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SOCIO-ECONOMIC DETERMINANTS OF FARMERS LEVEL OF INVESTMENT IN CLIMATE CHANGE ADAPTATION IN IKWERRE LOCAL GOVERNMENT AREA, RIVERS STATE, NIGERIA.

[1]Unaeze, H.C and Amadi, [2]L. U.

Department of Agricultural Economics and Extension, Faculty of Agriculture,
University of Port Harcourt, Rivers State, Nigeria.
Corresponding author email:henry.unaeze@uniport.edu.ng

Abstract
This study examined the socio economic determinants of farmer's level of investment on climate change adaptation in Ikwerre Local Government Area of Rivers State. A total of 60 farmers were sampled using a simple random sampling technique, simple descriptive statistics and multiple regression models were used for data analyses. Results show 36 years as the mean age of the respondents and their mean household size was 5persons while the number of years spent in schooling was 6 years among others. The study attested that the most adopted adaptation and mitigation strategies adopted by the respondents were the use of organic manures (15.49%), good cultural practices or operations (14.7%) andproper preservation of seeds. From the result of the multiple regression analysis, it was discovered that household size and annual income of the farmers were statistically significant in increasing the farmers' level of investment on climate change adaptation strategies. The major constraints encountered by the farmers in adapting to climate change are high cost of planting materials, poor government attention to the climate change issues and inadequate extension services. Government should design programmes that are capable of addressing the issue of climate change and adequately funds extension programs on adaptation to climate change.

Key Words; *Climate adaptation, level of investment, Nigeria.*

Introduction
Climate change refers to any change in climate overtime, whether due to natural variability or as a result of human activities (IPCC, 2007). Climate change is one of the most serious environmental threats facing the world today. It is a massive threat to human development and in some places it is already undermining the achievement of the Millennium Development Goals (MDGs) and the international communities' effort to reduce extreme poverty (Egbule, 2010).

Nigeria like all the countries of sub-Saharan Africa is highly vulnerable to the impacts of climate change (NEST, 2004; Intergovernmental Panel on Climate Change (IPCC), 2007 and Apata, et, al(2009). A major factor responsible for this change in climate is the increasing concentrations of greenhouse gas emission; these greenhouse gases include carbon IV oxide, nitrous oxides, and chlorofluorocarbons such as methane, ozone, aldehydes and water vapour into the atmosphere. As humans emit more carbon IV oxide into the atmosphere, global warming becomes stronger. This causes the earth to change unnaturally (BNRCC, 2008). Nigeria is reported to have 123 flaring sites in the Niger Delta region of the country, making Nigeria one of the highest emitters of greenhouse gases in Africa (Akinro*et al*., 2008).

The Niger delta is highly susceptible to adverse environmental changes, because it is located in the coastal region of the world. Coastal regions of the world are already experiencing flooding due to the rise in sea level. Amid the impacts of climate change, the region is also faced with myriads of environmental problem, resulting from oil exploration and exploitation activities (Etiosa andMatthew, 2007).The primary direct effects of climate change are increase in droughts and floods, more seasonal peaks in river flow, and a higher probability of more tropical storms (Muthukumara, Anil &Viju, 2008).

Climate change is a threat to agriculture and non-agricultural socio-economic development, though agricultural production activities are generally more vulnerable to climate change than other sectors (kurukulasuriya, *et al*., 2006). This is because agricultural production in most of its sectors is dependent on weather and climate. NEST (2004) asserted that climate plays a dominant role in agriculture having a direct impact on the productivity of physical production factors, for example the soil's

moisture and fertility. Adverse climate effects can influence farming outputs at any stage from cultivation through the final harvest. Even if there is sufficient rain, its irregularity can affect yields adversely if there is no rain during the growing stage of the crops (FAO, 2008). Therefore, to tackle the impacts and effects of climate change in agriculture requires some level of seriousness. Adaptation to climate change needs farmers awareness of climate change andtheir abilityto identify useful adaptation strategies and implement them (Unaeze and Ayeiloja,2013).

It is evident that the poorest countries and communities are likely to suffer the most because of their geographical locations, low incomes and low institutional capacity and reliance on climate sectors like agriculture (Muthukumara *et al.*, , 2008).IPCC(2007),went further to predict future economic losses and increase risk of hunger due to climate change. In recent years, adaptation to climate change has become a major concern to farmers, researchers and policy makers. Vulnerability and adaptation strategies are seen linked to poverty reduction measures (Halsnas and Traupi, 2009).

