



ASSESSMENT OF VULNERABILITY RESULTING FROM PROJECTED CLIMATE CHANGE ON THE LIVELIHOOD OF ORASHI FARMERS IN NIGER DELTA REGION OF NIGERIA

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ABSTRACT

The study was conducted to assess the vulnerability resulting from projected climate change and the rate of intervention by various institutions on the livelihood of Orashi farmers in Niger Delta region of Nigeria. Purposive sampling technique was used to select 100 respondents. Data were collected using structured questionnaire and analysed using both descriptive and inferential statistics. The findings revealed that on the socio-economic characteristics of displaced persons and institutions, 52% of the climate refugees were female. 90% of the farms were all in rural areas. 38% were within the age of 40-49 years, Approximately 50% had spent 6 years in school and the majority 57% had a household size of 4-7 persons, 38% had 1-3 persons, 3% had within 8-11 persons while 2% had above 11 persons. Going further the result on the Institution's socioeconomic characteristics reveals that the majority of the Institutions are public and are locally based with a staff strength of above 30 persons. On socio-economic characteristics as they affect their response to agricultural productivity using the probit model shows that because they are displaced and currently in a displaced camp their response towards their livelihood is low. The vulnerability category vulnerability category of 0.148-0.167 placed Ahoada West LGA as the most vulnerable landscape. Similarly, the vulnerability range of 0.144-0.148 placed Abua and Ahoada East LGAs as moderately vulnerable landscape. In contrast, the vulnerability range of 0.001-0.144 placed Ogbia Egbema Ndoni LGA as less vulnerable landscape. The study concluded that Institutions are the media through which external intervention reinforce and that local institutions play a key role in shaping the extent to which communities became vulnerable and respond to environmental risks. Therefore the study recommended that to help maintain cultural identity, community, and dignity, it would seem more just to attempt to relocate refugees who chose that option such that they are relocated to places where they will be together with member of their family, community, and broader and Government should design a multi-sectorial approach so as to build the capacity of Institutions in order to address the issue of climate refugees.

Keywords: Vulnerability, Livelihood, Climate change

INTRODUCTION

There is growing scientific certainty of exacerbating vulnerability and risks resulting from projected climate change, and now there is no doubt that the rise in sea levels or the salinization of coastal areas as climatic processes, or hydro-meteorological natural catastrophes as climatic events, have significant implications on human lives and livelihoods around the world, as well as in Developing countries (Kate, 2008). Nevertheless, there is considerable debate about the influence of environmental change on migration. The sceptics group opines that sudden or slow-onset changes in environmental conditions can be indirect factors in decisions to move, but social processes that create poverty and marginality are more important factors than environmental changes per se. (Barnet and Chamberlain 2010). Within this



complex and dynamic situation, environmental factors are increasingly recognized as an important component of people's migration decisions, notwithstanding the fact that there are also non-climatic migration factors to consider, as migration is not necessarily going to occur for reasons of climatic events alone (Walsham, 2009).

In Rivers state the consequences of this climate inconsistency has led to the creation of Climate Refugees which have affected agricultural productivity as well as to the state's socioeconomic activities. Particularly, climate change resulting from possible increasing temperature, as the years go by may have resulted in the current heavy precipitation events being observed in the state recently (Ayotamuno, 2020). Although Institutions which comprises of Governmental and Non-governmental organization have taken various initiatives in time past to support climate disaster affected people however it has been clearly noted that these supports are not sufficient to cover the entire climate refugees. Moreover is their role fully effective in regaining the affected people's normal course of activities and sustainability in the livelihood. This study is therefore carried out to describe the socio-economic characteristics of displaced persons as they affect their response to livelihood changes and identify the most vulnerable landscape in the study area.

METHODOLOGY

Study Area

Orashi in the Niger Delta region of Nigeria, and conservatively covers an approximate landmass of 70,000km² which represents one of the most extensive wetlands globally. It is an ecological zone located between latitude 4° and 6° North of the equator and longitude 5° and 7° East of Greenwich. It is also located on a coastal plain with fluvial deposits traversed by a number of rivers and tributaries which makes the area vulnerable to climatic factors (Mmom and Aifesehi, 2013). Orashi in the Niger Delta region consists of four ecological zones; lowland rainforest, freshwater swamp forests, mangroves and coastal barrier islands. It has dry and wet seasons, with poorly drained low-lying terrain and soil that encourages erosion and flooding occasioned by intense precipitation and river discharge in the wet season (Brown and Brisibe 2020).

