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ISSUES, CONSTRAINTS AND PROSPECTS OF MEETING SUB-REGIONAL FOOD CHALLENGES: CLIMATE CHANGE SCENARIO IN SOUTH EAST NIGERIA

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KEYWORDS: *Issues, Constraints, Prospects, Food Challenges Failing Economies*

ABSTRACT: *This study analyzed Issues, Constraints and Prospects of meeting sub-regional food challenges: climate change scenario in South East Nigeria. Specific objectives included to: determine farmers perception and trend of climate change in the study Area; ascertain farmers' perceived consequence of climate change on crop production: analyze the determinants of farmers' perception and adaptation decision to climate change in the study area; and analyze the relationship between farmers' socio-economic characteristics and their choice of adaptation strategies to climate change. The null hypothesis tested was farmers' socio-economic characteristics do not significantly affect their perception of climate change and decision to adapt to climate change. Data were collected from two hundred and forty (240) randomly selected farmers in the three selected states. Also, these primary data were supplemented by secondary data on climatic variables for a period of forty one (41) years, obtained from the Agrometeorological Division of the National Root Crops Research Institute, Umudike. Results confirmed the evidence of climate change in the area and the fanners were noticing the change too. The most prominent perceived consequences of climate change in crop production in the study area as indicated by the respondents were poor yields of crops and animals (mean = 4.04), low income from farming (mean = 3.98) and uncertainty in production (3.96). Also, the prominent adaptation strategies used by the respondents in the study area were: improved production techniques (mean = 4.13), planting early maturing crops (mean = 3.93) and use of organic manure (mean = 3.84) respectively. The result showed a dominantly married (67.80 per cent), young (48.1 years), literate (6.16 years) and well experienced (13.3 years) farming population. Also, the result showed that 59.40 per cent of the farmers belonged to social organizations and were engaged in full time (100 per cent) mixed farming (57.50 per cent). Farmers' socioeconomic characteristics significantly affected perception and adaptation to climate change. The most important characteristics determining perception are age, income, social membership, and extension. The main determinants of adaptation decision are education,*

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household size, farm size, income, and extension. It was recommended that government policies should ensure that farmers have access to affordable credit, education, extension, and to increase their ability and flexibility to change production strategies in response to perceived climate change and equally improve their well-being.

INTRODUCTION

1.0 Background Information

A billion people around the world continue to live in a state of chronic hunger and food insecurity. One billion people live on less than one dollar per day, a threshold defined by international standard as extreme poverty, below which survival is questionable (Douchamp, 2016). In Africa over 70% of the food insecure population live in the rural areas, more than half being small holder farmers, most of whom are women who produce over 90% of the continent's food supply. The situation worsened since 1970 and the proportion of the malnourished population has remained within 33% to 35% range in sub-Saharan Africa (Douchamps, 2016). Sub-Saharan Africa has a population of over 600 million people and has the highest hunger and malnutrition rates in the developing world coupled with extreme poverty (Africa Agricultural Technology Foundation, 2011). In sub-Saharan Africa, poverty is increasing and food security situation is deteriorating (Arndt, et al., 2015).

Food insecurity has been described as a common phenomenon in Africa where an estimated sixty thousand people majority of whom are children die each day of hunger (Ofoh, 2013). Majority of these deaths are reported to occur in sub-Saharan Africa. In virtually all rural sub-Saharan Africa, fluctuation in food security has become a fact of life that majority of the people have to contend with (Arndt, et al., 2015). Food insecurity and hunger represent the undesirable deprivation of basic needs as well as the possible precursor to nutritional health and developmental problems. Food insecurity is a complicated issue of global importance that is susceptible to many forces such as climate change, urban development, population growth and oil price shifts that are interconnected and rarely confined by borders. Others are poverty and inequality, neglect of agriculture, world trade rules, insecure land tenure and neglect of gender issues and conflict. Issues that are often overlooked in food security are;

1) The role of the very poor,
2) The importance of gender,
3) The role of nutrition in advancing agricultural growth and
4) The impact of climate change and environmental degradation on agricultural development.