There are lots of challenges facing agricultural adaptation especially in developing countries like Nigeria. According to Apata *et al*. (2009), lack of awareness and knowledge of climate change is perhaps the biggest obstacle to effective agricultural adaptation.

In the views of Enete and Amusa (2010), they identified some of the major challenges to climate change adaptation, these arehunger and poverty, poor agricultural funding for research and technology development, and traditional agricultural practices. The rest are trade liberalization and market development, weak policies, institutions and public goods and inadequate information and human capital. Apata *et al*, (2009)reported that capital, land and labour serve as important factors for coping with adequate adaptation, stressing that lack of these factors as well as choice of suitable adaptive measures constitute severe challenge to agricultural adaptation. Adaptation to climate is costly and the need for intensive labour use exacerbates this cost (Bradshaw *et al*,2004).If adaptation is not taken seriously, as temperature increases and rainfall pattern becomes more unpredictable, crop yields are expected to drop significantly. Also extreme weather events such as thunderstorms, heavy winds and floods can devastate farm lands, lead to crop failure and the migration ofpest and diseases in response to climate changes and variations.It is estimated that by 2100, Nigeria and other West African countries are likely to have agricultural losses of up to 4% of GDP due to climate change (BNRCC, 2008).

Since adaptation to climate is very important and also costly, it is on this background that this study focuses on farmer's level of investment on adaptation strategies to climate change. At this point, the following research questions become useful; (1) what are the socio-economic characteristics of the respondents in the study area?(2) What are the various adaptation strategies employed by the respondents in the study area? (3)What is the influence of farmer's socio-economic characteristics ontheir level of investment on climate change adaptation practices in the study area? (4)What are the problems encountered by farmers in adapting to climate change in the study area?

Materials and Methods

This study was carried out in Ikwerre Local Government Area of Rivers State. Ikwerre Local Government is one of the twenty three Local Government Areas of Rivers State. It is located North-West of Port Harcourt and lies between $4^0$65"North andlongitude5^0 to $7^0$12"East and has a population of 188,930 people (National population Census, 2006).The communities in the local Government area are as follows; Rumuekpe, Elele Alimini, Obelle, Omudioga, Elele, Egbeda, Rukpokwu, Aluu, Igwuruta, Eneka, Isiokpko. It has it's headquarter at Isiokpo. The major language is Ikwerre language. The major occupation of the people is farming. Simple random sampling technique was used to select five farmers from each community making up a total number of 60 farmers from the twelve communities. Regression analysis was used to determine the influence of the socio-economic characteristics of the farmer's level of investment on climate change adaptation.

Data Analysis;
The implicit form of the linear regression adopted is:
$Y=F(x_1,x_2,x_3,x_4,x_5,x_6,x_7,x_8,x_9)+e$
Where Y= the level of investment (naira)
X1 = Age (years)
X2 = Annual income (naira)
X3 = Educational qualification
X4 = Household size (number of persons)
X5 = Marital status (single=0, married=1)
X6 = Occupation (dummy, yes=1, no=0)
X7 = Farming experience (years)
X8 = Gender (male=0, female=1)
X9=number of years spent in schooling
e = error term
The relationship between the dependent and each of the independent variables was examined using the four functional forms; Linear, Semi-log, Exponential and double-log functions.

LINEAR FUNCTION:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 \dots\dots\dots\dots \beta_9 X_9 + U$$

EXPONENTIAL FUNCTION:

$$Y = \beta_0 + \beta_1 lnX_1 + \beta_2 lnX_2 + \beta_3 lnX_3 + \beta_4 lnX_4 \dots\dots\dots\dots \beta_9 lnX_9 + U$$

SEMI-LOG FUNCTION:

$$lnY = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 \dots\dots\dots\dots \beta_9 X_9 + U$$

DOUBLE-LOG FUNCTION:

$$lnY = \beta_0 + \beta_1 lnX_1 + \beta_2 lnX_2 + \beta_3 lnX_3 + \beta_4 lnX_4 \dots\dots\dots\dots \beta_9 lnX_9 + U$$

Where:
β_0 = intercept

β_1 *to* β_9 = Estimated coefficient

Results and Discussions.

