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Determinants of Climate Change Adaptation Strategies Used by Compound Farmers in Emohua Local Government Area of Rivers State

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ABSTRACT

The study identified determinants of climate change adaptation strategies used by compound farmers in Emohua Local Government Area of Rivers state. One hundred and twenty crop farmers were selected for the study using two stage sampling procedure. Data was collected with the aid of questionnaire complemented with interview schedule and analyzed using both descriptive statistics and inferential statistics namely, percentages, frequency, mean and ordinary Least Square regression Analysis (OLS). The result of the study showed that compound farmer's major source of climate change information is through fellow farmers (81%). The major adaptation strategies used by the compound farmers were changing of planting and harvesting date ($\bar{x}$=3.5), more frequent weeding ($\bar{x}$=3.5), planting of different crop varieties($\bar{x}$=3.4), crop rotation ($\bar{x}$=3.4) and application of indigenous knowledge. Ordinary least square regression analysis showed that a significant relationship exists between the choice of adaptation strategies used by compound farmers and their socioeconomic characteristics with an f-value of 22.456 which was significant at both 0.01 and 0.05 probability level. It is important that adaptation efforts by both government and intervention agencies recognize gender roles to make it more effective.

INTRODUCTION

Globally, over the years there have been vagaries of the climatic variables resulting in climate change. Climate change is phenomenon that has become a recurring decimal in local, national and international discourse (FAO, 2010). Agriculture plays a very important role in the Nigerian economic development as it contributes immensely to employment, food production, industrial inputs and foreign exchange earnings (Agwu, Nwachukwu, & Agwu, 2010). Climate change is rapidly emerging as a global critical development issue affecting many sectors in the world and is considered to be one of the most serious threats to sustainable development. An unprecedented increase in greenhouse emissions has led to increased climate change impacts. Agricultural activities have been shown to contribute immensely to climate change

as it ranks third after energy consumption and chlorofluorocarbon production in enhancing greenhouse emissions. Emissions from agricultural sources are believed to account for significant proportion of anthropogenic greenhouse gas emissions. Also, land use changes, often made for agricultural purposes, contribute are known to also contribute to the change in climate through increased emissions of GHG stimulated by these changes (Ozor & Nnaji, 2011). Adaptation to climate change is considered key in combating climate change in addition to mitigation measures throughout the world. Adaptation, a complex, multidimensional, and multi–scale process, has been defined as adjustments to behavior or economic structures that reduce vulnerability of society in the face of scarcity or threatening environmental change (Bryan & Behrman, 2013).

Compound farms are intensively cultivated fields found around or close to home or compound houses and they are normally under permanent cultivation. Compound farmers are those individuals who cultivate or plant crops behind their houses or close to their houses. This is why it is sometimes called backyard farming. This buttress more the crucial need of enhancing compound farming as the livelihood of huge proportion of the rural poor will be improved through this. Furthermore, Compound farming could play an important role in helping to reduce greenhouse gas (GHG) emissions that contribute to climate change because it ensures green vegetation in the compound that facilitate absorption of Green House Gases (Ifeanyi-obi, Angba, Aja, Abuta… et al., 2019). This implies that compound farming do not only help to enhance livelihood of the rural poor family, it also acts as mitigation to climate change through contributing to greenhouse gas absorption. As the changes in climate impacts compound farming, these farmers also respond to these effects using strategies available to them. Though other socio-economic factors play major roles in determining the adaptation strategies used by the compound farmers. Knowledge of these factors are not yet well documented. It is important to understand what factors determine choice of adaptation strategies used by compound farmers. This will help to inform advisory services and intervention programmes targeted at them hence making it more need-driven.

It is against this background that this paper assessed the determinants of climate change adaptation strategies used by compound farmers in Emuoha LGA of Rivers State. It specifically described the socio-economic characteristics of compound farmers, ascertained compound farmer's sources of climate change information, determined climate change adaptation strategies used by compound farmers in the study area and the determinants of the adaptation strategies used.