Factors exacerbating this situation are many and include the high prevalence of HIV/AIDS, civil war, poor governance, frequent drought and famine and agricultural dependency on the climate and environment. Another threat to sub-Saharan Africa food security is the new virulent strain of stem rust affecting the second most important crop, wheat, and has been reported in Uganda, Ethiopia and Kenya (Ofoh, 2013).

Many of the problems facing Africa today and in particular sub-Saharan Africa are as a result of the decreasing investment by donor and African governments in agriculture over the last 20years. The Organization For Economic Co-operations and Development (OECD) estimates that global financial assistance for African agriculture decreased from US $6.2 billion to US $2.3 billion between 1980 and 2002 with funding going to other sectors instead. The effect is that persistent hunger is

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still prevalent slowing progress towards all other Sustainable Development Goals (SDGS). Research is needed to develop effective technologies for production, harvesting, postharvest handling and for improving peoples understanding of agriculture's vulnerability to climate change (Kimatu, et al., 2012). Research is also useful in food price dynamics, food waste and consumption patterns, monitoring technologies and multi-disciplinary responses to climate change and food insecurity (Asaduzzaman et al., 2011).

Agriculture is one of the most climate dependent human activities. Therefore, its adaptation and resilience to climate should be well researched (Thornton, 2013; Neate, 2013). Hence the need for this research work.

Climate change, rapid population growth and stiff competition for available resources threaten human and animal survival. Saina, Murgor and Murgor (2013) and Agomuo (2015) have defined climate change as the change involving average temperature, wind and rainfall patterns over a long period of time that impacts negatively on agricultural yields by causing reduced soil moisture, faster depletion of soil organic matter, premature drying of grains, and increased heat stress. Climate change may lead, to land degradation, which reduces the productive capacity of land, and negatively affects food production, livelihoods, and the production and provision of other goods and services.

Knowledge of climate change hazards, successes and failures of part interventions may enable extension services providers to recommend feasible adaptation strategies that vulnerable communities can use to minimize the negative impacts of climate change. Adaptation arms to moderate the impacts of climate change, it's variability or extremes.

The role of women in agriculture and food security is important in sub-Saharan Africa. A considerable part of the world's food (over 50%) is produced by women and they are responsible for about 80 percent of food produced in sub-Saharan Africa. (Nwajiuba and Onyeneke, 2010).

Having recognized the importance of agricultural development to achieving economic growth, poverty reduction and food security in Africa, sub-Saharan Africa and in particular Nigeria, the various administrators (governments) had since early seventies tried to fight poverty and hunger using various slogans and programmes such as Operation Feed the Nation (OFN), National Poverty Eradication Programme (NAPEP), etc and recently, Special Programme for Food Security (SPFS), National Economic Empowerment Development Strategy (NEEDS), Fadama Programmes, etc. Most of these programmes collapsed midway and were abandoned while few successfully completed ones lacked adequate management and were eventually abandoned due to non-continuity and inconsistency in government policies.

Consequently, several declarations were made as a deliberate effort to enhance food security. At the first World Food Summit held in 1974, the US Secretary of State, Henry Kissinger, declared that global hunger would be eradicated by 1984. The declaration of Human Rights provided that it was the fundamental right of everyone to be free from hunger. The participants of the Food Summit organized by the Food and Agriculture Organization (FAO) in 1996 pledged to reduce the number of hungry people by half by the year 2015 (World Food Summit (WFS), 1996, FAO,2005), yet the food security situation has not improved as more of the population are still under the yoke of hunger and diseases.

The various national governments, aid agencies and civil society organizations have been reorienting their work around the Millennium Development Goals (MDGS) currently SDGS as a means of meeting the

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regional food challenges. African leaders made a pledge under the "New Partnership" for Africa's Development (NEPAD) to eradicate poverty and place their countries both individually and collectively on a path of sustainable growth and development, and at the same tune participate actively in the world economy and body politic.