Table1: Distribution of respondents according to their socio- economic characteristics in the study area.

Gender	60	mean	
Male	45	75	
Female	15	15	
Age			
25-30	13	21.6	
31-35	14	23.3	
36-40	17	28.3	36
41-45	14	23.4	
46-50	2	3.4	
Total	60	100	
Marital status			
Married	39	65	
Single	21	35	
Total		100	

Variable				
Household size				
1-5	39	65		
6-10	21	35	5	
Total	60	100		
Educational qualification				
No formal education	17	28.3		
Primary	30	50.0		
Secondary	11	18.3		
Tertiary	1	1.7		
Vocational training	1	1.7		
Total	60	100		
Major occupation				
Farming	57	95.0		
Civil servant	1	1.7		
Trading	2	3.3		
Total	60	100		
Type of farm				
Crop farming	21	35.0		
Crop and livestock	10	16.7		
Crop and vegetable	8	13.3		
Crop and poultry	6	10.0		
Vegetable and poultry	1	1.7		
Crop, livestock and vegetable	5	10.0		
Crop, vegetable and poultry	2	3.3		
All	1	1.7		
Total	60	100		
Farming experience				
1-5	7	11.7		
6-10	20	33.3		
11-15	11	18.3		
16-20	6	10	15	
21-25	7	11.7		
26-30	8	13.4		
31-35	1	1.7		
Total	60	100		
Annual income(naira)				
150,000-200,000	15	25.0		
200,001-250,000	11	18.3		
250,001-300,000	11	18.3	₦ 324,500	*($889.04)*
300,001-350,000	2	3.3		
Other sources of income				
None	50	83.3		
Handicraft	1	1.7		
Trading	9	15.0		
Total	60	100		

Source: Field survey, 2019

The table1, above shows that out of the 60 farmers sampled, 75% were males and 25% were females. This implies that more men were involved in agricultural production in the study area because. This could be as a result of the fact that their tradition permits only men to inherit land asset.The majority (28.3%) of the respondents were within the age range of 36-40 years, while their average age is 36years. This has shown that the farmers are in their active age. Only (3.4%) falls within the age range of 46-50years, while (65%) were married and 35% were single. This implies that married persons were predominated in agricultural activities in the study area. The highest number of respondents (65%) had between 1-5 persons as household size while (35%) had between 6-10 persons with 5 persons as average household size. This implies that household is large enough for increased labour supply. This finding is in consonance with (Enete *et al.*,2011) that farmerswith large household size has the advantageof farm labour availability, which affects the size of land cultivated and enhances returns. Majority of the farmers had primary education (50%), 28.3% had no formal education, 18.3% attained secondary education, 1.7% had tertiary education and the remaining 1.7% had vocational training. However the majority of the respondents (95%) had farming as their major occupation, (3.3%) had trading and the remaining (1.7%) were civil servants. This implies that the majority of the respondents were farmers.This agrees with the findings of Apata *et al*, (2009) who noted that majority of rural dwellers has farming as a major livelihood activity.

Farmer's average farming experience is15 years;the majority (33.3%) had a farming experience of 1-10 years, while 18.3% had 11-15 years' experience. This implies that the farmers have been farming for long as most of the farms were owned byfamilies.

Income distribution of the farmer's shows that, majority (35.2%) have an annual income level of above ₦350, 001, and the average income is ₦324,500. This implies that the farmer realizes a substantial amount annually from their farmingoperations. Also majority (83.3%) had no other sources of income, while (15%) had trading as their alternate income source and thelest (1.7%) had handicraft. This implies that the majority of the respondents were full time farmers.

Climate Change Adaptation Strategies Adopted by the Respondents in the Study Area

Table 2: Distribution of respondents According to Adaptation and Mitigation strategies adopted in the study area.

Adaptation and Mitigation strategies adopted	Frequency	Percentages
Conservation of water bodies	31	8.14
Use of organic manures	59	15.49
Planting of resistance varieties	38	9.97
Draining of wetland for cultivation	5	1.31
Making of contour bunds around farmlands	8	2.1
Planting of cover crops	24	6.3
Use of minimum tillage systems	16	4.2
Use of irrigation and water storage systems	2	0.5
Reforestation and afforestation activities	7	1.8
Use of agrochemicals	36	9.4
Practicing good cultural Operations	56	14.7
Use of early maturing crop varieties	22	5.8
Protection of water sheds and mulching	3	0.8
Proper preservation of seeds	46	12.1
Varying planting dates	13	3.4
Provision of rain garments	14	3.7
Loan disbursements	1	0.3
Total	381	100

Field survey, 2019. Multiple responses recorded.

