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Socio-economic factors influencing climate change adaptation among crop farmers in Umuahia South Area of Abia State, Nigeria

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ABSTRACT

The aim of the study was to determine the socioeconomic factors influencing climate change adaptation among crop farmers in Umuahia South Area of Abia State, Nigeria. The specific objectives of the study were to determine socioeconomic characteristics of crop farmers in the area, determine farmers level of awareness of climate change in the area, ascertain effects of climate change in crop production, identify adaptation strategies adopted by the farmers in the area and determine socioeconomic factors influencing adaptation to climate change. Data were collected through a questionnaire distributed to 120 farmers. Data were analyzed using descriptive statistical tools such as tables, likert type scale and multiple regression analysis. Results of data collected shows that the strategies adopted to combat the effects of climate change by farmers in the area include tree planting, cultivation of early maturing crops, mixed farming, use of improved crop varieties, increased use of family labour, engagement in complementary/diverse livelihoods, cover cropping, changes in planting and harvesting dates, irrigation practices, crop rotation, riverside/bank cultivation, increased frequency of weeding etc, Results reveal that farm size, farming experience, household size, and social organization (MEM COP) were significant at 5%, sex was significant at 1% . Extension educational campaign should be intensified to increase the knowledge about climate change. Government should collaborate with meteorologists in forecasting about climate change and also in bringing about measures to control the adverse effect of climate change especially in agriculture.

Keywords: Climate, adaptation, farmers, crop, strategy, farming.

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INTRODUCTION

Agricultural production in most of its sectors is dependent on weather and climate; it contributes to about 40% to Nigeria's Gross Domestic Product (Ozor, 2009). It is a major user of land resources. About 1.4 billion hectares (10% of total ice-free land) contributes to crop cultivation and an additional 2.5 billion hectares are used for pasture. Roughly 4 billion hectares is forested land, 5% of which is used for plantation forestry (Tubiello et al., 2007). On this land, 2 billion metric tons of crops are produced, e.g. grains, etc, yearly for food and feed providing two thirds of the total protein intake by humans. Significant quantities of chemicals inputs are applied to achieve such high levels of production; about 100 million metric tons of nitrogen are used annually, with large quantities leaching through the soil and leading to significant regional land, water and atmospheric pollution (Tubiello et al., 2007).

Secondly, agriculture is a major user of water, over 200 million hectares of arable land is under irrigation using 2,500 billion cubic meters of water annually representing 75% of fresh water resources withdrawn from aquifers, lakes and rivers by human activity. Irrigation sustains a

large portion of the total food supply, about 40% in the case of cereals (Tubiello et al., 2007; Tubiello and Rosenweign, 2008). In addition, 150 billion metric tons of fish (roughly 55% capture fisheries and 45% aquaculture) are consumed annually.

As a result of these large-scale activities, inadequate management and improper implementation, agriculture is a significant contributor to land and water degradation, and in particular a major emitter of green house gases (IPCC, 2007a). If emissions of greenhouse gases are not controlled in the coming decades, including those from agriculture, continued growth of their atmospheric concentrations is projected to result in severe climate change throughout the 21st century. As a result of greenhouse gases already in the atmosphere from past and current emission, our planet is already committed to at least as much warming over the 21st century as it has experienced over the 20th century (0.75°C). This implies that in addition to mitigation, adaptation to this anticipated warming is essential. Possible strategies for adapting food and forestry production to climate change have been identified (Easterling, 1996; Tubiello et al., 2007).

Climate change (including climate variability) already affects physical process in many parts of the world, leading to changes in temperature and rainfall patterns, in wind direction and increased intensity and frequency of extreme events like drought, floods and cyclones (Tubiello et al., 2007). The time-lagged nature of climate change implies that the currently observed climate change is attributed to greenhouse gas emission of the 19th and 20th centuries and that the effects of current greenhouse gas emission will also lag into the future. This means that focusing on mitigation alone will not address the inevitable impacts of currently observed climate change. Adaptation, that is adjustments which moderates harm or exploit beneficial opportunities in response to actual or expected climate stimuli or their effects is therefore imperative (IPCC, 2007b).

Adverse effects of climate changes were stated by the United Nations Framework Convention on Climate Change (UNFCCC), adopted May 9, 1992, to mean changes in the physical environment or biota which have significant deleterious effects on the composition, resistance, or productivity of natural and managed ecosystem or on the operation of socio-economic systems or on human health and welfare (UNFCCC, 2003). Article 2 of the convention among others seeks to achieve stabilization of greenhouse gas concentration in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change to ensure that food production is not threatened and to enable economic development to proceed in sustainable manner.

