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ASSESSMENT OF THE VIABILITY OF CLIMATE ADAPTATION STRATEGIES OF CASSAVA-BASED FARMERS IN SOUTHERN NIGERIA

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ABSTRACT

The study examined the viability of climate adaptation strategies of cassava-based farmers in Southern Nigeria. A total of 300 cassava-based farmers were randomly selected. Primary data were obtained through administration of questionnaire, interview schedule and Focus Group Discussion (FGD). Data were analysed using descriptive statistics which involved the use of percentages, mean and frequency distributions as well as OLS multiple regression model. The specific objectives include: to describe the socio-economic characteristics of the farmers, identify the climate change adaptation practices employed, ascertain the viability of the climate change adaptation practices and to determine the factors influencing the use of climate change adaptation strategies by the cassava-based farmers in the study area. Results show that majority of the cassava-based farmers were females, married, had a mean age of 46 years, 19 years farming experience, household size of 8 persons, and mean farm size of 1.23 hectares. Results further showed that the cassava farmers adopted various of adaptation strategies such as mixed cropping 24.3%, crop rotation 16.3%, change in planting date 36.6%, use of improved varieties 63.2%, minimum tillage 37%, early and late planting 35.3% and 13.5% respectively. These practices facilitated the adaptation to climate change by the farmers. However, farming experience, farm size, education, access to extension services, credits and farm income influenced the viability of the climatic adaptation strategies of the cassava-based farmers in the area. Farmers are advised to take good advantage of seminars, workshops, symposiums, and conferences on climate change and its implications on agricultural production.

Keywords: Assessment; Viability; Adaptation, Climate Change, Strategies, Cassava-based Farmers

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INTRODUCTION

Climate change is the persistent change in the mean and variability of climate parameters due to unimpeded growth of anthropogenic greenhouse gas (GHG) emissions observed and recorded over a long period (30 years or more) (Pant, 2011). Climate change is largely due to human activities. Such human activities resulting in emission of greenhouse gases (GHGs) includes: rising fossil fuel burning, land use changes (Schipper, 2007), population explosions, deforestation, industrialization, and urbanization among others. Khanal (2009) stated that climate change is already affecting people, their livelihoods and ecosystems and as such portends serious development obstacles for the global community in general and for the poor people in developing countries like Nigeria especially. Climate change affects agriculture more than any other economic sector (Mundai, 2012). More so, in recent times we have witnessed; devastating flood, heat waves, wildfire, rise in sea level, delayed and or excessive rainfall, erratic temperature, violent windstorm, new disease and pests dynamic to mention but a few as pointers to climate change. The unfortunate consequences of this especially in agricultural production as could be observed are numerous and diverse in nature; decrease in yield, reduced marginal gross domestic product (GDP) from agriculture, increase in cost of food items, increase in the population of people at risk of hunger, increase in level of food insecurity, migration and civil unrest among others. These problems have been projected to worsen with increased frequency over time especially in Sub-Sahara Africa which Nigeria happens to be part of (Intergovernmental Panel for Climate Change, 2007). Thus, this calls for drastic measures that will reduce the devastating effect of the changing climate. Climate change is already impacting negatively on cassava production; Ukonze et al. (2014) stated that climate change-induced flood has destroyed cassava crops in the riverine areas of Nigeria. Climate change leads to high incidence of pests and diseases which in turn feeds on cassava leaves. This leads to a reduction in photosynthesis as well as tiny tuberization of cassava root which makes processing of tubers difficult (Ayoade, 2012). Food and Agriculture Organization (2006) projected that due to climate change, crop yield in Sub Sahara Africa will fall by 50% in the 2050. This call for measures that will make farmers adapt to the devastating effects of the changing climate (Nwaiwu, 2013).

Adaptation to climate change is defined as an adjustment in human, ecological or physical or system in response to actual and or would be stimuli or their effects, which moderate harm or exploits beneficial opportunities (Shongwe, 2013). In agricultural sector especially crop production, it involves changes management practices which may include: shifting planting dates, increasing fertilizer use, use of improved varieties, construction of irrigation systems, crop diversification, adoption of mixed cropping and mulching among others. These adaptation strategies used by the cassava-based farmers is expected to improve productivity and thus improve the livelihood by combating poverty and food insecurity.