Population of Study

The Study population as seen in Table 1 was 155,000 persons (NEMA, 2021) which consisted of Individuals displaced by climate change in the selected four Local government areas of Orashi Region. These were local government areas affected by climatic variables.

Sampling Technique and sample size

Purposive sampling method was adopted to select 100 climate refugees. The Justification behind its use was that it helped to focus in-depth and on particular characteristics of a population that are of interest. For the Institutions, Purposive sampling procedure was also adopted in selecting thirty (30) Institutions. The Justification behind the use of this procedure is that the process helped in selecting participants possessing characteristics associated with the research study. Furthermore the rationale behind the selection of the L.G.A's was as a result of the in-depth interview carried out by the researcher before the commencement of the research which indicated that the L.G.A's have been impacted by Climate change.



Table 1: Population Distribution in Orashi Region

S/N	Local Government Area	Number of Persons affected	Sample size
1	Ahoada West	54,000	25
2	Abua	46,000	25
3	Ahoada East	32,000	25
4	Ogba Egbema Ndoni	23,000	25
	Total	155,000	100

Source: National Emergency Management Agency 2021

Method of Data Collection

The instrument adopted for data collection for this study was the structured questionnaire and interviews. The structured questionnaire was designed to collect information on ascertaining the rate of intervention between public and non-governmental Organizations on climate refugees in the study area and identifying the constraints encountered by institutions and the respondents in the study area.

Method of Data Analysis

Descriptive Statistics such as frequency, mean and percentage was used whereas the probit model and GIS was adopted.

Model Specification

Probit Model

Probit regression, also called a probit model will be used to model dichotomous or binary outcome variables

$$\text{Probit } (Y^*) = X_i\beta + u \quad \text{—————} 1$$

Where;

$$u = (0, 1)$$

$Y^* = 0 \text{ or } 1$ (dummy variable index representing respondent's opinion on analysis of the intervention rate of Institutional on climate refugees and livelihood in Rivers State positive = 1, negative - 0)

Y = Dependent Variables (Positive = 1, negative - 0)

X_1 = Age (Number)

X_2 = Farming Experience (Years)

X_3 = Household size (Number)

X_4 = Income (Naira)

X_5 = Schooling (Years)

e_i = error term

Geographical information system (GIS)

Choropleth map was generated with the aid of symbology Tab in layer properties using ArcGIS 10.8. The map was deployed for easy visualization of the level of vulnerability among the four sampled LGAs. However, the most vulnerable landscape in the study area was computed based on the interplay between the economic indicators, environmental indicators, social indicators and the underlying cause of vulnerability as well as number of persons affected as extracted from the questionnaire. Iyengar and Sudarshan (1982) model was used to calculate the most vulnerable landscape for the four sampled LGAs in Rivers State. The model developed a method to work out a composite index from multivariate data. This methodology is statistically well suited for the development of index of vulnerability to climate change. The formula is presented in equation 1 as follows:

$$(y_i) = \sum_{j=1}^n (w_j) x_{ij} \quad \text{—————} (2)$$

Where K = vulnerability indicators



M = (Ahoada West, Abua, Ahaoda East and Ogba Egbema Ndoni LGAs)
W = weights of individual vulnerability indicators
X_{ij}; i = 1,2,.....M., j = 1,2,.....K are the proportional scores.

In order to determine the most vulnerable landscape, the LGAs were weighted in respect to the vulnerability indicators. A number of weighting frameworks are available in literature including equal weighting, benefit of the doubt approach, unobserved component models, budget allocation, public opinion, analytic hierarchy process and conjoint analysis among others (Gan et al., 2017). Each of these weighting frameworks has inherent strengths and weaknesses. This study however adopted equal weighting in the weighting of all vulnerability indicators. The rationale is based on the fact that all the indicators are in the same way vital in the assessment, its simplicity, avoidance of undue/greater influence of certain indicators over others as well as wide application in many areas including stock market and sustainability assessments (Gan et al., 2017). The weights w_j were determined by dividing an integer '1' by all the indicators. The fractal intervals were then used to characterize the various stages of vulnerability;

Less vulnerable if	$0 < \bar{y} < z_1$
Moderately vulnerable if	$z_1 < \bar{y} < z_2$
Highly vulnerable if	$z_3 < \bar{y} < z_3$

