



Climate Change and Rehabilitation Programmes for Flood Victims in Niger Delta .

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Abstract

This study investigates the reoccurrences of flood disaster and the socio-economic rehabilitation programmes for flood victims in Niger Delta of Nigeria. Theoretically, disaster vulnerability theory was used to x-ray the incidence of climate change and flood. The study adopted the cross-sectional research design where questionnaire was used as instrument for data collection and purposefully selected Bayelsa, Delta and Rivers States as part of the states that makes up Niger Delta. The total population comprises all flood disaster victims. Out of which a sample size of 400 respondents were gotten from the study population using Taro-Yamane Formula. The study evaluated the socio-economic rehabilitation programmes for flood victims, and concluded that although there are indications of socio-economic programmes with the intention of helping victims. The study also find out that climate change is making flooding event frequent and worse in Niger Delta. Therefore, there is need to intensify the planning and execution of disaster management programmes, conduct a post disaster need assessment to know the need of the impacted persons, and there should be people oriented poverty alleviation programmes.

Keywords: Climate change, flood, natural disaster, rainfall, environment and hazard.

Introduction

One of the major consequences of climate change in Niger Delta is flood and the fluctuation in the rainfall regime which increases the probability of occurrence of extreme events in the form of excessive rainfall in certain areas and drought in others (Jumbo, 2023). As a common environmental problem, flood occur when a body of water moves over and above an area of land which is not normally submerged. Moreso, Nelson (2001), viewed flood as a natural consequence of stream flow in a continually changing environment. Most flood disaster is caused by prolonged rainfall fueled by climate change (Eluozo, 2023). Flooding has remained a recurrent natural hazard throughout human history, but available statistics show that the frequency, severity, extent and level of destruction are constantly on the increase globally (United Nations Disaster Risk Reduction UNISDR, 2013; Samuel et al, 2014; Samuel et al., 2017) Flood are common natural disaster occurring in most parts of the world resulting in damages and loss of human life and livelihood sources, deterioration of environment and retardation to development (Wizer and Week, 2014; Amangabara & Obenade, 2015).

Flooding is one of the most devastating hazards that are likely to increase in many regions of the world partly due to global climate change and poor governance (Eluozo, 2023).

Flood are the most recurring, widespread, disastrous and frequent natural hazards of the world. It is worthy to note that all floods are not alike, while some floods develop slowly and last for a period of days; flash floods can develop quickly, sometimes in just a few minutes and without any visible signs of rain. Flooding has resulted majorly in the destruction of economic and social infrastructure such as water supply, electricity, roads and railway lines (means of livelihood) and the loss of human lives. According to UN-Water (2011), worldwide, there has been rapid growth in number of people killed or seriously impacted by flood disasters. Indeed, the amount of economic damages affects a large proportion of people in low-lying coastal zones or other areas at risk of flooding and extreme weather condition. UN-Water (2011) also clarified that floods, is seen to have caused about half of disasters worldwide and 84% disaster deaths in the world was attributed to flooding.

In Niger Delta flood is the most frequent and most widespread natural hazard accounting for about one-third of all disasters arising from geophysical hazards and adversely affecting more people than any other natural hazard (Adebayo, & Oruonye, 2013). Flood disasters according to Obeta, (2009) accounted for about 38% of all the federally declared natural disasters between 1995 and 2012 in Nigeria. The 2012 flood



disaster in Nigeria adversely affected more people in one year than the combined number of all the people affected by other natural hazards, including soil erosion between 2005 and 2010 (Hassan, & Tokula, 2013).

In Nigeria, flood accounts for the highest occurring natural hazards, with great consequences on the life and property (Aderogba, 2012; Komolafe *et al.*, 2015). Causes of flood are both natural and anthropogenic; the natural causes are basically heavy rainstorm and ocean storms along the coast while the human causes are as a result of burst water main pipes, lack of effective drainage systems, dam failure and spills. Flood in Niger Delta is becoming yearly events; it occurs in the form of coastal flood, river flood, flash floods and urban flood.