To improve on the past efforts to achieve food security, NEPAD developed the comprehensive Africa Agriculture Development Programme (CAADP) which was endorsed by African Union Assembly in July 2003. The CAADP has four priorities for investment and action:

a. extending the area under sustainable land management and reliable water control systems, for example, by increasing access to irrigation.
b. increasing market access through improved rural infrastructure and other trade related interventions.
c. increasing food supply and reducing hunger across the region by increasing smallholders farm productivity and improving responses to food emergency crises.
d. improving agricultural research, improving systems to disseminate appropriate new technologies and increasing support to farmers to adopt these.

Having been proven that agriculture is a *sine qua non* for food security and that women constitute the bulk of the small scale rural farmers, there is need for this research to be carried out to ensure that there is food security for the sub-Saharan African people despite the scenario of failing economies of states in the sub-region using southeast Nigeria as a case study.

The study has the following objectives to: .

1. determine farmers' perception on climate change and compare with the trend of climate change in the study area.
2. ascertain farmers' perceived consequences of climate change on crop and animal production.
3. analyze the relationship between farmers' socio-economic characteristics and their choice of adaptation strategies to climate change.

The null hypothesis tested in this study is

H_0: Farmers' socio-economic characteristics do not significantly affect their perception on climate change and decision to adapt to climate change.

MATERIALS AND METHODS

This study was conducted in Southeast agro-ecological zone of Nigeria characterized by tropical rainforest. The Southeast agro-ecological zone lies within latitudes 5°N to 6°N of the equator and longitudes 6°E and 80 E of the Greenwich meridian. Southeast Nigeria is made up of five (5) states - Abia. Anambra, Ebonyi. Enugu and Imo. The zone occupies a total land, mass of about 10, 952, 400 hectares with a population figure of 195,874,683 persons in 2018 (National Population Commission, 2018). There are two major seasons experienced in this zone. These are dry and rainy seasons. The dry season lasts between November and March, while the rainy season occurs between April and October. Although over the recent decades, it appears very difficult to create a clear cut distinction between the periods referred to as rainy season and dry season especially between March and April, due to climate change. This is epitomized by heavy rainfall during the supposed dry spells and obvious dry spells suffered during the season that heavy rains are expected. About 60-70% of the inhabitants of

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the zone are observed to engage in agriculture, mainly crop farming and animal rearing (Okoye et al., 2010). The Southeast agro-ecological zone has a research institute known as the National Root Crop Research Institute (NRCRI) located at Umudike, Abia State.

The unit of sampling for this study was farmers. A multi-stage sample technique was used to select three states (Imo, Abia and Enugu) out of the five in the Southeast, Nigeria, and then the respondents, using a sample frame for farmers as compiled by the extension officers attached to the States' Agricultural Development Programmes (ADPs). A sample size of two hundred and forty (240) women, farmer respondents was gotten and used for analysis.

Data were collected from both primary and secondary sources. Interview schedule, structured questionnaire and field observations took care of the primary sources of data while, secondary data collected were climatic data collected for a period of forty years (1972-2012) from the National Root Crops Research Institute, Umudike, Umuahia.

Descriptive and inferential statistical tools were used for the data analysis. These included percentages, mean, trend analysis, Heckman Selection Model and Multinomial Logit Regression Model. Specifically, objective ii was analyzed using mean from Likert-type scale. The Likert-type scale of SA, A, U, D and SD with weights of 5, 4, 3, 2, and 1 respectively added up and a discriminating index established thus:

$$\frac{\sum fy}{n} = \frac{5+4+3+2+1}{5} = 3 \quad \text{..... (1)}$$

Objective was achieved by subjecting the climatic variables to trend analysis and then compared with farmers' perception to climate change. The hypothesis was analyzed using Heckman selection model. Adaptation to climate change involves a two-stage process: first perceiving change and, second, deciding whether or not to adapt by taking a particular measure. This leads to a sample selectivity problem since only those who perceive climate change will adapt whereas, we need to make an inference about adaptation by the agricultural population in general which implies she use of Heckman's Sample Selectivity Probit Model (Maddison, 2006).