Hypothesis of the study

The null hypothesis that was tested in the study is as stated below:

Ho: Compound famer's choice of climate change adaptation strategies is not significantly affected by their socio-economic characteristics.

METHODOLOGY

The research was conducted in Emohua Local Government Area of Rivers State. Emohua consist of fourteen wards and the predominant occupation of the people is farming. It has an area of 11,077 $km^2$4, 277 mi²and a population of 7,303,924 at the 2016 census. It has total of 10 communities, excluding the sub- villages which include Emohua town, Elebrada, Oduoha, Rumuji, Obella- ibaa, Rumuekpa Obakiri, Omudioga, Elele-Alimini, and Ndele.

The population of the study comprised of all households that are involved in compound farming in the study area. A two-staged sampling procedure was used to select sample for the study. The first stage was the random selection of six (6) communities from the ten communities in the LGA. In the second stage Snow ball sampling techniques was used to develop the list of all compound farmers in the six selected communities. Then 20 households were selected randomly from each of the 6 communities, giving a total of 120 households used for the study. Data collection was done with the aid of questionnaire and described with percentages, mean and frequency counts. The hypothesis was tested using ordinary Least Square Regression analysis.

Model Specification for the Ordinary Least Square Regression Analysis is stated as follows:

H_0: There is no significant difference between the socio-economic characteristic of compound farmer and the adaption strategies they use.

$$Y = f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, e)$$

Where Y= Pooled index of adaptation strategies used by compound farmer measured with a 4point-likert type scale of Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1).

X_1 = Gender (Dummy: Male = 1, Female = 2
X_2= Marital status
X_3= Household size
X_4 Age
X_5 = Educational level
X_6 = Type of animal reared
X_7 = Aim of compound farming
E = Error term

It is expected a priori that the coefficients of X_1X_2, X_3, X_4, X_5, X_6, X_7 >0
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. A lead equation was chosen based on the appropriateness of signs, magnitude of coefficient of multiple determination (R^2), statistical significance of the variables and a priori theoretical expectations.

Linear: $Y= B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 + e$

Semi-Log: $Y= B_0 + B_1 \log X_1 + B_2 \log X_2 + B_3 \log X_3 + B_4 \log X_4 + B_5 \log X_5 + B_6 \log X_6 + B_7X_7 + e$

Exponential: $\log Y=B_0 +B_1X_1 +B_2X_2 +B_3X_3 +B_4X_4 +B_5X_5 +B_6X_6 + B_7X_7 + e$

Double Log: $\log Y=B_0 +B_1 \log X_1 +B_2 \log X_2 +B_3 \log X_3 +B_4 \log X_4 +B_5 \log X_5 +B_6 \log X_6 + B_7X_7 + e$

RESULTS AND DISCUSSION

Socio-economic characteristics of compound farmers

Table1 showed the socio-economic characteristics of compound farmers. Result showed that women (57%) participate more in compound farming than the male (43%). Umunakwu, Nnadi and Chikaire (2014) in their study of information needs for climate change adaptation among rural farmers in Owerri west LGA similarly found that females were involved in farming more than their male counterparts. Increased migration of the male folk to cities in search of greener pastures may be part of the reason for increased incidence of female headed households and farmers. Majority (60.7%) were married with household size mainly (78%) between 2 to 5 persons. Enete and Okon (2012) similarly found that 60% of the farmers in the AkwaIbom State had household size ranging from 5-8 persons. On the other hand, Nnadi et, al (2012), noted that marriage encourages complimentary efforts among farming households and this could promote adaptation among farming household. Similarly, Umunakwu (2011) found that majority of farmers in Imo State are married. The average age of the compound farmers in the study area is 48years. Ozor, umunakwe, Ani and Nnadi (2015) in their study of perceived impact of climate change among rural farmer in Imo State, found similar result and noted that farmers within this age are still in their active and productive age and can be efficient in agricultural production. As regards educational qualification, significant percentage (44%) of the respondents do not have any formal education, only 29% have First school leaving certificate and 21% had the senior school leaving certificate. This shows that literacy level in the area is quite low and may have negative effect on their understanding of climate change as well as their readiness to adopt effective climate change strategies. Result further showed that the major farming enterprise engaged by compound farmers in the study area is crop production (81%) with cassava (80%), corn and cucumber (38%) as the major crops produced. None of the farmers engaged only in animal production, the low participation in animal production in the area may be as a result of constant stealing of animals by cult boys in the area deterring households from going into animal production as the animals are always stolen. The major aim of production among the compound farmers was found to be both consumption and sale (69%).