Devastating flood events in Nigeria can be dated back to 1963 in Ibadan city, when Ogunpa River was over-flown causing loss of lives and property; these hazardous events reoccurred in 1978, 1980 and 2011, with huge estimated damages and deaths of over 100 people respectively, thus making Ogunpa River nationally and internationally famous (Adegbola and Jolayemi, 2012; Agbola, Ajayi, Taiwo & Wahab, 2012; Komolafe *et al.*, 2015). The 2012 flood according to the National Emergency Management Agency (NEMA) affected 30 of the 36 States of Nigeria, 7 million people were affected in these States, 597, 476 houses were destroyed, 2.3 million displaced and 363 death were reported with large track of farmland and other means of livelihood destroyed, animals and other biodiversity were also gravely impacted upon (Amangabara & Obenade, 2015). In 2018, the National Emergency Management Agency (NEMA) announced that heavy rains across the country caused the Niger River and Benue River to overflow. According to the NEMA's report, 12 states were affected by floods, 4 states were declared under National Disaster (Niger, Kogi, Anambra and Delta), 441,251 people are affected and 108 casualties was reported (Joint Research Centre, 2018).

Flood disaster is a frequent occurrence of natural disaster in Nigeria especially the Niger Delta where severe flood occur in several of the communities resulting in many being forced to evacuate their homes to sheltered locations that were situated on higher grounds. Being placed in sheltered locations with unfamiliar people may cause invasion of personal space and privacy, which Gharai and Rafleian (2013), stated that privacy of personal space is a universal need in human, in which, trespassing this space would lead to stress, worry, and aggression. Put other words, the citizen's desire happiness and comfort and look up to the government to provide infrastructure that would make these possible. In the event of natural disaster and unforeseen circumstances which are beyond the capacity of the individuals and government fails in its responsibility to meet the people in their areas of need, the consequences would be negative on the part of the citizens.

Furthermore, many scholars have lend their voices on the subject matter of climate change, flood and socio-economic rehabilitation programmes for flood victims in Niger Delta, some are Akinsanola and Ogunjobi (2014) who investigated

rainfall and temperature variabilities in Nigeria using observations of air temperature (°C) and rainfall (mm) from 25 synoptic stations from 1971-2000 (30years). The data were analysed for the occurrences of abrupt changes in temperature and rainfall values over Nigeria while temporal and spatial trends were also investigated. Statistical approach was deployed to determine the confidence levels, coefficients of kurtosis, skewness and coefficient of variations. Analysis of air temperature indicated that in the first decade of 1971-1980 anomalies between -0.2 and -1.6 were predominant, in the second decade of 1981-1990, only five stations (Lokoja, Kaduna, Bida, Bauchi and Warri) shows positive anomaly while greater portion of the country were normal with evidence of warming in the third decade of 1991-2000. Results further indicated that there have been statistically significant increases in precipitation and air temperature in vast majority of the country. Analyses of long time trends and decadal trends in mean annual precipitation and air temperature in Nigeria during the study period.

Usman, Yelwa, Gulumbe, and Danbaba (2013) tested the applicability of Co-Kriging (CK) on the study of the changing climate in Northern Nigeria. Indices were derived from climatic variables (Rainfall and Temperature) obtained from Nigerian Meteorological Agency (NIMET) and remotely sensed data covering the period from 1981 to 2010 in the form of Normalised Difference Vegetation Index (NDVI) data derived from National Oceanic Atmospheric Administration-Advanced Very High Resolution Radiometer (NOAA-AVHRR). Results from the derived CK prediction maps showed that there are high variability in NDVI and rainfall across the time-series. Furthermore, spatial average variability in the growing season rainfall was 60% with a mean temperature of 4% although coefficient of variation in rainfall for the individual climatic stations ranged from 18.15 to 60.98 percent. While the highest coefficient of variation in temperature for the entire time series (1981-2010) was located around Katsina area, the lowest was located around Minna. From the results of this analysis it is evident that the higher prediction variance values particularly for vegetation NDVI and rainfall are located in the southern part of the study area particularly around Kaduna, Minna, and Jos as compared to the northern part of the study area falling around Maiduguri, Sokoto and Katsina which indicated relatively lower prediction values.