$Y^*j = f(Xjp + \mu ij)$.....(2)

Objective iii was analyzed using the multinomial logit regression. This is implicitly expressed as: $Y = f(X_1, X_2, X_3, X_4, \ldots X_{10}, e)$.....(3)

Where Y = Adaptation strategies, f = function, X_1 = age (number of years of respondents)

X_2 = educational level (years), X_3 = farming experience (years), X_4 = income (Naira) X_5 = household size (number of persons in a household), X_6 = Extension contact (number of visits), X_7 = Access to Credit, X_8 = farm size (hectare),

X_9 = Marital status (married 1, single 0)

X_{10}= social membership status (member l, otherwise 0), e = error term

Where y=Adaptation Strategies as

- Planting early maturing crops and animal, Engagement in diverse agricultural activities
- Involvement in non-farm economic activities, Use of organic manure
- Afforestation practices, Reduced investment in agriculture
- Membership of co-operative, Accessing several information sources
- Increased religious engagement, Undertaking insurance policies
- Others (mulching and crop rotation)

The apriori expectations from the relationship between the variables are: $X_1, X_4 < O$ $X_2, X_3, X_5, X_6, X_7, X_8 > 0$

Four functional forms of linear, exponential, semi logarithmic and logarithmic functions

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were estimated. A lead functional form was chosen from these estimated models based on R^2, F-ratio, the number of significant variables, and conformity of the signs of the coefficients to apriori expectation. The parameter estimates were tested for significance at 5% level of significance

RESULTS AND DISCUSSION

5.0 Tread of Climate Change in Southeast Nigeria and Comparison with Farmers' Perception on Climate Change

To assess farmers' perceptions of climate change, the study first examined climate data recorded at NRCRI, Umudike for a period of 4 years. The trend in recorded climate data was then compared with fanners' perception of the changes.

5.1.1 Trend of Temperature and Crop Farmer Perception on Temperature changes in study area.

Fig. 1: Trend result of temperature from 1972-20 12
** significant at 1% level of probability.

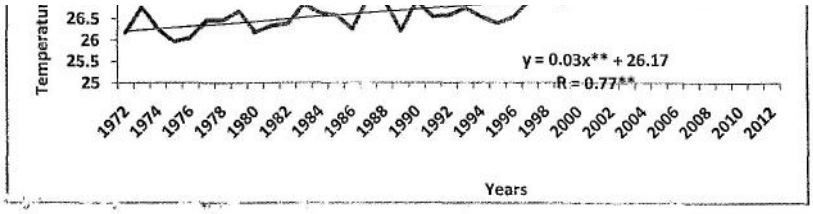

Table 1: Frequency distribution of farmers according to their perception on change in temperature in the study area.

Perception	Frequency	Percentage
Decreased	32	13.3
Unchanged	48	20.0
Increased	160	66.7
Total	240	100.0

Source: Field Survey, 2015

Data on temperature from 1972-2012 shows an increasing temperature trend (Figure 1.). The coefficient of correlation of temperature and time was 77% and was statistically significant, implying that temperature has significant positive relationship with time. Therefore, time is a major determinant for temperature changes. This means that climate warming is real and significant in southeast Nigeria. This is in line with the findings of Chidiebere-Mark *et at* (2014); (2013a); Okorie *et* a/.(2012); Babatunde *el* al. (2011);Women and Children Development Initiative (WACDI), 2011; Nwajiuba and Onyeneke, (2010) who observed that the evidence of variation in the climate of southeast Nigeria as seen in the steady increase In surface temperature of the area. The impact is very obvious as many crop farmers will record scorching of crops and decreased yield.