Manyatsi et al. (2010) observed the practice of unsustainable and ineffective agronomic and non-agronomic practices in Swaziland. They reiterated that rural households are already adapting to climate change, but there is still low productivity as evident in the presence of hunger and poverty in the area. Furthermore, empirical reviews of Ifeanyi-obi et al. (2013); and Ayoade (2012) identified the adaptation strategies used by arable crop farmers but none of these works assessed these adaptation strategies to ascertain their economic viability. Cassava-based farmers are expected to practice adaptation strategies that are resilience to climate change impacts. It is possible for adaptation practices adopted by the farmers not to be economical, un-stainable and inefficient. This gap gave rise to such questions as: farmers using the economic strategies or are they using the adaptation strategies the right way? Such questions cannot be fully addressed until these adaptation strategies are evaluated in terms of their efficiency and effectiveness.

Against this background, the study sought to achieve the following objectives: to describe the socio-economic characteristics of cassava-based farmers in the area; identify the adaptation strategies practiced by the cassava-based farmers; and assess the viability of the climate change adaptation strategies of the cassava-based farmers in the area.

Materials and Methods

The study was conducted in Southern Nigeria. The area is made up of South East, South West and South-South Nigeria. Multi-stage sampling procedure was employed in sample selection. In the first stage, two regions, South East and South-South geo-political regions were selected purposively from Southern Nigeria based on areas where cassava farming is most predominant. In the second stage, one state each was purposively chosen from each of the two geo-political regions making two states. These were states that have upland (Abia) and riverine areas (Rivers). In the third stage, five Local Government Areas, (LGA) were randomly selected from each state making 10 LGAs. Fourthly, five communities were selected from each LGA making 50 communities. Finally, six cassava-based farmers were selected from a list of registered cassava-based farmers in each community using simple random sampling. This gives a total of 300 cassava-based farmers in the study area. Primary data were obtained through administration of a set of questionnaires, interview schedule and Focus Group Discussion (FGD). Validation of the survey instruments was done using a pilot survey where ten percent of the questionnaire were given to the respondents to fill with the help of trained enumerators who were employed in data collection. Data were analysed using descriptive statistics which involved the use of percentages, mean and frequency distributions and OLS multiple regression models which is expressed as;

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, + e)$ ……………………………. Eqtn 1

Where,

Y= Viability (Naira)

X_1= age (years)

X_2 = farming experience (years)

X_3 = sex (dummy; 1= males; 2 = female)

X_4 = farm size (hectares)

X_5 = marital status (dummy; 1 = married; 0 = single)

X_6 = level of education (years)

X_7 = membership of co-operative society (dummy; yes = 1; no = 0)

X_8 = access to extension services (dummy; yes = 1; no = 0)

X_9 = access to credit (dummy; yes = 1; no = 2)

X_{10} = household size (number)

X_{11} = farm income (naira)

e = error term

A priori expectation is that $X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{11} > 0$; $X_1, X_{10} < 0$

Results and Discussion

Socio-Economic Characteristics of Smallholder Cassava-Based Farmers in the Area

The socio-economic characteristics of smallholder cassava-based farmers is presented in Table 1 below.