RESULT AND DISCUSSION

Socioeconomic characteristics of the climate Refugees displaced persons and institutions

Socio-economic Characteristics of Displaced Persons

The result in Table 2 indicated that 52% were Females who had been displaced. The result interpretation connotes that displacement has more effect on women than it has on men. When displacement occurs, far more damage results than simply the loss and destruction of goods and property, people's lives and the social fabric are left to tatters. As terrible as the destruction, may be, women usually suffer the effect more acutely than men do. Complex emergencies are often times upset as these findings correlate with the outcome of the results by Ogbanga (2015) who noted that women and children often make up the majority of the IDP Population. The result also indicates that 38% of the Respondents are within the age range of 40-49 years. The result corroborates with the findings in Ogbanga (2015) which asserted that the majority of the individual in rural areas were within the age bracket of 40-49 years. Furthermore, these findings are consistent with the report by BBC (2019) on The Ageing crisis threatening farming when they asserted that the average age of working-aged individuals primarily engaged in farming ranges from about 32-39 years. The implication of these findings was that respondents were young and productive.

Table 2 further showed that 63% of the respondents earned an average monthly income of N20, 000-N25, 000 monthly. This has shown that most households (male and female-headed) have limited resources and do not have ready access to financial services including saving facilities of banks and other formal financial institutions due to the absence of formal financial institutions in rural areas and the low literacy level of farmers. Mukaila, Falola, and Egwue 2021 noted that a better understanding of drivers of rural household income is a powerful guide for proper intervention toward poverty alleviation and better well-being.

Unlocking the Inherent skills of rural farmers lies in Education. Quality education makes farmers adopt critical production decisions, access relevant information, and adopt new technologies. Analysis of years spent in school as seen in Table 2 showed that 50% had spent 6 years (Primary education) while the least 5% had spent 12 years (Primary and secondary



education). On average one can conclude that the majority of the farmers do not have quality education. This has shown that farmers are not literate enough thus any disaster would have a great impact on them.

Typically large household size has a significant relationship with a much greater risk of poverty. Table 2 shows that about 57% had a household size of 4-7 persons, 38% had 1-3 persons, 3% had within 8-11 persons and 2% had above 11 persons. Thus the implication of the result is that the level of agricultural productivity is low among the population sampled.

Data Analysis as seen in Table 2 indicates that 38% had 21-30 years of farming Experience, the implication of these findings is that they must have had long years in Farming and Interaction with government and Non-governmental organizations. However, this result is contrary to the findings of Enete & Amusa, (2010) who stated that farmers finds it difficult to get support from both government and Non-government organization

Table 2 Distribution of the Socio-economic Characteristics of the Climate Refugees (n=90)

Socio-economic Characteristics	Frequency	Percentage %
Sex		
Male	43	48
Female	47	52
LGA		
Urban area	-	-
Rural Area	90	100
Age (Years)		
Less than 18yrs		
20-29 years	8	9
30-39years	27	30
40-49years	34	38
50-59years	14	16
Above 60years	7	7
Average monthly Income(Naira)		
5,000-10,000	-	-
10,000-15,000	3	3
15,000-20,000	9	10
20,000-25,000	57	63
Above 25,000	21	23
Years Spent in School		
0	15	17
6	45	50
12	5	5
16	25	28
Household Size (Number of Persons)		
1-3	34	38
4-7	51	57
8-11	3	3
Above 11	2	2
Years of framing Experience		
1-10	27	30
11-20	25	28
21-30	34	38
31-40	4	4
Total	90	100

Source: Field Survey, (2023)



Socio-economic Characteristics of Institutions

In their study on assessing the response capacity of Government Institutions to the Plight of Internally displaced persons, Raji, et al 2021 opined that the first primary responder to the plights of Internally Displace Persons is always the Government Institutions as they are involved in coordination and curtailment of their plight. This fact correlates with the research findings as seen in Table 3 which noted that 47% of the sampled institutions are the government institutions whose presence has been mostly felt by the climate refugees. Next to this are the Private Institutions as noted by 43% of the sampled institutions who asserted that they are active in the protection and assistance of the internally displaced persons. As seen in Table 3 the result depicts that 87% of the institutions were local institutions that are always involved in the coordination and curtailment of climate refugee's plight. The implication of the result is that these institutions will be abreast with the challenges of climate refugees based on the fact that they are locally owned.