There are views that climate change issue should be paid minor attention in Africa because present greenhouse gas emissions from Africa are negligible on a global scale, and climate change is a problem that is largely caused by emissions from individual countries, and hence these countries should bear the main responsibility and costs of reducing emission (Ikeme, 2001; Eze et al., 2008). The low contribution of Nigeria to climate change might induce advocating, indifference and for the buck to be passed to developed nations who are the Chief culprits. But a more sober reflection on the climate change impacts on Nigeria will suggest otherwise. This is because climate change in itself stands to affect Nigeria adversely suggesting that its mitigation and adaptation strategies are in Nigeria's interest (UNFCCC, 1992).

It is in the area of reduced agricultural production that perhaps the human angle of climate change impacts has been most severe. Although, incidences of food crisis arises from a combination of factors, reduced productivity arising from lower yield is suspected to be exacerbated by climate change and related events (Nnaji, 2001; Onyenechere and Igbozurike, 2008). Presently, local farmers are no longer able to predict incidence of rain, based on past observation. This is leading to planting too early and subsequent losses due to non-envisaged drought. Increased drought incidence in many parts of the country decreases water availability to crops, leading to severe yield reduction. It is against this back drop that this study was conducted to identify various adaptation strategies adopted by farmers in the study area (Umuahia South Area) that will help to mitigate the effects of climate change. The general objective was to identify the strategies necessary for climate change adaptation among crop farmers in Umuahia South Area of Abia State. The specific objectives were to:

1. Determine socio-economic characteristics of crop farmers in the area.
2. Determine farmers' level of awareness of climate change in the study area.
3. Ascertain effects of climate change on crop production.
4. Identify adaptation strategies adopted by farmers in the study area.
5. Determine socioeconomic factors affecting adaptation to climate change.

METHODOLOGY

The study was conducted in Umuahia South Area of Abia State, Nigeria. It's headquarter is in the town of Apumiri, Ubakala. It has an area of 140 km^2 and a population of 138,570 at the 2006 census. The area is located at the centre of Abia State. It shares boundaries with Umuahia North and Bende LGAs on the North, Ikwuano on the East, Isiala Ngwa North on the South, while it is bounded by Obowo LGA of Imo State on the western frontier. Umuahia South is made up of 3 clans which have 40 autonomous communities. Out of these 40, 20 communities was randomly selected, and out of these 20, 6 farmers from the communities were randomly selected in the second stage using a multi-stage random sampling technique and making a total of 120 farmers. The study made use of both primary and secondary data. The primary data

was collected by administering questionnaire to farmers. Secondary data sources were utilized to provide background information and other necessary information to achieve some of the objectives of the study. Such secondary data include Journals, proceedings, textbooks etc. Basically descriptive statistics were used to analyze most of the data. These involved the use of percentages and frequency counts, means presented in tabular forms. This was used to achieve objectives 1, 2 and 4, Likert type scaling was used to achieve objective 3 while ordinary least square regression mode was used to achieve objective 5 of the study. The model is specified as follows:

$Y = f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, e)$
Y = Adaptation strategies adopted
X_1 = Age of farmers (years)
X_2 = Farm size (hectares)
X_3 = Educational level (years)
X_4 = Farming experience (years)
X_5 = Household size
X_6 = Sex
X_7 = membership of co-operative
E = Error term
The Likert type measuring instrument is represented by the formula:

$$\overline{x} = \frac{\Sigma fx}{N}$$

where $\overline{x}$ = mean score
Σ = summation sign
f = frequency
N = No of responses
3 different scaling statements were used namely; high, moderate and low. The mean of the scaling statement was found as:

$$\frac{3+2+1}{3} = \frac{6}{3} = 2$$

Therefore, 2 is the weighed mean of the scaling statement.

Decision Rule: Any mean value greater or equal to 2 is high, any mean value less than 2 is low.

RESULTS AND DISCUSSIONS

Socio-economic characteristics of the respondents

Table 1 reveals that 8.3% of the respondents are within the age bracket of 21 to 30 years, 28.3% are within the age bracket of 31 to 40 years, 37.5% are within the age bracket of 41 to 50 years and 9.2% of the respondents are 61 years and above. The mean age of the farmers is 50 years. This therefore implies that people at the age bracket of 40 to 60 years are more involved in farming which explains their knowledge and awareness of climate change. Table 1 shows also that 60% of the respondents are male, while 40% of them are females which means that majority of the respondent males own landed property as heads of families. The majority (64.2%) of the farmers are married, while 18.3% of the farmers are widows, 14.2% of them are widowers, while 3.3% of the farmers are divorced. This indicates that we have more of married individual farmers in Umuahia South Area of Abia State and this is as a result of the high responsibility and expectation to meet up with the family demand. It was seen that 24.2% of them had primary school education, 17.5% of them got up to secondary level, 32.5% did not attend any formal school. While 25.8% attended tertiary institution. This therefore implies that the higher number of farmers in the area is educated; no wonder they are

Table 1. Socio–economic characteristics of respondents.