Table 1, reveals the socioeconomic characteristics of the cassava-based farmers in the area. From the table, majority of the cassava-based farmers 34%, are in the age bracket of 51-60 years with a mean of 48years. This implies that they farmers are well advanced both in age and farming to mitigate adverse climatic conditions. Advancement in age helps farmers to withstand undue pressures emanating from adaptation to climate change. This agrees with the findings of (African Management Information System, AMIS, 2018). Majority of the farmers 55% had farming experience within the range of 21-30 years with a mean of 19years, this opined that the cassava-based farmers were well experienced in the cultivation of the cassava crop having spent a good number of years, part of which were used in mitigating climatic effects. The mean level of education of the cassava-based farmers is 10 years and this implies that the farmers completed their secondary education and were able to read and write as well as understand and evaluate adaptation strategies. The mean household size of the cassava-based farmers is 8 persons. This implies that the farmers had a relatively large household size comprising of family members and relatives whose energy and strength were employed in combating incidence of climate change. The result further reveals that more women were effective in adapting to climatic changes with about 59% of them engaging in cassava cultivation and production. This confirmed the findings of Ministry of Agriculture, Land and Management Cooperative (MOALMC, 2018) which stated that women had a better understanding of climatic issues relative to men. This could be due to their involvement and impeccable interest in cassava farming. About 72% of the cassava-based farmers were married and this could contribute heavily, support and strengthen their household size in adapting to climatic changes. More than 24% of the cassava-based farmers belong to co-operative societies, associating with these societies enable farmers' to readily access farming inputs which add value to cassava production and other relevant climatic adaptation strategies. This agrees with the findings of (Shrestha et al. 2017). However, about 74% of the cassava-based farmers had no association with co-operative societies; this invariably hinders the accessibility of the cassava famers to farm inputs and adaptation strategies which could be beneficial to the farmers in mitigating climatic changes. Majority (58%) of the cassava-based farmers had farm sizes in hectares of 0.5-1.0. This implies that the cassava farmers have limited farm lands which sometimes are scattered, and sparsely distributed making adaptation to climate change a bit difficult. This is also seen in the mean farm size which was not up to 1.2 hectares. Accessibility of the cassava-based farmers to extension contacts recorded more than 40% of the farmers. Extension contacts expose farmers to diverse adaptations' strategies and methods which assist them in mitigating climatic conditions (AMIS, 2018). About 92% of the cassava-based farmers were not able to access credit facilities and this could be due to the stringent conditions attached in accessing these credit facilities by credit giving institutions and this automatically makes it impracticable for the farmers to adapt to climatic occurrences. The mean values of farm income and non-farm income were ₦207, 000 and ₦263, 000. This implies that there is slight marginal difference in income of the cassava-based farmers and this might possibly influence the adaptation strategies of the farmers. Furthermore, more than 90% of the cassava-based farmers were aware of climate change as against 1%. This further implies that the cassava-based farmers were disposed enough to tackle the menace of climatic interferences. This agrees with the findings from (Shrestha et al. 2017).

Evidence of climate change

Perceived evidence of climate change by the cassava-based farmers is presented in Table 2.

The results in Table 2 shows that majority (66%) of the farmers perceive irregular rainfall pattern as the perceived evidence of climate change in Nigeria. About 61.33% of the cassava-based farmers perceive high temperature as the evidence of climate change. This was followed by 45.62 % of the cassava-based farmer who see high incidence of flood as the evidence of climate change. This is in agreement with the findings of Yusuf (2016) who reported that smallholder farmers in Gombe state, observed increases in temperature, decreases in rainfall totals, and changes in the onset and cessation of the rains as evidence of climate change. However, 41% and 28% of the farmers perceive change in seasons and drought as evidence of climate change in the study area.

Climate Adaptation Strategies Practiced by the Cassava-Based Farmers in the Area

Climate Adaptation Strategies Practiced by the Cassava-Based Farmers is presented in Table 3 below.

Table 3, shows the climate change adaptation strategies practised by the cassava-based farmers. The result depicts that over 35% of the cassava-based farmers adopted change in planting date. Changing planting dates helps farmers to overcome changing climatic variations and forestalls adverse climatic consequences. This agrees with the findings of (Darand et al. 2015). About 62% of the cassava-based farmers adapted the use of improved varieties as climatic mitigation strategies. Use of improved varieties have been proven beyond doubts as an effective antidote to changing climates as it improves agricultural production which in turn improves income of the farmers. The intercropping and rotation of crops are seen as important climate change adaptation strategies used by farmers in the study area. This adaptation strategy is known to improve the fertility of the soil which enhances quantum yields of crops (Shrestha et al. 2017). However, this adaptation strategies involves technicality and requires expertise to see its results, this is evident in this table as only 16% and 9% of cassava-based farmers were involved in it (Akpan et al. 2014).

Mixed cropping was used by the cassava- based farmers, 24% as an adaptation strategy. The cultivation of more than one crop on a piece of land is a good adaptation strategy that maximises the utility of the land mitigating adverse climatic variations. Mixed cropping ensures adequate protection of the crops in terms of any climate impact which might be devastating. About 37% of the cassava-based farmers adopted minimum tillage as adaptation strategy; this procedure sustains the farmlands texture and structure of the soil leaving no harm on the environmental surface. The relocation of farmlands is practised by 19% of cassava-based farmers as an important adaptation strategy in mitigating adverse climatic changes affecting cassava production. Farmlands are relocated when there is signalling of climatic eventualities. This is done quickly to checkmate climatic possibilities and overcome possible damages. This agrees with the findings of (Osuji, 2017). A cross section of the

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cassava-based farmers, 35% and 13% adopted the use of early and late planting methods. These techniques seek to overcome inauspicious climatic variations and changes as this practice gives the farmers a sign of relieve as well as improve cassava production. The construction of drainage channels is practised by 17% of cassava-based farmers. Construction of drainage channels is an effective adaptation strategy that cannot be undermined as far as climate change is concerned. This technique is to overcome grievous erosion and water run-offs along the farmlands. Framers with drainage channels are better equipped when faced with environmental concerns induced by changing climates (Shrestha et al. 2017).