As seen in Table 3, 93% of the sampled institutions involved in intervention have a staff strength of above 30 persons the implication of this correlates with the fact that the recipe for outstanding performance and goal achievement lies in staff strength thus this fact correlates with the research findings. Table 3 further reveals that 93% of the sampled institutions have existed for over 16 years. The implication of these findings will reveal that standard best practices will put be put in place while carrying out their operation. The Research Findings as seen in Table 3 reveals that 93% of the sampled institution have a budget of above 30 million naira. The implication of these indicates that majority of the institution impact will be felt by these climate refugees.

Table 3: Distribution of the Institutions Based on their Categories and Statuses. (n=30)

Category of Institutions	Frequency	Percentage %
Private	13	43
Public	14	47
NGO	3	10
FBO	-	-
Institutional Type		
Local	26	87
International	4	13
Institutional Staff Strength		
10 and below	-	-
11-20	-	-
21-30	2	7
Above 30	28	93
Years of existence		
1-5years	-	-
6-10years	-	-
11-15years	2	7
16 and above	28	93
Institutional annual Budget		
10million and below	2	7
11-20million	-	-
21-30million	-	-
Above 30million	28	93

Source: Field Survey, (2023)



Table 4: The Probit Model

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	45.96500	48.22710	0.953095	0.3405
AGE	-0.139268	0.087549	-1.590744	0.1117
FMEXP	-0.379519	0.574772	-0.660295	0.5091
HHS	-0.647778	0.727327	-0.890629	0.3731
INCME	-0.000123	0.000164	-0.751516	0.4523
SCHOOLING	1.158263	1.027769	1.126968	0.2598
McFadden R-squared	0.718298	Mean dependent var	0.922222	
S.D. dependent var	0.269322	S.E. of regression	0.168764	
Akaike info criterion	0.287316	Sum squared resid	2.392428	
Schwarz criterion	0.453970	Log likelihood	-6.929226	
Hannan-Quinn criter.	0.354521	Deviance	13.85845	
Restr. deviance	49.19546	Restr. log likelihood	-24.59773	
LR statistic	35.33701	Avg. log likelihood	-0.076991	
Prob(LR statistic)	0.000001			
Obs with Dep=0	7	Total obs	90	
Obs with Dep=1	83			

As seen in Table 4 The Probit model classified observations based on their predicted probabilities. A Positive coefficient means that an increase in the predictor leads to an increase in the predicted probability. A negative coefficient means that an increase in the predictor leads to a decrease in the predicted probability thus the result shows that because they are displaced and currently in a displaced camp their response towards agricultural productivity is low. This can be supported by the negative value of some of their socio economic indicators like age (-0.139268), Farming experience (-0.329519), household size (-0.64778), Income (-0.000123) which are all negative, only years spent in schooling (1.158263) is statistically significant and positive.

The negative response of respondents age (-0.139268), could be that irrespective of their age and based on the fact that they are dislodged they do not have a stable mindset to respond if there is positive agricultural productivity or not. Also looking at farming experience (-0.379519) with a negative value could also be that as they are not in their stable state, irrespective of the number of years they must have spent in their family it didn't affect their response positively thereby giving a negative response on Livelihood. Household size supposed to be a contributory factor to agricultural productivity is also negative in responding to livelihood in the study area. This is because on their unstable frame of mind caused by their dislodgement. Also, income which is another vital contributory factor to farm productivity is negative showing that respondent's relocation affects their income thereby giving negative response to livelihood. It was only the number of years spent in formal schooling that is positive. This can be that since respondents can read and write they should be aware if there is agricultural productivity or not. A critical look at the Akaike criterion (0.287316) shows a positive value which means that the model is a good fit.

Table 5: Vulnerable landscape computation in Ahoada West LGA (n = 31)

Indicators of landscape vulnerability	Frequency (Yes)	Proportion (x)	Weights (w)	(x . w)
Loss of source of livelihood	6	0.193	0.125	0.024
Slow down development plan	4	0.129	0.125	0.016
Loss of soil nutrient	3	0.097	0.125	0.012
Air pollution	2	0.065	0.125	0.008
Residing in a flood prone are	5	0.161	0.125	0.020
Poverty	7	0.226	0.125	0.028
Lack of alternative livelihood (s)	4	0.129	0.125	0.016
Percentage of persons affected	34.8	0.348	0.125	0.043
				$\Sigma(x . w) = 0.167$

