CLIMATE ADAPTATION MEASURES BY IFAD-VCDP RICE FARMERS IN WUSHISHI LOCAL GOVERNMENT AREA, NIGER STATE, NIGERIA.

Jirgi, A. J.[1], J. G. Tuedogheye[1], A. O. Simon[1], A. I. Oseghale[1]

[1]Department of Agricultural Economics and Farm Management, School of Agriculture and Agricultural Technology, Federal University of Technology, Minna, P.M.B 65, Minna, Niger State, Nigeria.

*Corresponding Author's E-mail – jirgi.abigail97@gmail.com ; GSM: +234 (0)8168983283

ABSTRACT

Change in Climate is one of the major global environmental glitches threatening the survival of the entire human race. It is a global threat with serious negative results on agriculture, natural ecosystem, water supply, health, soil and atmosphere, which are all elements that institute the support for long term sustainability of life on earth. The variation in climate parameters affect different sectors of the economy such as agriculture, health, water, resources, energy etc. this main cause of climate change has been attributed to human activities. This study describes the socio-economic characteristics and examines the determinants of climate change adaptation strategies used by IFAD-VCDP farmers in the study area. The results of the study are expected to give direction for policy makers in designing appropriate policies to increase climate adaptation measure in Wushishi LGA. It will provide a useful guide to international and local donor agencies interested in climate adaptation in their provision of grants and funds for environmental and resource management studies. Researchers will also find the outcome of the study relevant in a bid to expand the frontiers of knowledge. A multi-stage sampling procedure was used to select 120 rice farmers from a total of 173 rice farmers in the LGA using the Yamane's formula at 5% limit or tolerable error. The farmers were male, married and have a mean age of 34 years. The years of farming experience was 23 years. The majority of the farmers cultivate less than five hectare as reveal by a mean farm size of 1.04ha. The result from the multinomial logit revealed that farm income, the number of years in school and years in farming were positively significant. Income from farm activities and years in farming were positively significant and had positive marginal effect on probability of choosing and using various adaptation strategies while household size was negatively significant. It is therefore recommended that government provide basic amenities such as hospital, market and credit facilities.

KEYWORDS: Climatic adaptation, IFAD –VCDP, Rice, Niger state

INTRODUCTION

Change in Climate is one of the major global environmental problems threatening the survival of the entire human race. It is a global threat with serious negative results on agriculture, natural ecosystem, water supply, health, soil and atmosphere, which are all elements that constitute the support for long term sustainability of life on earth (Emeka, 2008). Ikehi and Zimoghen (2015) also defined Climate change is the variation in the statistical distribution of the average weather conditions over a prolong period of time. Climate change refers to weather changes, including steady alteration in usual temperature (rise or fall), rainfall pattern or intensity), wind, relative humidity and solar radiation over time. The variation in climate parameters affect diverse sectors of the economy such as agriculture, health, water, resources, energy etc. this main cause of climate change has been accredited to human activities. Agriculture is therefore the main perpetrator of climate change producing significant effects through the production and release of GHGs. Climate change is one of the most serious environmental threats facing mankind. It affects agriculture in several ways, one of which is its direct impact on food production.

Adaptation is defined as "decision-making processes and actions" that enhance enabling conditions for adaptation (Eisenack and Stecker, 2010). Climate adaptation refers to organized methods through which people and societies adjust to changes in climate, thereby making changes in the operation and use of natural resource by systems and other forms of social and economic organizations (Quan and Dyer, 2008).

Crop yield are affected by many factors resulting from climate change which include temperature, rainfall, and other extreme weather events. Adapting to climate change entails taking the right measures to reduce the negative effects of climate change (or exploit the positive ones) by making the appropriate adjustments and changes (UNFCCC, 2007). Adaptation therefore aims at reducing vulnerability to climatic change and vulnerability of communities, regions, and nations to climate variability.

Rice farming is highly dependent on environmental factors which are the most important among several factors that influence agricultural production. Edeh *et al.* (2011) stated that rice production depends on optimum combination of production inputs in order to achieve remarkable yield. These inputs are both the familiar production inputs and the various environmental factors provided by nature such as rainfall characteristics (intensity and duration), relative humidity and temperature constitute. As reported by Manneh *et al.* (2007), rice when compared with other crops is very sensitive to drought which can reduce stand establishment, tillering, plant height, spikelet fertility and also delay flowering. The degree of impact on drought however, is dependent on the stage of growth of the crop. Nguyen (2004) also noted that the growth pattern, duration and productivity of rice crop is greatly influenced by temperature while severe moisture stress especially during rice reproductive stage may lead to complete crop failure.