Table1 Socio-economic characteristic of compound farmers

	Frequency	Percentage	Mean
Gender			
Male	48	42.9	
Female	64	57.1	
Marital status			
Single	25	22.3	
Married	68	60.7	
Divorced	1	0.9	
Separated	18	16.1	
Household size			
2-5	87	78	
6-10	24	21	2
Above 10 persons	1	1	
Farmers age			
26-33	14	12.5	
34-41	20	17.9	
42-49	24	21.5	
50-57	30	26.9	
58-65	23	20.3	
66-73	1	0.9	48
Educational level			
No formal education	50	44.7	
First school living certificate	32	28.6	
SSCE	23	20.5	
OND	3	2.7	
HND	0	0	
BSC	4	3.6	
Post graduate	0	0	
Area of specialization			
Crop production	91	81.3	
Animal production	0	0	
Both	21	18.8	
Crops produced			
Vegetable	42	37.5	
Cassava	90	80.4	
Yam	25	22.3	
Corn and Cucumber	43	38.4	
Plantain	40	34.8	
Others (pepper, okra, groundnut, melon, sugar-cane)	21	18.8	
Animals reared			
Goat	14	12.5	
Poultry	6	5.4	
Sheep	0	0	
Others (pig and dock foul)	2	18	
Major aim for compound farming			
Consumption	17	15.2	
Sale	18	16.1	
Both	77	68.8	

Source: Field survey 2019

Compound farmer's sources of climate change information

It was shown in Table 2 that compound farmer's sources of climate change information were mainly from their fellow farmers (81%), radio (43%) and television (38%). Result showed that not much information was received from the agricultural extension agents implying low extension coverage. It was also shown that mobile phones constitute a minor means of information source for the farmers. It could be that farmers in the study area are yet to harness the potentials of mobile phones as a vital tool of information sharing and dissemination. There is low presence and activities of farmers associations in the area. This could also hamper their access to some resources like credit resources as financial institutions prefer to relate with farmers associations rather than individual farmers. The result agrees with Tologbonse, Auta, Bidoli and Jaliya *et al*. (2010) which reported that farmers seem to have thorough knowledge on the effects of climate change through information from fellow farmers.

Table 2 Compound farmer's sources of climate change information

S/N	Source	*Frequency	Percentage
1	Agricultural Extension agents	2	1.8
2	Ministry of agriculture	3	2.7
3	Radio	48	42.9
4	Television	42	37.5
5	Farmer's association	1	0.9
6	Non-Governmental Organization	10	8.9
7	Internet	23	20.5
8	Prints materials such as Newspaper, handbills, leaflets, posters and news letter	23	20.5
9	Consultants/experts	8	7.1
10	Fellow farmers	91	81.2
11	Mobile phones	9	8.0

Source: Field survey 2019: *Multiple response

Adaptation strategies used by compound farmers in the study area

Result of adaptation strategies used by compound farmers in the study area showed that the major adaptation strategies used by the compound farmers were changing of planting date ($\bar{x}$=3.5), more frequent weeding ($\bar{x}$=3.5), use of crop rotation measures to control pest ($\bar{x}$=3.4), planting of different crop varieties ($\bar{x}$=3.4) and application of indigenous knowledge in adapting to climate change ($\bar{x}$=3.1). The result agrees with Ifeanyi-obi, Etuk and Uloh, (2014) in their study of Cassava farmers' adaptation to climate change in Oron Agricultural zone of Akwa Ibom State found major adaptation strategies used by these farmers to include use of different planting dates for the crop, early planting of crop and planting of different crop varieties. Planting of tress, soil conservation, use of different crop varieties, changing of planting date and irrigation has been found by many researchers as major climate change adaptation strategies used by farmers (Bradshaw *et al*., 2004; Kurukulasuriya and mendelsohn, 2008; Maddison, 2006; Nhemachena and Hassan, 2007; Hassan and Nhemachena, 2008; Ole *et al.,* 2009).