Kemela and Phoebe (2021) investigated the variability of climate over the Niger Delta Region (NDR) focusing on the indicators of land use/land cover, land surface temperature (LST) and rainfall. Previous climate studies covered parts of the NDR; states and local areas, and these studies only quantified the amount of rainfall or air temperature separately. Hence, this study used a holistic approach. Rainfall and remotely sensed Landsat imageries (TM, ETM+ and OLI) for the period (1986-2018) were acquired and analyzed for land use/cover and obtained 97.6%, 98.8% and 99.8% accuracies for 1986, 2001 and 2017 respectively; 27°C, 29°C and 31°C was obtained as fluxes in surface temperature for 1986, 2001 and 2017 respectively. Results for rainfall variability from the

interpolated maps showed a general trend for the study period. First, it was found that rainfall in terms of amount varied and increased within the study period (1985-2014) across the NDR. To further validate the variability of rainfall, the Annual Rainfall Anomaly Index (RAI) was further calculated and analyzed for frequency and intensity of the dry and rainy years in the study area and found that the area within the period of study recorded more positive anomaly (rainy years) than alive anomaly (dry years). It was established also in this study that there is a relationship between different land use/land cover categories, LST and rainfall.

Bello et al., (2021)) analysed the rainfall and temperature trends of three (3) Agro-Ecological zones of Gombe State. The data for this study were sourced from the Nigerian Metrological Agency (NiMet). Gombe State Agricultural Development Program (QSADP) and Upper Benue River Basin Development Authority (UBRBDA). The results an revealed increasing pattern of temperature in all the zone. The mean temperature for the study period revealed an increasing rate of 0.0352°C, 0.0031°C and 0.0281°C in the Southern Guinea Savannah (SGS), Northern Guinea Savannah (NGS) and Sudan Savanna (SS) respectively. The annual rainfall revealed a decreasing trend at the rate -0.957mm, -2.74mm and -0.87mm per-lin SGS, NGS and SS respectively while Gombe station in NGS revealed an increasing trend at the rate of 3.05mm per⁻¹. The projected trends revealed that there is going to be are creasing of temperature for Billiri station in SGS and an increasing trend of rainfall for Gombe station in NGS for the coming decades. The study concludes that there is a significant increase of temperature in all the zones and there is no statistical trend of rainfall in SS. The current trend will affect soil moisture, crop water requirement and subsequently lead to ecological change.

Research Objectives

The set objectives include to:

- (i) Examine the spatial variation in climate variables in Niger Delta,
- (ii) Determine the flood disaster impacts on the livelihood of the people,
- (iii) To assess flood rehabilitation programmes in Niger Delta.

Research Questions

- i. Are there spatial variation in climate variables in Niger Delta?
- ii. What are the causes and impact of flood disaster on the livelihood of the people of Niger Delta?
- iii. What are the rehabilitation programmes for flood victims in Niger Delta?

Theoretical Framework

Disaster Vulnerability Theory:

Vulnerability theory evolved through various social sciences disciplines with scholars like Blaike, Susancutter, Turner, David Alexander, Martha Fineman and Zakour and Gillespie Shapingits application in understanding disaster impacts.

Disaster vulnerability theory seeks to explain the susceptibility of individuals. Groups, organizations, communities, and countries to losses from disaster. The basic ideal of vulnerability is practical and easily understood. Vulnerability describes a set of conditions of people that derive from the historical and prevailing cultural, social, environmental, political, and economic contexts. In this sense, vulnerable groups are not only at risk because they are exposed to a hazard but as a result of marginality, of everyday patterns of social interaction and organization, and access to resources (Bankoff 2004). Thus, the effects of a disaster on any particular household result from a complex set of drivers and interacting conditions. It is important to keep in mind that people and communities are not only or mainly victims, but also active managers of vulnerability (Pelling, 2003). Therefore, integrated and multidimensional approaches are highly important to understanding causes of vulnerability. Measures to tackle vulnerability could be technical, such as indoor climate control to avoid freezing or overheating during temperature extremes (Kelman, Gaillard, Lewis & Mercer (2016). Measures to tackle vulnerability are more often social. Examples are resource allocation to make one' s own choices regarding vulnerability and political systems giving people options for holding leaders accountable when vulnerability reduction measures are not enacted. Most often, social and technical vulnerability reduction measures are intertwined, because social conditions permit which technical measures to be implemented and their effectiveness (Kelman et al., 2016).