Source: Field Survey, (2023)

Table 6: Vulnerable landscape computation in Abua LGA (n = 27)

Indicators of landscape vulnerability	Frequency (Yes)	Proportion (x)	Weights (w)	(x . w)
Loss of source of livelihood	5	0.185	0.125	0.023
Slow down development plan	3	0.111	0.125	0.014
Loss of soil nutrient	2	0.074	0.125	0.009
Air pollution	2	0.074	0.125	0.009
Residing in a flood prone are	5	0.185	0.125	0.023
Poverty	6	0.222	0.125	0.028
Lack of alternative livelihood (s)	4	0.148	0.125	0.005
Percentage of persons affected	29.7	0.297	0.125	0.037
				$\Sigma(x . w) = .148$

Source: Field Survey, (2023)

Table 7: Vulnerable landscape computation in Ahoada East LGA (n = 19)

Indicators of landscape vulnerability	Frequency (Yes)	Proportion (x)	Weights (w)	(x . w)
Loss of source of livelihood	4	0.211	0.125	0.026
Slow down development plan	2	0.105	0.125	0.013
Loss of soil nutrient	1	0.053	0.125	0.006
Air pollution	1	0.053	0.125	0.006
Residing in a flood prone are	3	0.158	0.125	0.019
Poverty	5	0.263	0.125	0.033
Lack of alternative livelihood (s)	3	0.158	0.125	0.019
Percentage of persons affected	20.7	0.207	0.125	0.026
				$\Sigma(x . w) = 0.148$

Source: Field Survey, (2023)

Table 8: Vulnerable landscape computation in Ogba Egbema Ndoni LGA (n = 13)

Indicators of landscape vulnerability	Frequency (Yes)	Proportion (x)	Weights (w)	(x . w)
Loss of source of livelihood	3	0.231	0.125	0.029
Slow down development plan	1	0.077	0.125	0.010
Loss of soil nutrient	1	0.077	0.125	0.010
Air pollution	1	0.077	0.125	0.010
Residing in a flood prone are	2	0.154	0.125	0.019
Poverty	3	0.231	0.125	0.029
Lack of alternative livelihood (s)	2	0.154	0.125	0.019
Percentage of persons affected	14.8	0.148	0.125	0.018
				$\Sigma(x . w) = 0.144$

Source: Field Survey, (2023)