Farmers' perception regarding temperature changes indicates that most of the farmers (66.7%) perceived that long-term temperature is increasing (Table 1.). The farmers also perceived the direction of temperature change in the area which is on the increase. There are similar studies reported in the literature supporting these findings. Chidiebere-Mark *et al.* (2014) found that 77.50% of food crop farmers in Imo State perceived temperature as increasing for the past 30 years. WACDI (2011) reported that people in Enugu, Anambra, Imo and Abia States reported harsh temperature in

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their States. Matching these results on farmers' perception on the direction of temperature change reported in the literature and analyzed trend of temperature in southeast Nigeria means that crop farmers in southeast Nigeria correctly perceived the direction of temperature change which is on the increase. This could also mean that the farmers have chosen local adaptation measures to counteract the negative effects of increasing temperature perceived in the area.

5.1.2 Trend of volume of rainfall and crop farmers' perception on volume of rainfall changes in the study area.

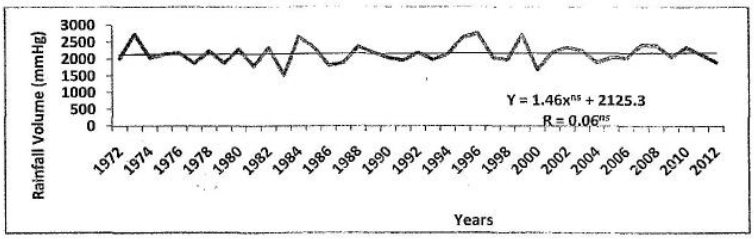

Figure 2: Trend result of rainfall volume from 1972 - 2012
Nb: ns is not significant

Table 2: Frequency distribution of farmers according to their perception on change in rainfall volume in the study area.

Perception	Frequency	Percentage
Decreased	28	11.7
Unchanged	64	26.7
Increased	148	61.7
Total	**240**	**100.0**

Source: Field Survey, 2015

Aggregate volume of rainfall in the area shows that there is high inter-annual variability in volume of rainfall from 1972 to 2012 which also resulted to a very low and insignificant correlation (0.06) between rainfall volume and time (Figure.2.). Volume of rainfall in the area experienced increasing but insignificant trend. This result is substantiated with the findings of Babatunde *et al.* (2011) who asserts that aggregate rainfall in the rainforest and coastal regions of Nigeria will not change but the intensity and pattern will change.

The overall perception on long-term changes in volume of rainfall was that the region is getting wetter as majority (61.7%) of the farmers reported this (Table.2).This corroborates with the findings of Onyeneke *et al.* (2012) in Bayelsa State, Nigeria. Also, Chidiebere-Mark *et al.* (2014).

5.1.3. Trend of rainfall intensity and crop farmers' perception on rainfall intensity changes in the study area.

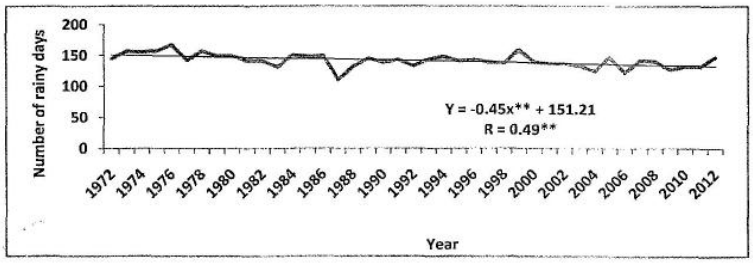

Figure 3: Trend result of rainfall intensity from 1972 - 2012 NB: ** Significant at 1% level of probability

Table 3: Frequency distribution of farmers according to their perception on change in number of rainy days in study area.

Perception	Frequency	Percentage
Decreased	144	60.0
Unchanged	64	26.7
Increased	32	13.3
Total	**240**	**100.0**

Source: Field Survey, 2015

Figure 3 demonstrates that there has been significant reduction in number of rainy days between 1972 and 2012. However, the trend is very significant as well as the correlation (0.49). The trend coefficient is 0.45 implying that number of rainy days is likely to reduce by 4.5 days every ten years. This record supports Babatunde *et al.* (2011) and Connolly (2016) findings who observed that the pattern of rainfall in southeast Nigeria in terms of number of rainy days is decreasing and will

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continue to experience a decreasing and significant trend.