Four approaches to understanding vulnerability and its causes can be distinguished, rooted in political economy, social-ecology, vulnerability, and disaster risk assessment, as well as adaptation to climate change:

- i. The Pressure And Release (PAR) model (Wisner et al., 2004) is common to social science-related vulnerability research and emphasizes the social conditions and root cause exposure more than the hazard as generating unsafe conditions. This approach links vulnerability to unsafe conditions in a continuum that connects local vulnerability to wider national and global shifts in the political economy of resources and political power.
- ii. The social ecology perspective emphasizes the need to focus on coupled human-environmental systems (Turner et al., 2003). This perspective stresses the ability of societies to transform nature and also the implications of changes in the environment for social and economic systems. It argues that the exposure and susceptibility of a system can only be adequately understood if these coupling processes and interactions are addressed.
- iii. Holistic perspectives on vulnerability aim to go beyond technical modeling to embrace a wider and comprehensive explanation of vulnerability. These approaches differentiate exposure, susceptibility and societal response capacities as

causes or factors of vulnerability (Birkmann, 2006; Birkmann and Fernando, 2008). A core element of these approaches is the feedback loop which underlines that vulnerability is dynamic and is the main driver and determinant of current or future risk.

- iv. In the context of climate change adaptation, different vulnerability definitions and concepts have been developed and discussed. One of the most prominent definitions is the one reflected in the IPCC Fourth Assessment Report, which describes vulnerability as a function of exposure, sensitivity, and adaptive capacity (Cardona, van Aalst, Birkmann, Fordham, McGregor... 2012). This approach differs from the understanding of vulnerability in the disaster risk management perspective, as the rate and magnitude of climate change is considered. The concept of vulnerability here includes external environmental factors of shock or stress.

Despite various frameworks developed for defining and assessing vulnerability, it is interesting to note that at least some common causal factors of vulnerability have been identified, in both the disaster risk management and climate change adaptation communities (Gallopín, 2006):

- i. Susceptibility/fragility (in disaster risk management,) or sensitivity (in climate change adaptation): physical predisposition of human beings, infrastructure, and environment to be affected by a dangerous phenomenon due to lack of resistance and predisposition of society and ecosystems to suffer harm as a consequence of intrinsic and context conditions making it.

Methodology

The paper adopted cross-sectional research design to investigate the state of affairs in Niger Delta, the frequency of attribute such as specific exposure, disease or any other related event in Niger Delta. From the projected population of 1,844, 961 being the total number of affected people in Bayelsa, Delta and Rivers States. While for Bayelsa State, a total of 7 LGAs, 55,337 household numbering 387,360 people was affected; in Delta State, 13 LGAs, of 69,074 household with 483,517 people were affected. Hence a total of 367,932 household were affected. In Rivers State, 4 LGAs, 243,521 household of 974, 084 were affected. Based on the eligibility criteria, purposive sampling technique was adopted in selecting the LGAs and states. And Taro Yamene formula for sample determination was adopted.

Conceptual Review

Climate Change in Niger Delta

Nigeria's climate has been changing, evident in: increases in temperature; variable rainfall; rise in sea level and flooding; drought and desertification; land degradation; more frequent extreme weather events: affected fresh water resources and loss of biodiversity (Ebele and Emodi, 2016; Haider, 2019). The durations and intensities of rainfall have increased, producing large runoffs and flooding in many places in

Nigeria (Enete, 2014; Haider, 2019), rainfall variation is projected to continue to increase. Precipitation in southern areas is expected to rise and rising sea levels are expected to exacerbate flooding and submersion of coastal lands (Ebele and Emodi, 2016; Raider, 2019).

In Nigeria, inundation is the primary threat for at least 96 percent of the land at risk (Ebele and Emodi, 2016, 7). A sea level rise of 1m could result in loss of about three-quarters of the land area of the Niger Delta (Federal Ministry of Environment, 2014; Haider, 2019). It has also been estimated that a rise in sea level by up to 59cm by 2100 will result in the submersion of several Nigerian coastal states. This includes parts of Lagos and other smaller towns along the coast (Ebele and Emodi, 2016). This will disrupt the life and activities of residents and wreak immense havoc on the ecological balance (Ebele and Emodi, 2016). Droughts have also become a constant in Nigeria, and are expected to continue in Northern Nigeria arising from a decline in precipitation and rise in temperature (Haider, 2019). Lake and Chad and other lakes in the country are drying up and at risk of disappearing (Haider, 2019). Temperature has risen significantly since the 1980s (Enete, 2014; Federal Ministry of Environment, 2014; Haider, 2019). Climate projections for the coming decades reveal a significant increase in temperature over all the ecological zones (Haider, 2019). The challenges associated with climate change are not the same across the country. Nigeria has a tropical climate with two precipitation regimes: low precipitation in the North (short grass and marginal savanna) and high precipitation in parts of the Southwest and Southeast. This can lead to aridity, drought and desertification in the north; and flooding and erosion in the South (Haider, 2019). Vulnerability analysis demonstrates that states in the north experience higher degrees of vulnerability to climate change than those in the south (Federal Ministry of Environment, 2014).