The Value Chain Development Program is a Federal Government Programme was inaugurated by International Food for Agricultural Development (IFAD) in 2015. The programme is for rice and cassava farmers for improving cassava and rice value chains for small farmers in the six states namely Anambra, Benue, Ebonyi, Niger, Ogun and Taraba State. The programme is aimed at enhancing the economic status of small -holders' farmers in the rural areas over a period of six years. The programme will strengthen farmers' organization, opportunities and overcome constraints along the value chain through the use of smart technologies. The goal of the programme is to reduce rural poverty, increase food security and accelerate economic growth on a sustainable basis.

A prolonged period of insufficient or excessive rainfall, a sudden hot spell or cold snap, climatic extremes such as flooding of storms, can have a significant influence on local rice yields. In Nigeria, farmers are facing problem of extreme weather events such as floods, droughts and low soil fertility which are responsible for low rate of rice production (Arimi, 2014). Existing adaptation strategies may not work under future changes and consequently more work on adaptation preparedness would be required. Although several studies have been conducted on climate change and adaptations (Ayoade, 2012; Ifeanyi-Obi *et al.*, 2012; Otitoju, 2013), little empirical knowledge exist on the climate adaptation measures by IFAD/ FGN/ VCDP rice farmers.

It is against this backdrop that the study describe the socio-economic characteristics and examine the determinants of climate change adaptation strategies used by IFAD-VCDP farmers in the study area. The results of this study are expected to give direction for policy makers in designing appropriate public policies to increase climate adaptation measure in Wushishi LGA. The study will also provide a useful guide to international and local donor agencies interested in climate adaptation in their provision of grants and funds for environmental and resource management studies. Researchers will also find the outcome of the study relevant in a bid to expand the frontiers of knowledge.

METHODOLOGY

Study Area

The study was undertaken in in Wushishi, Local Government Area in Niger State, Nigeria. Niger State is located between Latitudes 8°22'N and 11°30'N and Longitudes 3°30'E and 7°20'E. Wushishi local government area has an area of 1,879 km², density of 31.6inh/km and a population of 81,783 at the 2006 census. The towns include: Dagbako, Akare, Barwa, Bagi, C-ekun, Kanko e.t.c and the town is known for enormous farming activities. The State covers a total land area of 74,244sq.km, which is about 8% of Nigeria's total land area. This makes the State the largest in the Country. The population of the State is 3,950,249, comprising 2,082,725 males and 1,867,524 females (National Population Commission (NPC), 2006). The projected population of the State as at 2016 was 5,556,200 (United Nations Population Fund (UNFPA), 2016). The average annual rainfall in the State is 1,219 mm. The dry season is between November and March. Temperature is fairly regular and ranges from 26.1°C (June - February) to 30.1°C (March – April). The soil types support sustainable production of arable crops. Major crops cultivated include rice, guinea corn, maize, yam, beans, groundnut, and sugarcane (www.nigerstate.gov.ng). The State has large water bodies (River Niger and River Kaduna) with numerous tributaries, as well as lakes and dams which make it suitable for the cultivation of irrigated crops such as rice, vegetables. Livestock rearing and fishing activities are also prevalent in the State (International Rice Research Institute (IRRI), 2000)).

Sample Design, Techniques and Sample Size

Sample Selection

A multi-stage sampling procedure was used to select respondents for this study. In the first stage, one local government area was selected (Wushishi LGA) in Niger State. Second stage, four (4) villages were purposively selected because of their predominance in rice production in the local government area (Table 1). The third stage, involved random selection of a total of 120 rice farmers from a total of 173 rice farmers in the LGA using the Yamane's formula at 5% limit or tolerable error.

Method of Data Collection and Management

Primary data was used for the study. Primary data was collected using a well-structured questionnaire to be administered on the respondents by the researcher and team of extension agents involved in IFAD - VCDP program in Niger state. Information on some socio- economic variables such as Input output data on production was also be collected.

Model Specification

Descriptive statistics and multinomial logit regression was employed to analyse the date from field survey.

The multinomial logit model is specified in equation 1:

$$Yi = \beta_0 + \beta_1 x_1, +\beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 + \beta_9 x_9 + \beta_{10} x_{10} + e \quad (1)$$

Where Y_i = Adaptation strategies (Change crop variety and Build water conservation scheme = 1, Implement soil conservation scheme and use of chemical fertilizer = 2, Seeking early warning information and changing planting date = 3, Reduce number of livestock and diversity from farming to non-farming activity = 4).