Variable	Frequency	Percentage
Age		
21 – 30	10	8.3
31 – 40	34	28.3
41 – 50	45	37.5
51 – 60	20	16.7
60 and above	11	9.2
Sex		
Male	72	60
Female	48	40
Marital status		
Married	77	64.2
Widow	22	18.3
Divorced	4	3.3
Widower	17	14.2
Educational level		
Non formal education	39	32.5
Primary	29	24.2
Secondary	40	33.3
Tertiary	12	10
Family size		
1 – 4	45	37.0
5 – 10	60	50
10 and above	15	12.5
Membership of social organization		
Belong	91	75.8
Not belong	29	24.2
Farm Size		
< 1	60	50
1 – 2	39	32.5
2-5 – 3	14	17.7
Farming experience		
1 – 15	20	16.7
16 – 30	30	25
31 and above	70	58.3

aware of climate change variability. Table 1 shows also that majority of the farmers (50.0%) maintain a family (household) of 5 to 10 (or average mean of 5) people, 37.5% have household member of 1 to 4 while 12.5% of the farmers did not have any household due to their unmarried nature. The implication for the household size of between 5 and 10 people is that there will be more hands to help in agricultural activities and also house works. Again 75.8% of the farmers belonged to social organization, while 24.2% of them do not belong to any. This implies that the farmers are likely to get information about climate change from their fellow members. Furthermore, 50% of the farmers own less than 1 hectare (< 1 hectare), 32.5% of them own 1 to 2 hectares, 17.7% own 2.5 to 3 hectares, 5.8% own more than 3.5 hectares. From this, it is obvious that majority of the farmers (60%) are small scale who do not have enough land to cultivate on and produce food for both human and animal consumption. Table 1 shows that 16.7% of the farmers have been in the farming business from 1 to 15 years, 25% has been farming for between 16 and 30 years, while 58.3% has been in it for more than 31 years. This implies that majority of the respondents are old time farmers.

Table 2. Distribution of farmers' awareness and sources of awareness.

Source	Frequency	Percentage (%)
Aware	111	92.5
Not aware	9	7.5
Radio	15	12.5
Television	17	14.2
Newspaper	7	5.8
Extension agents	30	25
Research institute	17	14.2
Cooperative society	2	1.7
Internet	4	3.3
Fellow farmers	21	17.5
No response	7	5.8
Total	120	100

Source: Field Survey data, 2012

Information on climate

Table 2 reveals that 92.5% of the farmers are aware of climate change, while 7.5% of the farmers are not aware of climate change. The majority who are aware put up adaptation practices to cope with weather variability. On how the source of climate change variability, the table indicates that 12.5% of the farmers became aware of climate change through Radio, 14.2% were through Television, 5.8% through Newspaper, 25% through Extension agent, 14.2% through research institute, 1.7% through Cooperative Society, 3.3% were through internet, 17.5% got to know about it through their fellow farmers while 5.8% did not indicate the source of the awareness. Finally, majority (25%) of the farmers became aware through Extension agents.

Perceived effects of climate change

Table 3 shows that flooding/erosion, prolong drought, severe wind storm and increased rate of weed infestation were low. But increased incidence of pest and disease outbreak, soil fertility depletion, poor field, increased cost of production were high, these therefore brings about the production of low quality and quantity of crops in the area.

Adaptation strategies adopted by the farmers

Table 4 reveals the adaptation strategies practiced by respondents in the area. To adapt to climate change variability, the farmers plant cover crops with suppress the fast growth of weeds and also supply certain nutrients to the soil like, nitrogen. They also practice mixed farming as shown by 76.7% response, changing of planting dates, crop rotation, cultivation of early maturing varieties and tree crop planting (agro-forestry) are some adaptation practices of respondents.