The Northeast and the Northwest are the most vulnerable. The combination of rising heat and less rain has hastened desert encroachment, with loss of the wetlands, and fast reduction in the amount of surface water, flora and fauna resources on land (Ebele Emodi, 2016; Federal Ministry of Environment, 2014; Haider, 2019). The Southwest and Southeast are relatively less vulnerable than other parts of the country. Within Southern Nigeria, the South-south (Niger Delta region) is the most vulnerable, due to sea level rise, increased precipitation, coastal erosion and flooding which has resulted in the displacement of many settlements (Federal Ministry of Environment, 2014; Haider, 2009).

The pattern of vulnerability to climate change also corresponds to the dominance of climate-sensitive agricultural activities (Haider, 2009). The Northern regions of Nigeria, which have higher degrees of rurality, are more vulnerable to climate change (Haider, 2019).

The trend of climatic variable has never been static, it has been fluctuating over space and time. Changes in the frequency and pattern of the climatic variable have a significant impact on the natural and human system (Bello,

Adehayo, and Abubakar, 2020). These changes may cause certain extreme weather events such as flood, drought and heat stress increase, dry and wet spells, plant pest and diseases. According to IPCC (2007), global temperatures near the earth surface have increased by 0.74°C from 1906 to 2005 and are estimated to increase by about 6.4°C on average during the 21st century. In the Africa continent, there is an overall increase in temperature with an approximate rate of increase at 0.7°C during the 20th century with the warming rate 0.050C per decade (IPCC. 2007; Bello et al., 2020).

Flood Disaster Events in Nigeria and their Resulting Consequences

Historically, flooding in Nigeria dates back to the early 1950' s with coastal and fluvial floods. Magami, et al. (2014) reported that floods do occur in Nigeria in three main ways; coastal flooding, river flooding and urban flooding. Flood disaster is not a recent phenomenon in Nigeria. Its destructive tendencies are sometimes enormous. Its occurrences have been reported in Ibadan 1985, 1987, 1990 etc.). Osogbo (1992; 1996; 2002), Yobe (2000) and Akure (1996: 2000; 2002; 2004, 2006). The coastal cities of Lagos, Port Harcourt, Calabar, Uyo, and Warri among others have many times experienced incidents that have claimed many lives and properties worth million of dollars (Magami, et al., 2014). In Nigeria, flood disaster has been perilous to people. Communities and institutions. The 1948 flood occurrence in Ibadan is one of the earliest and oldest experiences recorded in the history of Nigeria (Etuonovbe, 2011; Magami, et al., 2014). Studies have reported that communications and traffics are interrupted, electricity and telephone lines have been lost for many days, while many land areas were inundated, industrial plants and commercial establishment were paralyzed during floods in Nigeria (Magami, et al., 2014). Fluvial floods account for the majority of the flood threats experienced in locations along the plains adjoining major rivers in the country, including rivers Niger, Benue and Hadeja. The states in Nigeria mostly affected are Adamawa, Kano, Niger, Jigawa, Kaduna, Cross River and Kebbi (Nkwuonwo, 2016). The worst fluvial flood in Nigeria was the Kano state flood disaster of 2006 which affected hundreds of thousands of lives with economic loss worth millions of US dollars (Nkwuonwo, 2016). Coastal floods in Nigeria affect the low-lying areas in the southern part of the country (comprising for examples Lagos, Oyo, Ondo, Akwa-Ibom and Bayelsa states) (Nkwuonwo, 2016). In 2010, Usmanu Danfodiyo University, Sokoto, and other parts of the state have been affected by flooding chasing the inhabitants away and so many places were swept way. Infact the University has students remain at home for four months due to damage of the bridge which is the only way linking the University with the city, this incident affected the academic activities of the university for that period of time (Etuonovbe, 2011; Magami, et al., 2014). In 2012, Nigeria experienced its worst flooding in recent history (Nkeki et al., 2013; Echendu, 2020). More than 2.3 million people were displaced, 363 lost their lives and another 16 million people were impacted in various ways and years of development gains were reversed (Oladokun and

