus *el al.* (2015) employed Multinomial logit model to analyse the effects of climate variability on the farmer household's choices of livelihood in Anambra State, Nigeria. Kurukulasuriya and Mendelsohn (2006) used the multinomial logit model to see if crop choice by farmers is climate sensitive. Deressa et al. (2009) also employed Multinomial logit model to analyze factors that affect the choice of adaptation methods in the Nile basin of Ethiopia

Multinomial Logit Model

The multinomial logit was used in this study because of the various response categories. The model specifies the relationship between the probability of choosing option Y_i and the set of explanatory variables X. (Greene, 2003). The climate risk management choices were grouped into six categories 0, if the farmer choose no management strategies category category 1, if the farmer chose indigenous practices; category 2, if crop diversification was chosen; category 3, if mulching was chosen; category 4, if multiple planting dates was chosen and category 5, if multiple crop types and varieties was chosen. The model was employed instead of Tobit model because Tobit model assumes that non-adopter of a given practice does not adopt any other. This is because when there is more than one practice choice to choose from, that the farmer does not pick one does not imply he is a non-adopter. Hence non-adopter of one does not necessarily puts the farmer in non-adopter category. This supports the model appropriateness (Owombo *et al*., 2014).

The model was specified as;

$$U_i = \beta_i X_i + \varepsilon_i$$

Which implies that the utility, U_i of choosing a particular practice is a stochastic linear function of farm, farmer and practice specific attributes (X_i). inthis multinomial logit, the probability of choosing a

$$\text{Prob (choice } j) = \exp(\beta j X) \,/\, \sum_j^n exp(\beta j X)$$

given practice j is equal to the probability that the utility of that particular technology is greater than or equal to the utilities of all other technology in the model. The dependent variable in this model was a discrete variable taking the value 0, 1, 2, 3, 4, and 5 for cases of no management strategies, indigenous practices, crop diversification, mulching, multiple planting date, and multiple crop types/varieties respectively.

The empirical model specification is:

$$Yi = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + e_i$$

Where; Y_i = Climate risk management choices. (0 = no management strategies, 1 = indigenous practices, 2 = crop diversification, 3 = mulching, 4 = multiple planting date, 5 = multiple crop types/varieties).β_0 = constant, β_1 to β_8 are coefficients of the factors that influenced farmer's choice of different management strategies.

The independent variables are as follow;

X1 = Household size (Number of individuals in the family)

X2 = Age of respondent (in years)

X3 = Education of respondent (year spent in school)

X4 = Farm size (in hectares)

X5 = Access to extension services (Access = 1, 0 otherwise)

X6 = Land tenure system

X7 = Access to credit (Access = 1, 0 otherwise)

X8 = Farming Experience (in years)

The multidisciplinary independent variables included farmer, farm and institutional factors postulated to influence the choice of climate risk management options. These variables included were age of respondent, education of respondent, farm size, access to extension services, land tenure system, access to credit, and farming Experience. It is hypothesized that a farmer's decision to either adapt or otherwise to climate change is influenced by the combined effect of a number of factors related to farmers' objectives and constraints, (Sofoluwe *et al*., 2011). The variables in the model were hypothesized to influence farmers management strategies positively (+), negatively (-), or both positively and negatively (+/-).

RESULTS AND DISCUSSION

Socio-economic characteristics

The analysis of the socio-economics characteristics (Table 1) of the respondents shows that 69% of the respondents where between 31-50 years of age. 90% were married with 10% either single or widow or widower. 89.7% of the farmers are male with only 17.3% female. On the level of education, 65.5% of the farmers attended higher institution, with 10%, 10%, and 14.5%, never went to school, attended primary school and attended secondary school respectively. 60.9% of the farmers have household size of 1-5 persons while 39.1% have above 5 persons per household. Access to extension services is 36.4%, while 63.6% of the respondents have no access to extension services. This implies that extension services in the area is poor and needs to be improved. About 44.5% of the respondents have 1-10 years farming experience, while 55.5% of the respondents have above 10 years farming experience in the study area. On the form of land ownership, 47.3% of the farmers inherited their land, 37.3% own their land as leasehold while 5.5% own land on crop share basis.

Climate Risk Management Strategies

From the data obtained and analysed, majority of the respondents chose one or more climate risk management strategies (Table 2), i.e 10% chosed the use of indigenous practices, 16.36%, 29.09%, 24.55%, 15.45% and 4.55%, chosed crop diversification, mulching, multiple planting dates, multiples crop types/varieties and no management strategy respectively.