Table 3 Climate change adaptation strategies used by compound farmers

Adaptation strategies	SD	D	A	SA	MEAN
Use of improved crop varieties	79(70.5)	29(25.9)	2(1.8)	2(1.8)	1.3*
Changing of planting and harvesting date	2(1.8)	4(3.6)	37(33.0)	69(61.6)	3.5**
Making ridge across slope in the farm to prevent erosion	7(6.2)	52(46.4)	39(34.8)	14(12.5)	2.5**
Planting of cover crop to reduce evaporation	9(8.0)	49(43.8)	40(35.7)	14(12.5)	2.5**
Increased mulching to conserve soil water	12(9.8)	27(24.1)	41(36.6)	32(28.6)	2.8**
Use of information from extension agents to minimize the effects of climate change	78(69.6)	30(26.8)	3(2.7)	1(0.9)	1.3*
Avoid the practice of bushing burning in clearing farmlands	37(33.0)	54(48.2)	21(18.8)	0	1.8*
Use of irrigation facilities	46(41.1)	57(50.9)	7(6.2)	2(1.8)	1.6*
I adopt crop rotation measures to control pest	3(2.7)	7(6.2)	44(39.3)	58(51.8)	3.4**
Planting of different crop varieties	3(2.7)	1(0.9)	52(46.4)	56(50.0)	3.4**
Increased use of fungicides and pesticides	72(64.3)	36(32.1)	3(2.7)	1(0.9)	1.4*
Increased use of inorganic manure e.g. fertilizers	64(57.1)	32(28.6)	15(13.4)	1(0.9)	1.5*
Increased use of organic manure	37(33.0)	33(29.5)	35(31.2)	7(6.2)	2.0*
I undertake other non-farm activities to ensure steady income flow	49(43.8)	19(17.0)	24(21.4)	20(17.9)	2.1*
I weed more frequently to put the weeds under check	6(5.4)	4(3.6)	23(20.5)	79(70.5)	3.5**
I combine crop and animal production to increase income	2(1.8)	2(1.8)	3(2.7)	15(13.4)	0.6*
I rear improved varieties of livestock	17(15.2)	4(3.6)	1(0.6)	0	0.2*
I sprinkle water on my animals during extreme hot weather	1(0.6)	7(6.2)	13(11.6)	1(0.6)	0.5*
I feed my livestock more frequently than before	1(0.9)	3(2.7)	17(15.2)	1(0.9)	0.6*
I feed my livestock with artificial feed supplements	15(13.4)	7(6.2)	0	0	0.2*
I apply indigenous knowledge in adapting to climate change	3(2.7)	8(7.1)	61(54.5)	40(35.7)	3.1**

Source: Field survey, 2019: * means disagreement while ** means agreement

TEST FOR HYPOTHESIS

There is no significant Relationship between the Socio-economic characteristics of compound farmers and the climate change adaptation strategies they use.

Table 4 showed the result of the Ordinary Least Square regression analysis (OLS) conducted. Based on the appropriateness of signs, magnitude of R^2 and number of significant variables, the exponential function was chosen as the lead equation.