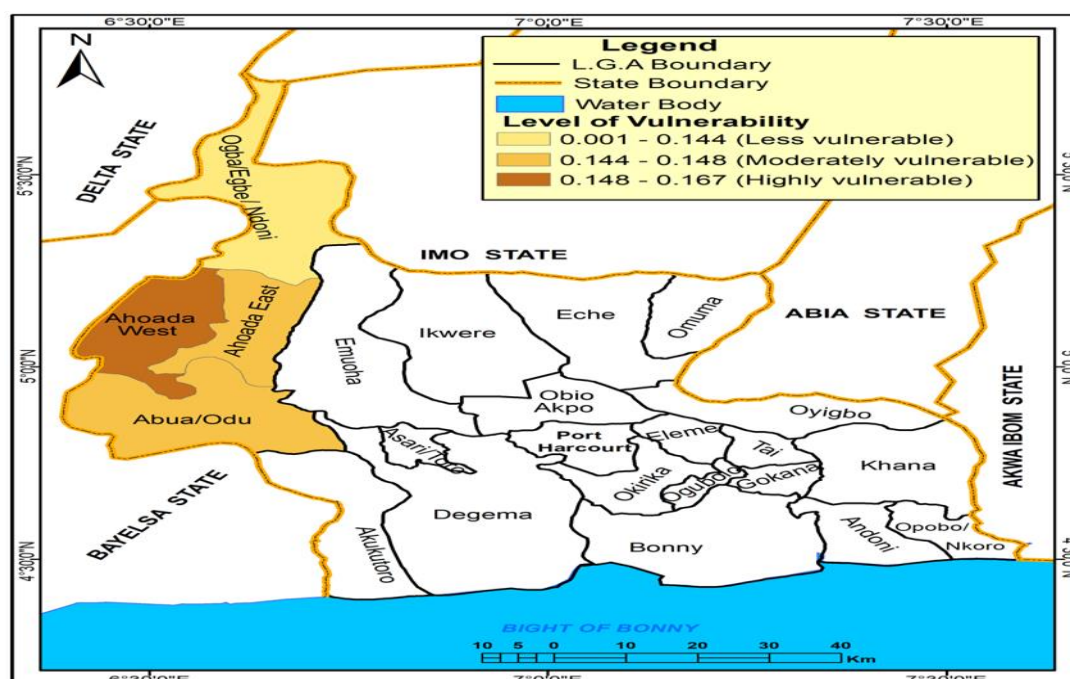


Fig 2: Level of Vulnerability of Landscape in the Sampled Local Government Area

Source: Researcher Fieldwork, 2023

The areas that are most vulnerable to climate change-induced flooding had consequences in each household where respondents lived. The interplay between the economic indicators, environmental indicators, social indicators and the underlying cause of vulnerability as well as number of persons affected produced the most vulnerable landscape as presented in Figure 2. As it could be seen, the vulnerability category of 0.148-0.167 placed Ahoada West LGA as the most vulnerable landscape. Similarly, the vulnerability range of 0.144-0.148 placed Abua and Ahoada East LGAs as moderately vulnerable landscape. In contrast, the vulnerability range of 0.001-0.144 placed Ogba Egbema Ndoni LGA as less vulnerable landscape.

CONCLUSION AND RECOMMENDATIONS

The study concluded that Institutions are the media through which external intervention reinforce and that local institutions play a key role in shaping the extent to which communities became vulnerable and respond to environmental risks



- I. Therefore the study recommended that to help maintain cultural identity, community, and dignity
- II. it would seem more just to attempt to relocate refugees who chose that option such that they are relocated in places where they will be together with member of their family, and
- III. Government should design a multi-sectorial approach so as to build the capacity of Institutions in order to address the issue of climate refugees.

REFERENCES

- AbuJarour, S. & Krasnova, H. (2017). Understanding the role of ICTs in promoting social inclusion: The case of Syrian refugees in Germany.
- Ayotamuno. A. (2020). Changes of Key Climatic Parameters and Flooding in Rivers State, Nigeria. *The International Journal. Discovery Publication*, 2(7): 223 -246.
- Barnett, J. & Webber, M. (2010). Migration as Adaptation: Opportunities and Limits. In McAdam, J. (Ed.), *Climate change and displacement: Multidisciplinary perspectives* (pp. 37-56). Oxford, England: Hart Publications
- Brisibe, W. G., & Brown, I. (2020). Building Local Resilience Capacity In Communities Vulnerable To Floods In The Orashi Region Of Rivers State, Nigeria. *International Journal Of Research-Granthaalayah*, 8(4): 297-312.
- Enete, A. A. & Amusa, T. A. (2010). Challenges of agricultural adaptation to climate change in Nigeria: A synthesis from the literature. *Field Actions Science Reports. The Journal of Field Actions*, 4: 234 – 242.
- Gan, X., Fernandez, I. C., Guo, J., Wilson, M., Zhao, Y., Zhou, B. and Wu, J. (2017). When to use what: Methods for weighting and aggregating sustainability indicators. *Ecological Indicators*, 81: 491–502.
- Iyengar, N. S. and P. Sudarshan (1982). 'A Method of Classifying Regions from Multivariate Data', *Economic and Political Weekly*, Special Article: Pages 2048-2052.
- Kate, A., Verbitsky, J. & Wilson, K. (2019). In different voices: Auckland refugee communities' engagement with conflict resolution in New Zealand. *Journal of International migration and Integration*, 20: 459-477.
- Mmom, P. C. & Aifesehi, P. E. (2013). Vulnerability and resilience of Niger Delta coastal communities to flooding. *IOSR Journal of Humanities and Social Science*, 10(6): 27-33.
- Mukaila, R., Falola, A. & Egwue, L. O. (2021). Income diversification and drivers of rural smallholder farmers' income in Enugu State, Nigeria. *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development*, 21(3): 585-592.
- NPC (2006). National Population Commission.
- Ogbanga M. 2015 Assesemnt of flood hazard on livelihood activities of rural dwellers in Rivers state, Nigeria journal of agriculture, food and environment. 11(4): 90 – 97.
- Raji, S., Adekayaoja, F. A., Agaku, E. A., Akujobi, J. & Hamzat, A. A. (2021). North-eastern Nigeria: assessing the response capacity of National Emergency Management Agency to the plights of internally displaced persons. *Heliyon*, 7(6): 89 – 96.