Proverbs 2016). Total losses were put at US\$16.9 billion (Security 2013). In reality, the extent and nature of Nigeria' s flooding are such that the actual figures for displacements, losses, and fatalities cannot be truly ascertained (Nkwunwo et al., 2015; Cirella and Iyalomhe 2018; Echendu, 2020). The year 2013 also witnessed flood disasters though it was not as severe as the 2012 floods. Floods displaced about 600 people and caused one fatality in northern Kano. About 20 bodies were unearthed at a cemetery in Yan Kaba area of Kano state while in Katsina state, also in the north, 55 farms were inundated by heavy rains (Nemine, 2015). From existing literature, it is clear that the impacts of flooding in Nigeria continue to trigger concerns for food security, vulnerability of local communities within the country, humanitarian in needs and services, primary health delivery, environmental management, solid waste management, urban development, professionalism in journalism practice and the dynamism or lethargy of Nigerian democracy and political system (Clement 2013; Magami, et al., 2014; Echendu, 2020). Whilst investigating these factors vis-a-vis flood risk mitigation in Nigeria is vital, key features of flooding which influence its level of impacts in the country include flood water depth, inundation extent and duration of inundation.

Consequences of Flood Events in Nigeria

i. Impacts on Agriculture and Food Security: Eni, et al (2011), Sidi (2012), Apata and Ojigi, et al (2013) used Remote Sensing and GIS techniques to map and assess the impacts of the floods on agriculture and food security. The findings from (Sidi 2012), showed that the 2012 floods inundated a total of 95 LGAs in 14 states of the country which are within the River Niger and Benue basins between September and October 2012. This represents 12.3% of the 774 LGAs in Nigeria. The entire population of the area is over 15.8 million (1996 Census). He examined effects on tuber and cereal crops, and his analysis showed that:

- a. 27.9% of Yam production areas were affected
- b. 21.6% of Cassava production areas were affected
- c. 1 7.2% of Sweet Potato production areas were affected

There was likely yam deficit in Benue, Kogi, Kwara, Niger, Taraba, Anambra, Cross River, Delta, Edo, while cassava deficit was expected in Anambra, Bayelsa, Benue, Cross River, Delta, Imo, Edo, Kogi, Kwara, Rivers. For cereal crops, Sidi' s results showed that:

- a. 31 .4% of Rice producing areas were affected
- b. 20.1% of Maize producing areas were affected
- c. 14% of Sorghum producing areas were affected

Rice deficit was expected Benue, Kogi, Kwara, Niger, Taraba, Adamawa, Anambra, Cross River, Delta, Edo and Imo states; while maize deficit was to expected in Adamawa, Anambra, Niger, Benue, Cross River, Edo, Kogi, Kwara, Taraba. Impacts on Human Settlements (Towns and Cities): Studies by Adebayo & Jegede (2010), in Benin City, (Olajiyigbe, Rotowa & Durojaye (2012), Adetunji and Oyeleye (2003) in Ape; Ojeh & Ogboma (2012) in Abraka; Olajiyegbe et al., at

Mile 12, Lagos and (Orounye (2012) in Jalingo all show that severe urban floods are a phenomenon in Nigeria. So, the 2012 floods not only affected rural communities, but urban communities were probably more at the receiving end. From these studies, the conclusion is made that urban flood are accentuated by:

- a. **Increasing urbanizations:** Urban population now accounts for about 50% at the total population in Nigeria, which means that more than 80 million Nigerian now live in the towns and cities. With rapid urbanization, there is settlement advance into areas most prone to flooding and other natural disasters.
- b. **Climate change:** Climate change affects urban settlements in different ways; rural floods drive an increasing number of rural folks into the cities, while heavy downfall due to global warming results in heavier rainfall patterns in many areas, the rise sea levels and the inundation of rivers and streams. The thawing of the ice caps is also leading to rise in sea level and increasing threats to coastal regions and coastal communities (see for example, Oni (2003).
- c. **Lack of proper infrastructure:** Storm water channels and the blockage of drainage channels.
- d. Construction of buildings and residential houses in the floodplains. Drainage basins and river banks which are most susceptible to flooding and are high flood risks areas. This is mostly the case in Lagos, Benin. Makurdi, Port Harcourt, etc.
- e. Poor land use planning, and ineffective development control systems in many Nigeria cities (Adedeji, et al., 2012; Ogboi (2013).