Socioeconomic factors influencing adaptation

Ordinary least square multiple regressions were used. The double log functional form was chosen as the lead equation and used for the discussion based on the possession of the highest coefficient of multiple determinations (R–square) of 0.684 and F–value of 33.701. This means that 68% were taken into account during the analysis and this also implies that 32% were errors which might have occurred from the person carrying out the analysis or the machine being used. The coefficient of multiple regressions (R^2) was 0.684 implying that there were 68% of the variations in it. Another reason for which the Double log functional form was chosen was because it has the highest number of significant variables (Table 5). The result concerned with a prior expectation. It was discovered that farm size (x_2), educational level (x_3), farming experience (x_4), household size (x_5), and social organization (MEM COP) (x_7) were significant at 5% level of significance while sex was significant at 1% level of significance indicating that these are the variables that affect the adaptation strategies adopted by the farmers in the study area. Age and occupation were not significant at 5% level indicating that they are variables that do not influence the adoption of the adaptation strategies in the study area.

Table 3. Distribution of farmers according to effects of climate change.

	Perceived effects	3	2	1	Mean	Decision
		High	Moderate	Low		
a.	Flooding/erosion	17	29	74	1.5	Low
b.	Prolong drought	10	32	78	1.4	Low
c.	Severe wind storm	1	3	116	1.0	Low
d.	Incidence of pest disease outbreak	63	39	18	1.6	Low
e.	Increased rate of weed infestation	96	21	3	2.8	High
f.	Soil fertility depletion	71	45	4	2.5	High
g.	Poor yield	84	34	2	2.7	High
h.	Increased cost of production	112	5	3	2.9	High

Source: Field survey data, 2012.

Table 4. Distribution of farmers according to adaptation strategies adopted.

Adaptation strategies		Frequency *	Percentage
a.	Tree planting	16	13.3
b.	Cultivation of early maturing crops	88	73.3
c.	Mixed farming	92	76.7
d.	Use of improved crop varieties	26	21.7
e.	use of pest and disease resistant varieties	28	23.3
f.	Increased use of family labour	14	11.7
g.	Engagement in complementary/diverse livelihoods	3	1.7
h.	Cover cropping	108	90
i.	Changes in planting and harvesting dates	54	45.0
j.	Irrigation practices	3	2.5
k.	Crop rotation	19	15.8
l.	Riverside/bank cultivation	9	7.5

*****Multiple responses. Source: Field Survey data, 2012.

Table 5. Multiple regression result.

Explanatory variables and important statistics		Functional forms			
		Linear	Exponential	Semi-log	Double-log
1	Age (x_1)	0.089	0.075	0.038	0.025
	t ratio	(1.374)	(1.163)	(0.549)	(0.157)
2	Farm size (x_2)	0.653	0.540	0.610	0.738
	t ratio	(9.336)*	(7.706)*	(7.814)*	(11.829)*
3	Edu. Level (x_3)	-0.024	0.007	0.581	0.532
	t radio	(-0.374)	(0.116)	(-735)	(2.418)*
4	Farm Exp. (x_4)	-0.055	0.160	-0.098	-0.032
	t ratio	(-0.839)	(2.435)*	(-1.365)	(3.579)*
5	Household size (x_5)	0.006	-0.087	-0.053	-0.076
	t ratio	(0.098)	(-1.347)	(-0.763)	(2.381)*
6	Sex (x_6)	0.176	0.073	0.206	0.103
	t ratio	(1.640)	(1.089)	(2.860)*	(1.793)**

Table 5. Multiple regression result.

7	Mem Cop (x_7)	0.172	0.109	0.197	0.104
	t ratio	(2.602)*	(1.645)	(2.763)*	(2.826)*
8	Occupation (x_8)	0.037	0.258	0.009	0.102
	t ratio	(0.507)	(3.550)*	(0.117)	(1.604)
9	Constant				
	t ratio	(-1.872)	(17.265)	(0.421)	(7.530)
10	R square (R^2)	0.565	0.564	0.504	0.684
11	F – value	18.035	17.945	15.849	33.701
12	Sample size	120	120	120	120

Figures in parenthesis are t – ratio; * = significant at 1%; ** = significant at 5%; 1.658 = 5% significant; 2.358 = 1% significant.

Conclusion

From the results shown, it is obvious that the farmers are aware of climate change to a high extent and can also identify the effects even though majority of them had no formal education. The strategies taken to combat the effects of climate change perceived by the farmers in the area include the following; tree planting, cultivation of early maturing crops, mixed farming, use of improved crop varieties, increased use of family labour, engagement in complementary/divers livelihoods, cover cropping, changes in planting and harvesting dates, irrigation practices, crop rotation, riverside/bank cultivation, increased frequency of weeding etc.

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