Table 1: Socio-economic characteristics

Variables	Mean %
Age (years)	46
Household size	5
Farming experience(years)	10
Level of education	
No school	10
Primary school	10
Secondary school	14.5
Higher institution	65.5
Total	**100**
Access to extension services	
Yes	36.4
No	63.6
Total	**100**

Source: Field Survey, 2017

Table 2: Climate Risk Management Strategies

MANAGEMENT STRATEGIES	Frequency	Percentage
No management strategy	5	4.55
Use of indigenous practices	11	10.00
Crop diversification	18	16.36
Mulching	32	29.09
Multiple plant date	27	24.55
Multiple crop types/variety	17	15.45
TOTAL	**110**	**100**

Source: Field Survey, 2017

Multinomial logit regression result

Table 3 summarizes the multinomial logistic regression analysis of the socio-economic factors that influenced climate risk management strategies choices adopted by the respondents. The model was estimated with maximum likelihood procedure. The Chi square statistic was highly significant ($p < 0.0001$), suggesting that the model has a strong explanatory power. The pseudo R^2 was 22.08%, thus confirming respondents' choice decision making process could be attributed to fitted covariates. In terms of consistency with a priori expectations on the relationship between the dependent and the explanatory variables, the model appeared to have performed well. Household size had a negative sign but significantly ($p < 0.01$) related to the probability of farmer's choice of crop diversification and mulching as climate risk management strategies. It also had a negative sign but significantly ($p < 0.05$) related to probability of choosing multiple crop types/varieties. Implying that a unit increase in the number of household size will result in 2.5 times decrease in the choice of mulching as climate risk management. Household size is also significantly related to the probability of choosing indigenous practices and multiple planting dates at $p < 0.1$ significant level as climate risk management strategies. Age of household head was negative and significantly ($p < 0.1$) related to the probability of choosing indigenous practices, crop diversification, mulching, multiple planting dates and multiple crop types/varieties as climate risk management strategies in the area. Educational level of the respondent was positive and significantly ($p < 0.1$) related to the probability of choosing indigenous practices, crop diversification and multiple planting dates. This implies that the more educated the farmers are the likely their choice of different climate risk management strategies in the area of study.Education is expected to impact positively on farmer's decision making, since educated households are expected to be more informed and knowledgeable on the best livelihood choices to make in combating the effect of climate variability. This finding is in line with that of Birkmann and Fernando (2008), who noted that education and skills up grading are powerful adaptive strategies for individual families and communities. In addition, Adi (2007) identified education as one of the determinants of livelihood choice in Eastern Nigeria. Farm size was negative and statistically significant ($p < 0.1$) to the probability of choosing indigenous practices and mulching and significantly ($p < 0.05$) related to the probability of choosing crop diversification. Farming experience was positively and statistically significant ($p < 0.05$) related to the probability of choosing all the climate risk management strategies. This could mean that households with more years of experiencecould choose one or more climate risk management strategies in the study area. This finding is in line with that of Festus et al. (2015).

Table 3. Multinomial logit regression results of factors influencing the choices of climate risk management strategies among the respondents in the study area.

EXPLANATORY VARIABLES	COEFFICIENT				
	UINDGEN	CRPDVER	MLCHN	MLTPLND	MLTCRPV
Household Size	-1.76541 (0.092)***	-3.188687 (0.008)*	-2.494191 (0.014)*	-1.694943 (0.102)***	-2.022829 (0.059)***
Age of Household	-2.300361 (0.071)***	-1.930019 (0.127)***	-2.07031 (0.096)***	-2.338398 (0.062)***	-2.077293 (0.105)***
Level of Education	1.078883 (0.116)***	1.237442 (0.069)***	0.6796611 (0.283)	1.230948 (0.060)***	0.6945551 (0.289)
Farm Size	-1.596484 (0.118)***	-2.322156 (0.028)**	-1.370943 (0.131)***	-0.7001563 (0.414)	-0.7732059 (0.378)
Extension service	-1.065665 (0.650)	-0.6874795 (0.768)	-1.524704 (0.500)	-1.8660125 (0.703)	-0.170799 (0.941)
Land Ownership	0.7293628 (0.54)	0.2431497 (0.869)	0.2996775 (0.835)	1.155099 (0.430)	1.374502 (0.357)
Access to Credit	-0.2393214 (0.830)	-0.6243064 (0.733)	2.107527 (0.195)	-0.7174764 (0.673)	0.3729784 (0.826)
Farming experience	3.784928 (0.025)**	3.484905 (0.038)**	3.505024 (0.035)**	3.951218 (0.018)**	4.089071 (0.015)**

Statistics: chi^2 (40) = 80.61, prop > ch^2 = 0.0001; Pseudo – R^2 = 0.2208; number of observation= 110. The figure in parenthesis are standard errors. *p< 0.01; **p< 0.05; ***p<= 0.1. Source: Field survey, 2017

CONCLUSION AND RECOMMENDATION

Conclusively, farmers in the area were in their active years as shown in the age distribution (30-50 years) of the respondents. Majority of the farmers are married and mainly male with only 17.3% females. Most of them are literate with only few illiterate shown by the percentage of those that have never attended school before in the area. Household size, age, educational level, farm size and farming experience were the major determinants of households' choice of climate risk management strategies in the study area. Household with more farming experience chose all the various strategies employed in climate risk management. Educated farmers chose most of the strategies in coping with climate risk. Implying that the more educated the farmers are, the better informed they are in using climate risk management strategies. Educational level and farming experience had a positive and significant influence on the choice of management strategies in the study area while household size, age, and farm size had a negative but significant influence on the choice of management strategies. Extension services and access to credit had a negative influence and not significantly related to the probability of choosing any of the management strategies in the area of study. Based on the findings of this study, the farmers (especially young farmer) should be encouraged to be educated as this will enhance their knowledge more about climate risk and the right management strategies to employ. The younger generation should also be motivated to engage in farming early enough so as to gather necessary farming experiences that will better equipped them in managing climate risk effectively in the study area.

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