Assessment of the Viability of Climatic Adaptation Strategies of the Cassava-Based Farmers in the Area

Assessment of the Viability of Climatic Adaptation Strategies of the Cassava-Based Farmers is presented in Table 3.

Table 3 shows the factors affecting the viability of climate change adaptation strategies of the cassava-based farmers in the area. Four functional forms of the OLS model were fitted in to assess the viability of climatic adaptation strategies of the cassava-based farmers. The Linear model was outstanding amongst other fitted models as it produced the highest number of significant variables. This shows that 74 percent of the variations in the viability of the climate change adaptation strategies is explained by the variables included in the model. The F-value of 20.426 is significant, further consolidating the choice of the model. From the result, farming experience was positive and significant at 1%, this implies that the more the cassava-based farmers acquire farming experience, the more the viability of the cassava production. Farming experience helps farmers to survive harsh climatic conditions and other farming exigencies and in return improves agricultural outputs (Ogbuabor and Egwuchukwu, 2017). The coefficient of farm size was positive and significant at 5%, implying that as the farmers acquires more farmlands; the viability of the cassava production tends to increase accordingly. Large expanse of farmlands vis-a-vis increases the viability of crop productions (Obeta, 2014). Sometimes due to the nature of most agricultural farm lands, farmers face a lot of difficulties in improving yields and sustaining their production as well.

Education plays a vital role in increasing the viability of most crops and as such cassava farmers benefited immensely as the coefficient of education was positively significant at 5%. In Table 1, the above cassava farmers were relatively educated up to secondary school level, with this they can read and write as well as evaluates climatic adaptation techniques which helped in increasing the viability of their cassava productions and this agrees with the findings of (Osuji et al. 2017). The coefficient of extension services was negatively correlated and significant at 1%. This implies that a percentage increase in accessing extension services will invariably lead to a percentage decrease in the viability of cassava production. This is evidently true in this study because more than 57% of the cassava in Table 1 above did not access extension services. This might be due to unexplainable logistics beyond the control of both the cassava farmers and the extension agents. Access to credit enables farmers to procure more farm inputs and other needed farming facilities which enhance crop production.

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CONCLUSION

Consistent variations in climate change have been persistent and this has adversely affected agricultural production to a large extent. The findings of this study revealed that majority of the farmers had farming experience implying that the cassava-based farmers were well experienced in the cultivation of the cassava crop having spent a good number of years which helped them in climate change adaptation strategies. Furthermore, the cassava-based farmers adopted a good number of climatic adaptation strategies such as crop rotation, early and late planting, mixed cropping, minimum tillage, change in planting dates, intercropping, relocation of farm lands, construction of drainages among others, these practices facilitated the adaptation to climate change by the farmers. However, farming experience, farm size, education, access to extension services and credits and farm income influenced the viability of the climate change adaptation strategies of the cassava-based farmers in the area.

RECOMMENDATIONS

The following recommendations are made based on the findings: Relevant stakeholders should embark on sensitization campaign to educate farmers on the meaning of climate change and encourage them to employ better and viable adaptation strategies. Effective agricultural policies and programmes should focus on intensifying awareness on climate change and encourage farmers to employ viable climate change adaptation strategies.