X_1= Farm Income (Naira);

X_2= Age of Farmer (years);

X_3= Household Size (Number);

X_4= Source of capital (1= own savings, 0 = other sources)

X_5= Years in school (Years);

X_6= Years in farming (Years);

X_7= Farm size (ha);

X_8= Access to credit (1= yes, 0= No)

X_9= Off farm income (Naira)

B_0 = Intercept

$\beta_1 - \beta_8$ = Coefficients to be estimated

e = error term

RESULTS AND DISCUSSION

Socio economic characteristics of the farmers

Figure 1 reveal that majority 90.8% of farmers were male while only 9.2% were females. This shows that males dominated the crop production activities in the study area. This agrees with the findings of Akintonde *et al.* (2016), Ayoade (2012) and Defeng *et al.* (2017) who asserted that rice production were dominated by male. Ifeanyi-Obi *et al.* (2013) disagree with this assertion. Figure 2 show that 92.5% of the total farmer were married, while the remaining 7.5% were single. This may determine availability of labor in traditional agricultural economics. Furthermore, figure 3 showed that the mean age was 34 years with most of the respondents 48.3% within the age range of 31 - 40 years which indicates an agriculturally active age bracket while 23.3% of the respondents were within the age of 41- 50 years. The age of the farmers determine the quality and quantity of work he or she can do on his her respondents were within the agriculturally active age bracket. This is in agreement with the finding of Ifeanyi-obi *et al.* (2013). Also, figure 4 show that the mean household size of 6 persons with 32.5% of respondents having a household size of between 4 - 6 persons and 23.3% having household size of between 10-12 persons. Figure 5 revealed that 58% had one form of formal education. Education enhances individual farmer's ability to make correct decision on the adoption of technologies and practice in the farm. This is in consonance with Ayoade (2012) and Akintonde *et al.* (2016) who reported the range of household size was between 5-10 persons. Figure 6 show that the mean years of farming experience was about 23years which indicates that they have been involved in agricultural activities for a relatively long time and should be familiar with climatic condition prevalent in their area and are likely accept and adapt any strategy that will help to mitigate the effect of climate change on crop production in the area. This is in agreement with Defeng *et al.* (2017) and Ifeanyi-obi *et al.* (2013) who reported that farming experience was above 20 years. Moreso, figure 7 revealed that 45.8% of the respondents had farm sizes of less than 2 hectares in scattered plots and in different locations. About 41.7% of the respondents had 2.1 to 4.0 hectares of farm land and only 12.5% had more than 4 hectares of farm land. With a mean farm size of 1.04ha, it implies that, majority of the respondents were basically small scale farmers. This corroborated the findings of Segun, *et al.* (2010) who found that most of the farmers had affirm size of less than 2 hectares. Also, figure 8 shows that 60.0% of respondents planted between 16 -25kg of rice seed with 27.5% planting between 26 -35kg, 10.8% planting above 36kg and 1.7% planting between 1 -15kg of rice seed.

Determinants of climate adaptation strategies

Multinomial logit regression was used for the analysis (Table 2). The result revealed that income, years in school and years in farming were positively significant. The incomes of the respondents was positively significant and had positive effect on probability of changing crop variety and building water conservation scheme, and reduce number of livestock and diversity from farming to non-farming activity. The income of the respondents was positively significant and had positive effect on probability of changing crop variety and building water conservation scheme, and reduce number of livestock and diversity from farming to non-farming activity. Higher level of education are positively related to adoption of improved technologies. Farmers with more schooling are expected to adapt better climate changes and extreme climatic events. The values from result indicate that higher educational level have positive effect in accepting seeking early warning information and changing planting date. This is in consonance with Nkanya *et al.* (2008) and Gbegeh and Akubinto (2012). The level of farming experience increases the possibility of undertaking different adaptation strategies, since experienced farmers are knowledgeable and better informed on climate change. Farm experience here is significant for two adaptation strategies: changing crop variety and build water conservation scheme, and implement soil conservation scheme and use of chemical fertilizer. This agrees with the findings of Gbegeh and Akinbinto (2012) and Nhemachena and Hassan (2007). Furthermore, the result show that farm size was positively significant with changing crop variety and build water conservation scheme. This implies that as farm size increases, adaptation of changing crop variety and build water conservation scheme will increase. Increase in farmland reflects the farmer positive attitude towards practicing rice farming and as such would welcome new adaptation strategies. Moreso, household size is negatively significant. It implies that as household size increase, the probability to adapt to new technologies decreases. An increase in household size will reduce the adaptation strategy of changing crop variety and build water conservation scheme. This can be attributed to extra household expenses in the house which can reduce the amount spent on farming practices.