Flooding as a Visible Climate Change Induced Disaster in Nigeria

Most noted flooding the world over are those of coastal, river and urban categories caused by natural causes and aggravated by human causes. According to IPCC (2012), where vulnerability is high and adaptive capacity is low, changes in climate extremes can make it difficult for systems to adapt sustainable without transformational changes. Vulnerability is however often concentrated in lower-income countries can although higher-income countries can also be vulnerable to climate extremes. Social, economic, and environmental sustainability can be enhanced by a good disaster risk management and adaptation approaches. In the ranking of countries with water bodies liable to floods, Nigeria was the least of 15 countries ranked having 8,600km length of water bodies, while China was ranked the first with 110,000km length of water bodies (Bello, Adepoju and Adeogun, 2016).

This was corroborated by the fact that the coastal region of Nigeria (Delta, Edo, Lagos, Ondo, Akwa-Ibom, Bayelsa, Cross River and River State) covered about 70,000km² representing only 7.5% of total land mass of Nigeria indicating that Nigerian flooding problem should be manageable compared with other countries. Flooding is

therefore expected to be much more pronounced in the coastal areas because of rise in sea level and riverside areas because of overflowing of river banks after torrential rainfall, the coastal land and property are more liable to wash away by sea erosion and aquatic life, wetland and tourist beaches are also threatened by the floods (New England Aquarium. 2012).

In Nigeria, coastal flooding coupled with beach erosion is the most common climate change disaster applicable to the built environment and their widespread is due to the higher waves generated by on shore storm winds (Patunola-Ajayi. 2014). While Halley (2001) identifies the major cause of flood in Africa to be inadequacy of drainage, but study of cause of flood in Nigeria has been identified to be excessive rainfall (Akanin and Bilesanmi, 2011; Ojo, 2011, & Aderogba, 2012) occasioned by increased precipitation. While some of the flooding could be due to natural occurrence or closeness to coastal areas, the case of urban flooding in Ibadan, a non-coastal city in Nigeria is a typical example of man-made flood disaster.

Some states with evidences of flooding occurrences in Nigeria include Oyo (1980 & 1990), Lagos (1970-2015), Kano (2001), Delta (2001), Edo (2015), Adamawa (2001-2015) and Kogi (2012) with negative effects on the built environment; destruction, submerging or washing away of buildings and structures, water pollution, bridge collapses and road wash away. The worst flooding occurrence in the history of Nigeria has been that of June/July 2012 when Benue and Niger rivers overflowed their banks. Although this was predicted early by the Nigerian Meteorological Agency, but governments at all tiers took no adaptation or mitigation actions. This singular incidence affected 30 of the 36 states in Nigeria, about 250 local government areas (representing 32% of 774 total local governments in Nigeria). About 30% of Nigerian land mass was submerged by flood affecting 7.7million people, 300 were dead, and over 2million people were displaced (Bello, et al., 2016).

Flood Impact in Nigeria

In Nigeria, flooding displaces more people than any other natural disaster with an estimated 20% of the population at risk (Etuonovbe 2011; Cirella and Iyalomhe, 2018). This perennial problem consistently results in death and displacement of communities. The number of flood related fatalities has varied significantly from flood-to-flood with the percentage of displaced versus killed persons not conclusive in the literature. Groundwork into verifying the correlative connection between the two would require an in-depth data mining check on fatalities and an analytical breakdown of each flood occurrence to date. Using this method, the performed a preliminary calculation of 34 floods and found results ranging from 0.0% to 2.8% for larger-scaled floods versus 0.0% to 42.8% for smaller-scaled ones. In about half of the flood events no fatalities occurred. The higher smatter-scaled percentages related to examples like the event from 7 August 2005 in Jigawa State in which 7 persons were displaced and 3 died. On the other hand, at the larger-end of the scale, in 2012 for example, flooding caused more than two

million to be displaced with hundreds of fatalities—resulting in more deaths, but at a much lower percentage. In any case, flood fatalities warrant further research, beyond the scope of this review; they alarmingly pose a real threat to citizenry and stress the continued need into best practices nation-wide (Cirella and Iyalomhe, 2018). Equally concerning, flooding has become increasingly severe and more frequent throughout the country. Unfortunately, impacts are felt more by the urban poor where recovery is unlikely without external aid (Cirella and Iyalomhe, 2018). As a result, the urban poor are most vulnerable since they often build homes along a floodplain. Flooding in various parts of Nigeria has caused four notable problems (Brown and Chikagbum 2015; Ade 2018; Cirella and Iyalomhe, 2018):

- i. Forced millions to relocate,
- ii. Destroyed businesses,
- iii. Polluted water resources and
- iv. Increased risk of disease.