The table 2 above comprises the adaptation and mitigation strategies that are adopted by the respondents in the study area. As shown in the table, the most adopted strategy is the use of organic manures (15.49%), andsecond most adopted was the practise of good cultural practices or operations (14.7%) whileproper preservation of seeds was the third adaptation and mitigation practices adopted by the respondents(12.1%). However the use of minimum tillage systems (4.2%) and Protection of water sheds and mulching (0.8%) are commonly employed by African local farmers as their adaptation and mitigation strategies. These findings are in consonance withIPCC (2007), who noted that in Africa, local farmers are already practicing zero tilling and mulching during cultivation and other soil management techniques. Also, IPCC (2007) observed that women now plant crops that are more resistant to droughts and pest as well as save seeds for planting each year.

Table3**: Estimated socio economic factors that influences farmers level of investment on climate change adaptation**

Variable	linear	semi-log	double-log
Constant			
Coefficient	9319.83	8.88939	0.30765
Standard error	(10205.2)	(0.578784)	(3.06453)
Gender			
Coefficient	1923.67	- 0.0053791	- 0.0059799
Standard error	(2618.1)	(0.148484)	(0.0233417)
Age			
Coefficient	90.1959	0.00708629	0.0583573
Standard error	(330.203)	(0.0187272)	(0.708258)
Marital status			
Coefficient	3241.95	0.00708629	0.0071827
Standard error	(4053.72)	(0.229904)	(0.0385142)
Schooling			
Coefficient	-82.566	-0.00198677	-0.0231858
Standard error	(241.783)	(0.0137126)	(0.0692487)
Household size			
Coefficient	997.887*	0.0725007**	0.312496**
Standard error	(543.497)	(0.0308241)	(0.12878)
Occupation			
Coefficient	5851.32**	-0.269026*	- 0.404571
Standard error	(2794.96)	(0.158514)	(0.331542)
Farming experience			
Coefficient	268.562	-0.0221933**	-0.213694
Standard error	(160.411)	(0.00909759)	(0.129587)
Annual income		06***	
Coefficient	0.0043756***	2.45071e	0.76824***
Standard error	(0.00864366)	(4.9022e-07)	(0.172091)
R- Squared	0.442907	0.481441	0.443552
F-ratio	5.068333	5.9186885	4.683032
S.D dependent	9701.340	0.570282	0.573828
P-value (F)	0.000115***	0.000023***	0.000293
Akaike criterion	1253.765	80.46709	80.87822

Source: field survey,2019

N/B ***, **, * significant at 1%, 5% and 10% respectively

The F-ratio for each functional form is significant at 1% implying that the models can be used for further analysis and are adequate.The choice of the best functional form was based on the coefficient of multiple determination (R^2) estimates and the standard error values as well as consistency with apriori expectations. Therefore the lead equation chosen is the semi-log model.

From table 3 above, household size and annual income are significant at 5% and 1% respectively. This conforms to apriori expectation that a unit increase in the level of farming experience of farmers and annual income level will bring about an increase in their level of investment. This agrees with the findings of Uddin, Bokelmann and Estsminger (2014) who noted that farmers with high income are more likely to adopt adaptation strategies to climate change effects than farmers with low income.

Other explanatory variables like gender (-0.0053791), schooling (-0.00198677), farming experience– (0.0221933**) and marital status (0.00708629) are not statistically significant in increasing the level of investment in climate adaptation in the study area. The reason why gender negatively influenced level of investment in adaptation strategy could be that male gender that constitutes about 70% of the respondents was shouldered with the responsibilities of providing financial needs of their various households members therefore investing in climate change adaptation practices becomes difficult.. Respondents'level of schooling waslow, for example 50% had only primary education. This might be a strong reasonfor not accepting to invest in climate change adaptation practices as education is the key that unlocks the latent or inherent entrepreneurial skills of rural farmers. Education of householdheads increases the probability of adapting to climate change.The negative influence of Marital status to the level of investment in climate change adaptation strategy was counter intuitive to the findings ofAdenegan, Adams &Nwauwa (2013)that being married was supposed to have determined the capability of the farm households to efficiently allocate their farm resources. Also On technological adaptation practices, marital status was positive and significantly related with the agronomic adaptation.