Farmers' perception regarding long-term changes in number of rainy days is presented in Table 3. Majority of the farmers (60.0%) perceived that the number of rainy days in Southeast Nigeria was decreasing. This is in line with Chidiebere-Mark *et al.* (2014) findings that 80.83% of food crop farmers perceived rainfall intensity to be decreasing in Imo State. Farmers in the area also rightly perceived the direction of change in number of rainy days implying that they must have been responding to changes in rainfall intensity.

5.2 Farmers' Perceived Consequences of Climate Change on Agricultural Production

In assessing the perceived consequences on agricultural production, it was found that inhabitants of the study area are already facing the menace of climate change.

Table 4: Distribution of Farmers according to Perceived Consequences of Climate Change in agricultural Production in the study area.

Perceived Consequences	Mean	Rank
Delay in take-off of farming	3.76*	5[15]
Uncertainty in production	3.96*	3rd
Waterlogging	3.55*	10th
Increasing incidence of gullies and rills	3.56*	9th
Prevalence of pests and diseases of crops	3.69*	7
Weak/poor adaptation of crops to the environment	3.81*	4th
Low income from farming	3.98*	2nd
Poor yields of crops	4.04*	1st
Increased processing cost	3.52*	11th
High rate of spoilage of agricultural produce	3.73*	6th
Increased rate of sickness of farmers	3.04*	12th
High period of phototropism	2.90	13th
All year round availability of short duration crops	3.58*	8th
Others (1) Reduction in soil fertility	0.55	14th

Source: Field Survey Data, 2015

The findings in Table 4 showed that the inhabitants of Southeast Nigeria are already facing the menace of climate change. This is shown in the level of perceived effects climate is already having on them. In the last decade, an overwhelming consensus emerged among scientists that the world has entered an era of rapid global climate change (Douchamps, 2016 IPCC, 2014). This expectation can be seen to be a reality today as the effects of climate change is already manifesting in different forms and degrees. This is evident in the findings of this study as well as in many others conducted all over the nation and beyond FAO, 2013 and Ifeanyi-Obi, *et al.*, 2011).

5.3 Determinants (Socio-Economic Characteristics) of Farmers' Choice of Adaptation Methods

The multinomial logit model was undertaken for this study and the test accepted that the null hypothesis of independent of the climate change adaptations, suggesting that the model is appropriate to model climate change adaptation practices of crop farmers. The result of the multinomial logit regression on the factors determining choices of resilience options is presented in Table 5

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Table 5: Multinomial logit estimates of the determinants of farmers' choice of adaptation options to climate change in Southeastern Nigeria

Variable	Improved production techniques	Involvement in non-farm economic activities`	Use of organic manure	Planting early crops	Reduced investment in agriculture	Undertaking insurance policies	Accessing several information sources	Afforestation
Age	-1.55e-06 (-2.67)***	-0.00009 (-3.18) ***	-0.013 (-3.25)***	0.001 (2.53)**	0.008 (2.24)**	-0.005 (-2.84) ***	-0.008 (2.18)**	0.018 (-4.00)***
Education	4.20e-06 (1.08)	0.00009 (0.63)	0.008 (0.96)	0.012 (-0.68)	-0.02 (-1.64)	0.009 (0.91)	-0.01 (-1.42)	0.008 (0.96)
Farming experience	-4.96e-06 (0.76)	-0.00005 (0.15)	0.011 (1.35)	0.0015 (1.01)	-0.011 (-0.52)	-0.007 (-0.63)	0.006 (1.24)	0.011 (1.35)
Income	1.19e-08 (2.16)**	3.79e-09 (1.94)*	-7.54e-09 (1.09)	3.02e-06 (1.63)	2.66e-06 (1.50)	-2.34e-06 (0.69)	-3.13e-06 (0.54)	-7.54e-09 (1.09)
Household size	-0.000042 (-0.25)	0.0004 (0.14)	0.003 (0.35)	-0.017 (-0.12)	-0.009 (-0.19)	-0.001 (-0.29)	0.05 (0.84)	0.003 (0.35)
Extension contact	0.0028 (3.21)***	0.006 (5.04)***	0.013 (4.85)***	0.054 (5.10)***	0.08 (4.69)***	0.16 (4.97)***	0.07 (4.68)***	0.013 (4.85)***
Access to credit	0.027 (4.04)***	-0.00098 (-1.63)	-0.134 (-1.60)	0.161 (1.84)*	0.11 (0.95)	0.08 (0.95)	0.11 (0.99)	-0.134 (-1.60)
Farm size	-0.000046 (-0.68)	-0.0006 (-1.46)	-0.07 (-0.88)	0.112 (0.98)	-0.03 (-0.59)	-0.12 (-1.45)	-0.12 (-0.63)	-0.07 (-0.88)
Marital status	-0.00015 (-0.11)	0.0006 (0.76)	0.234 (1.17)	-0.155 (-0.12)	-0.23 (-0.05)	0.14 (0.87)	0.011 (0.54)	0.234 (1.17)
Social membership	-4.37e-06 (-0.37)	0.179 (5.01)***	-0.169 (-0.13)	-0.023 (-0.25)	0.04 (0.54)	-0.04 (-0.21)	0.018 (0.48)	-0.169 (-0.13)