The result showed that four (4) of the seven (7) independent variables correlated positively and significantly with the adaptation strategies used by the compound farmers, gender was significant at 10% with t-ratio of 32.723. This could imply that gender plays a major role in the adaptation strategies the compound farmers used. Male and female farmers thread different paths in adapting to climate change. Female farmers maybe using different adaptation strategies from the ones used by their male counterparts. Marital status was also found to correlate positively and significantly with adaptation strategies used by the compound farmers at 5% with t-ratio of 2.509. This could imply that being married could also impact on adaptation decision. Those who are married may not easily use new adaptation strategies they have not tried before due to the fact that they may not be ready to take certain level of risk. They have more household responsibilities to also cater for and may not be ready to use adaptation strategies that have much financial implications.

Furthermore, age was found to be significant and correlate positively with the adaptation strategies used by compound farmers at 5% with t-ratio of 2.669. This could imply that the older the compound farmers become, the more equip they are to choose effective adaptation strategies. Older farmers are known to have more experience and as such could make better adaptation decision than the younger ones.

Educational level was significant at 10% with t-ratio of 1.866 which positively correlated with the adaptation strategies used by compound farmers. This implies that as their level of education increases the choice of adaption strategies used by compound

farmers will also become better. As farmer's literacy level increases, their capacity also increases and they identify better ways to adapt to climate change.

The result of this study corroborates Eminu and Onome (2018) which found that households' heads age, gender, educational level, farming experience, access to credit, farm/herd size, membership of cooperative, household income, and access to weather information, access to extension services influenced farmers adaptation strategies used in Delta State.

In same vein, Hirpha, Mpanedi and Bantider (2020) in assessing determinants of adaptation strategies to climate change among small holder farmers in Ethiopia found that age and sex of household head, as well as their education, family size, access to agricultural extension services and training on climate change significantly influence the practices of adaptation measures.

Table 4: Ordinary Least Square Regression result

Variables	Linear	Exponential	Semi-log	Double log
Constant	33.806(7.958)***	1.533(32.723)***	117.372(3.018)***	2.229(6.721)***
Gender	-1.405(-1.583)	-0.016(-1.663)*	-12.576(-1.129)	-0.089(-0.941)
Marital status	1.302(2.560)	0.014(2.509)**	1.913(0.209)	0.015(0.191)
Household size	1.092(1.314)	0.012(1.342)	2.750(0.300)	0.031(0.391)
Age	3.771(3.023)***	0.037(2.669)**	-9.298(-0.784)	-0.067(-0.661)
Educational level	0.976(1.889)*	0.011(1.866)*	-0.205(-0.038)	-0.002(-0.045)
Type of animal reared	-0.034(-0.619)	0.000(-0.459)	-40.233(-1.846)	-0.317(-1.705)*
Aim of compound farming	-0.708(-1.344)	-0.008(-1.428)	8.895(0.533)	0.049(0.348)
R^2	**0.60**	**0.64**	**0.50**	**0.47**
F-Statistics (F-Value)	**18.744**	**22.456**	**1.349**	**1.238**

Figures in parenthesis are t-ratio; **** Significant at 5%**; *****Significant at 1%**;
*** Significant at 10%**

CONCLUSION AND RECOMMENDATIONS

Based on the findings it was concluded that farmers' choice of adaptation strategies used n the study area is influenced by their age, educational level, gender and marital status. It is important to take these factors into cognizance in planning climate change adaptation programme for farmers. Based on the findings of the study, the following recommendations were made:

This study suggests the need for programmes and seminars to intimate farmers with modern adaptation strategies especially the use of simple irrigation facilities (like water harvesting) to supplement rainfall in Nigeria since Nigeria depend mostly on rain fed agriculture. This will help the compound farmers to ensure food availability round the season in their homes as most of the household interviewed have boreholes in their family compound. Sensitization of farmers on the importance of weather forecast is also advocated. The stakeholders in the Nigerian agricultural sector should begin to develop appropriate sustainable agricultural production policies with adequate attention to the significant variables affecting agricultural output in the country. There is need for the Agricultural Development Programme (ADP) to increase the extension services delivered to compound farmers in the study area. This will help to enhance farmer's capacity to adapt to the effects of climate change. Compound farmers should be encouraged to form associations like cooperative society as this will help them to pool their resources together and better adapt to climate change.

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