Table4: Distribution of respondents according to the constraints encountered by adapting and mitigating to climate change in the study area.

Constraints	Frequency	%
Inadequate information	15	25
Ineffectiveness of indigenous strategy	36	60
Inadequate extension services	40	66.7
High cost of planting material	46	76.7
Inadequate access to improve crop varieties	39	65.0
Absence of water management technique	39	65.0
Poor government attention to climate change issues	43	71.7
Low awareness level of climate change	33	53.0
Inability to access available information on how to combat the consequences of climate change	32	53.3
Limited knowledge on adaptive measures	36	60.0
Low institutional capacity	27	45.0
Lack of access roads	22	28.3
Problems of political party affiliations	17	28.3
Inadequate finance	17	28.3

Source: field survey, 2019

Multiple Responses Recorded.

Table4, above, reveals that the majority (76.7%) of the respondents complained that the high cost of planting materials was their major problems. Due to the high cost of planting material, farmers find it difficult to adapt to climate change. Also, 71.7%complained of poor government attention to climate change issues, which imposes problems to adaptation. Furthermore, (66.7%) complained of inadequate extension services. This result agrees with Egbule (2010) who reported that inadequate extension service is a constraint to climate change adaptation.

Conclusion and Recommendations.

Based onthe findings of this study, thelevels of the farmers' investment on adaptation strategies wereaffected by their household size and annual

income. The major strategies in combating climate change consequences are the use of organic manures to enrich impoverished soils in the study area. It is recommended that pragmatic agricultural policies at both national and local level be advocated and extension services should be strengthened in order to assist farmers cope with climate change consequences in the study area.

References

Adenegan, K.O, Adams.O, and NwauwaL.O.E (2013): Gender Impacts of small-scale farm Households on Agricultural Commercialisation in Oyo state, Nigeria: British Journal of Economics, Management & trade 3(1):1-11.Adesina, F. A., and

Odekunle, T. (2011). *Climate Change and Adaptation in Nigeria: Some Background to Nigeria's Response iii.* Obafemi Awolowo University, Department of Geography. Singapore: LACSIT press.

Apata, Mccari, Angerer, Dyke and Stuth (2009).*Analysis of Climate Change Perception and Adaptation Among Arable Food Crop Farmer's in South Western Africa.* Department of Agricultural Economics and Extension Services. Beijing, China: International Association of Agricultural Economist.

Egbule, C. L. (2010,). *Indigenous and Emerging Adaptive Agricultural Technologies to Climate Change in the Niger delta Region of Nigeria.* Nsukka.

Enele, A. A., Madu, I. I., Mojekwu, J. C., Onyekuru, A. N., Onwubuya, E. A., & Eze, F. (2011). *Indigenous Agricultural* Adaptation to Climate Change: Study of Imo and Enugu States in South East Nigeria. Nairobi, Kenya: The African Technology Policy Studies Network.

FAO, (2008).Organic Agriculture and climate change. Retrieved.arcj8.2010 from http://www.fao.org/DOCREP/oo5.

Farauta, B. K., Egbule, C. L., & Agu, V. C. (2011). Climate Change and Adaptation Measures in Northern Nigeria: Empirical Situation and Policy Implications. Nairobi, kenya: African Technology Policy Studies Network.

Halsnaes, K., &Traerup, S. (2009). Development and climate change: a mainstreaming approach for assessing economic social and environmental impacts of adaptation measures. Environmental Management 43(5):465 – 718

Ifeanyi-Obi, C. C., Etuk, U. R., & Jike-wai, O. (2012, March). Climate Change Effect and Adaptation Strategies;Implication for Agricultural Extension System in Nigeria. Greener Journal of Agricultural Sciences, 2(2), 053-060.

Ogbo, A., Ndubisi, L. E., & Ukpere, W. (2013). Risk Management and Challenges of Climate Change in Nigeria. University of Nigeria, Department of Management; Department of Psychology & People Management. Enugu: Kamla-Raj.