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Pseudo R2	0.2327
Likelihood	87.00**
Chi square	

Note: values in parenthesis are Z-Values
xxx Significant at 1% level, xx Significant at 5% level; Field Survey, 2015

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The interpretation of the multinomial logit result indicates the following: Age of farmers (Xi): Age of the farmers significantly affected adaptation to climate change. Age of the farmers was positive across adoption of adjusting planting, reduced investment in agriculture, and afforestation. This relationship could be because; the options here have been practised for a long period of time and are well known by older farmers than their younger counterparts. On the other hand, age of the farmers had a negative influence on the probability of uptake of use of improved production techniques, involvement in non-farm economic activities, etc. Onyeneke and Nwajiuba (2010) confirmed the importance of age on choice of climate change adaptation measures in Africa. Educational level of fanners (X_2): Education of the farmers was positive on all adaptation options to climate change. Maddison (2006), Onyeneke and Nwajiuba (2010) confirmed the importance of education on choice of climate change adaptation measures in Africa. Income of farmers (X_4): The income of farmers surveyed had a positive and significant effect on the likelihood of adopting involvement in non-farm economic activities and use of improved production technologies. This is because higher-income farmers are less risk averse and have more access to information, a lower discount rate, a longer-term planning horizon and wealthier than less-income farmers (Arndt, et al., 2015).

Contact with extension agents (X_6): Contact with extension agents which denotes access to information had positive effect across all adaptation options indicating that extension contact increases the likelihood of adapting to climate change. It is an important precondition for farmers to take up adaptation measures (Runhiar, et al, 2006).

Conclusion and recommendations

Based on the findings from this study/research work it is concluded that climate change is significantly affecting the farmers in their crop production in Southeast, Nigeria, and by extrapolation in sub-Saharan Africa. They, in their own capacity are already using different adaptation strategies available to them to adapt to the consequences of climate change.

It is also evident that the adaptation strategies available to these farmers had not been adequate in combating the menace of climate change so far. There has been the need for boosting the awareness level of these women on the changes in climate taking place in their environment, as well as, the need for better and scientific strategies that would help to improve on the indigenous knowledge of these farmers.

This will enable them adapt better to the consequences of climate change, whilst also improving on crop and animal production, making sure that food security is the order of the day in Southeast Nigeria and sub-Saharan Africa as a whole.

Based on the findings from this study, the following recommendations are made:

i. Agricultural extension systems through the extension agents should rise up to the challenge of creating necessary and adequate awareness to the farmers by embarking on massive campaign on climate change issues in the study area.
ii. Farmers should form cooperatives to enable them pool resources as this will help them fight more vigorously the challenges and threats of climate change events.

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