Table 3 shows the marginal effects on determinants of various adaptation strategies. The results show that two variables (income from farm activities and years in farming) were positively significant and had positive marginal effect on probability of choosing and using various adaptation strategies while household size was negatively significant. This implies that marginal increase in income from farm activities and years in farming would cause a 1.97E-07 and 0.0161 increase in probability of choosing and using cultivation of improved varieties. Furthermore, marginal increase in household size will lead to a decrease in the probability of choosing cultivation of improved varieties, Change in planting date, fertilizer application, Seeking early warning information and use of conservation practices 0.0547.

CONCLUSION AND RECOMMENDATIONS

The study examined the climate adaptation measures by IFAD-VCDP rice farmers in Wushishi LGA, Niger state. The study concluded that climate change had negative effect on the farmers income which resulted in adapting to various adaptation strategies to improve the income. The farmers made use of various adaptation strategies that helped in adjusting to climate change in the study area. The marginal increase in income from farm activities and years in farming would cause an increase in probability of choosing and using cultivation of improved varieties. It is therefore recommended that the farmer should continue to adapt more climate adaptation strategies in order to improve their income. Such strategies are the use of information system, improved varieties and use of resources in efficient manner in order to obtain high yields and hence more income.

Table 1: Sample frame and size of registered Rice farmers under Wushishi local government area, Niger state

VILLAGES	SAMPLE FRAME	SAMPLE SIZE
Danko	36	25
Kanko	47	33

Wushishi	30	21
Bankwagi	60	41
TOTAL	**173**	**120**

Source: Federal Ministry of Agriculture and Rural Development, (2017).

Table 2: Distribution of respondents according to climate adaptation strategies

Adaptation strategies	CCVABWCS	ISCSAUOCF	SEWIACPD	RNOLADFFTNA
Constant	-3.166 (-1.44)	-3.755 (-1.46)	-5.235 (-2.58)	-3.528 (-1.48)
Income from farming activities	2.57E-06 (1.75)*	2.20E-06 (-1.38)	-1.42E-07 (-0.09)	3.38E-06 (2.34)**
Age	-0.086 (-1.32)	-0.071 (-0.95)	-0.044 (-0.84)	-0.0456 (-0.69)
Household size	-0.44 (-1.94)*	-0.175 (-0.68)	0.131 (-0.75)	-0.057 (-0.26)
Source of capital	-0.21 (-0.16)	-0.591 (-0.37)	-0.816 (-1.83)*	-0.614 (-0.56)
Years in school	0.092 (-0.73)	0.114 (-0.79)	0.178 (1.92)*	0.055 (-0.52)
Years in farming	0.272 (3.04)***	0.228 (2.27)**	0.212 (2.81)***	0.168 (1.84)*
Farm size	0.657 (1.66)*	0.411 (-0.91)	0.43 (-1.39)	0.158 (-0.39)
Access to credit	-10.507 (-0.01)	-11.750 (-0.01)	0.501 (-0.33)	1.377 (-0.87)
Off farm income	3.21E-06 (-1.60)	2.08E-06 (-0.88)	2.72E-06 (-1.51)	3.36E-06 (-1.62)

Number of observations = 120
Source: Computer data, 2018

NOTE: CCVABWCS stands for Change crop variety and Build water conservation scheme, ISCSAUOCF stands for Implement soil conservation scheme and use of chemical fertilizer, SEWIACPD stands for Seeking early warning information and changing planting date, RNOLADFFTNA stands for Reduce number of livestock and diversity from farming to non-farming activity