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APPENDIX

Table 1: Socioeconomic characteristics of the cassava-based farmers in the study area

Variable	Frequency	Percentage
Age (years)		
20 – 30	18	6.00
31 – 40	54	18.00
41 – 50	126	42.00
51 – 60	102	34.00
Mean	45.87	
Farming Experience (years)		
1 – 10	64	21.33
11 – 20	70	24.66
21 – 30	166	55.33
Mean	18.9	
Level of education (years)		
0 (no formal education)	12	4.00
1 – 6	49	16.33
7 – 12	160	53.33
13 - 18	79	26.33
Mean	11.5	
Household Size (number)		
1 – 5	92	30.67
6 – 10	144	48.00
11 – 15	64	21.33
Mean	8	
Gender		
Male	124	41.33
Female	176	58.67
Marital Status		
Married	216	72.00
Single	84	28.00
Membership of co-operative association		
Yes	77	25.66
No	223	74.33
Farm Size (hectares)		
0.5 – 1.0	174	58.00
1.1- 2.0	88	29.33
2.1 – 3.0	31	10.33
3.1 – 4.0	7	2.33
Mean	1.236	
Access to extension services		
Yes	121	40.33
No	179	59.66
Number of Visits		
0 (no visit)	182	60.67
Once	44	14.67
Twice	47	15.67
Thrice	21	7.00
Four times	6	2.00
Mean	Once	

Access to credit facilities		
Yes	23	7.67
No	277	92.33
Farm income (₦) ('000)		
Below 100	75	25
101 – 200	112	37.33
201 – 300	46	15.33
310 – 400	27	9.00
401 – 500	20	6.67
501 – 600	9	3.00
Above 600	11	3.67
Mean	207.23	
Non-Farm income (₦) ('000)		
0 (none)	54	18.00
Below 100	80	26.67
101 – 300	50	16.67
301 – 500	57	19.00
501 – 700	30	10.00
Above 700	29	9.66
Mean	263.99	
Awareness of climate change		
Yes	293	97.67
No	3	1.33
Total	**300**	**100**

Source: Field Survey, 2020

Table 2: Perceived evidence of climate change by the Cassava-Based Farmers in the study area

Variable	***Frequency**	**Percentage**
Drought	84	28.00
Irregular rainfall pattern	198	66.00
High incidence of flood	137	45.62
High temperature	184	61.33
Change in season	123	41.00

Source: Field Survey, 2020 *Multiple responses recorded

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Table 3: Climate change adaptation strategies practiced in the study area

Variable	*Frequency	Percentage
Change in planting date	110	36.67
Use of improved varieties	187	62.33
Crop rotation	49	16.33
Mixed cropping	73	24.33
Minimum tillage	111	37.00
Intercropping	28	9.33
Relocation of farmland	58	19.33
Early planting	104	35.33
Late planting	41	13.56
Construction of drainage channels	59	19.67

Source: Field Survey, 2020 *Multiple responses recorded

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Table 3: Factors affecting the Viability of Climatic Adaptation Strategies of the Cassava-Based Farmers in the study area.

Variable	Linear	Exponential	Semi-Log	Double log
Constant	10837.386	102918.868	4194.537	96723.243
	(0.248)	(1.984)	(0.905)	(1.849)
Age	747.541	587.242	850.518	764.663
	(0.774)	(0.503)	(0.876)	(0.651)
Farm Exp	-930.585	-2419.480	-709.005	-2365.746
	(-0.582)	(-1.259)	(-0.444)	(-1.326)
Sex	-4575.449	9396.918	-10316.545	3648.271
	(-0.301)	(0.514)	(-0.678)	(0.199)
Farm size	107066.099	25712.968	108462.744	27535.827
	(11.670)*	(2.414)**	(11.780)*	(2.564)*
Marital Stat	-12625.962	-16862.078	-15246.558	-19677.445
	(-0.793)	(0.878)	(-0.954)	(-1.022)
Edu level	4112.195	5454.817	3675.596	4894.907
	(2.067)**	(2.279)**	(1.847)	(2.046)**
Memb asso	-23668.815	-33759.105	-22078.620	-32157.535
	(-1.356)	(-1.599)	(-1.254)	(1.511)
Access Ext	6197.469	529.804	10074.037	5148.265
	(0.384)	(0.027)	(0.620)	(0.263)
Access Credit	38923.791	49878.069	36316.029	47021.678
	(2.069)**	(2.204)**	(1.921)	(2.069)**
Household Size	-215.816	-679.865	-287.698	817.878
	(-2.179)**	(0.444)	(-0.225)	(0.529)
Farm income	0.104	0.198	0.108	.200
	(2.674)*	(4.279)*	(2.791)*	(4.342)*
R^2	0.743	0.491	0.483	0.636
F-value	20.426	6.074	5.867	20.245

Source: Field Survey, 2020; figures in parenthesis are t-ratios; * sig at 1%; **sig at 5%