Figures in parentheses are Z- values

*** denotes 1%, ** denotes 5%, while * denotes 10% level of significance.

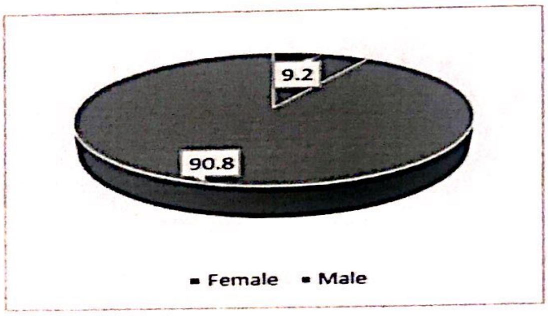

Figure 1: Sex of respondents

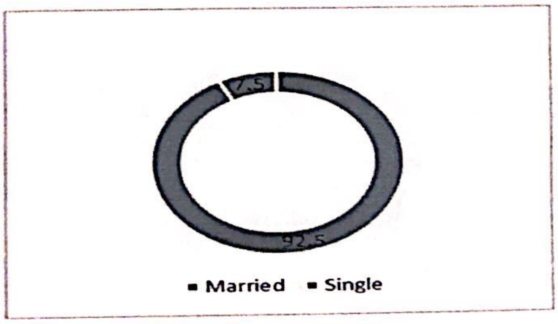

Figure 2: Marital status of respondents

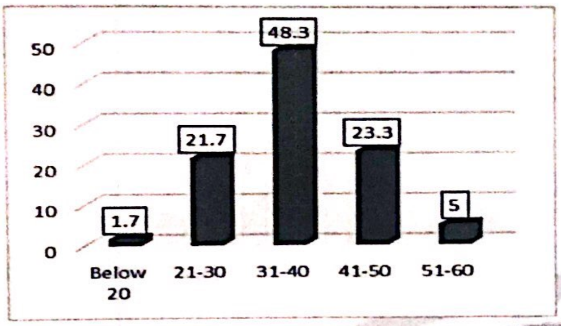

Figure 3: Age of respondents

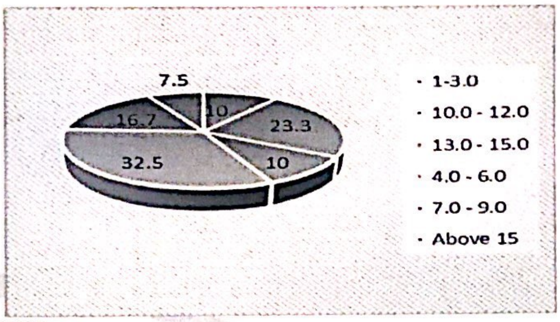

Figure 4: Household size of respondents

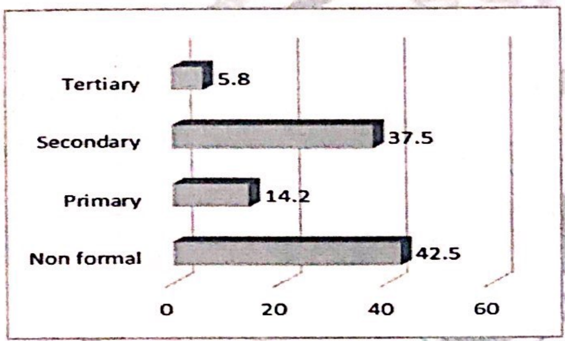

Figure 5: educational status of respondents

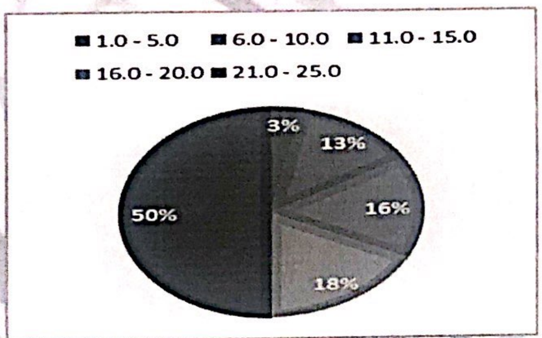

Figure 6: farm experience of respondents

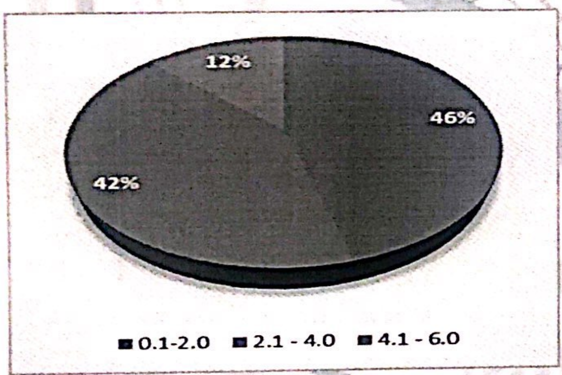

Figure 7: farm size of respondents

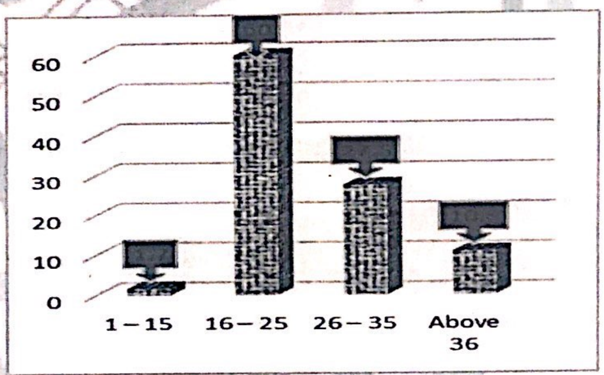

Figure 8: amount of seed planted / hectare

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