In the last few decades, high annual seasonal rainfall prediction (SRP), conducted by the Nigerian Meteorological Agency, affirm irregular flooding and consequential suffering for many parts of the country. The national response to SRP has been anything but communicative or comprehensive. Flood management, by in large, is a reactionary after effect with relief provided to unfortunate victims. Management is limited to waiting for an event to occur with limited SRI mass communication, hazard prevention or associated risk reduction efforts (Isma and Saanyol, 2013; Cirella and Iyalomhe, 2018). The notion of flood risk reduction largely depends on the amount of available information and regional knowledge affecting ongoing events. A lack of accurate hydrometeorological data affects the uncertainties associated with flash flooding and relating tidal wave hazards. There is, therefore, an urgent need to introduce mitigation measures to ensure that these areas are protected so flooding can be minimized. Demands for the use of modern day techniques identify steps that will help government and relief agencies identify flood prone areas and help with future flood prevention.

Several researchers have examined the utilization of remote sensing and geographic information system (GIS) data in regards to flood risk (Cirella and Iyalomhe, 2018). Ogunurisa and Abawua (2005) applied GIS within a flood risk assessment analysis to a wide variety of countries around the world. Their research formulated risk assessment into five categories:

- i. Meteorological parameters
- ii. Hydrological parameters
- iii. Socioeconomic factors,
- iv. Combination of hydrometeorological and socioeconomic factors and
- v. GIS predictive testing.

In reference to the latter, Okoduwa's (1999; Cirella and Iyalomhe, 2018) research utilized and identified specific GIS itemized variables (e.g., land use, land cover and soil strength) correlating with varying areas of flood prone probability (i.e., low, medium and high levels). This predictive research

overlay focalized urban flooding within Benin City, Nigeria and created a digital database for land relief mapping.

Rehabilitation Programmes for Flood Victim

The most important aspect of any post-disaster effort is the rehabilitation of the affected communities. This envisages resetting of the disturbed communities through rebuilding of the affected communities in terms of social and economic aspects as well as rebuilding retrofitting of the damaged houses. The main objective of any rehabilitation package should be to bring back the affected regions/communities to normalcy and to provide the opportunity to affected community to restart their socio-economic and cultural life as early as possible.

The rehabilitation package should not be an exercise merely of providing help either financially or of rebuilding-repairing-retrofitting the damaged houses. Any rehabilitation program; should be focused on the redevelopment of the affected communities/regions rather than merely on the provision of facilities. The basic concept behind any rehabilitation package should be to bring back the affected communities/areas to at least its original state that existed prior to the disaster. Efforts should be made to incorporate developmental aspects in the rehabilitation process taking care of the fact that this does not delay the process unduly. Besides, the package should also aim at strengthening the existing infrastructural facilities to face possible future disasters in a far better manner.

The rehabilitation package offered after any disaster may be classified into the following categories:

- i. Housing and Infrastructure Redevelopment
- ii. Social Rehabilitation Programmes
- iii. Economic Rehabilitation Programmes
- iv. Other Related Programmes and Activities.

The housing and infrastructural part should cover the requirements and other necessary details pertaining to housing, civic, amenities, roads, bridges, electric power supply network, communication network, water supply schemes, irrigation and related structures public buildings etc. The social rehabilitation programmes should cover health, education, and special programmes for children and women. The economic rehabilitation package should cover the special programmes for rehabilitating agricultural farmers, labourers, artisans, animal husbandry, special training programmes. The package on other related programmes and activities should include all remaining portions of the rehabilitation package like development of better environment in the area by creating green belts and repairing public buildings and monuments.

Results and Discussion

Table 1.1 Questionnaire Administration and Retrieval

States	Bayelsa	Rivers	Delta	Total
No administered	60	265	75	400

No retrieved 53 229 62 344

Table 1.2 Climate Variables, Causes and Impact of Flood

S/No	Statement	Respondents	Percentage
1.	Rainfall, temperature and humidity	56	16.2
2.	Increase in rainfall	52	15.1
3.	Blockage of flood path	37	10.7
4.	Destruction of crops and livestock	21	6.1
5.	Food insecurity	56	16.2
6.	High rate of poverty	55	15.9
7.	Disruption of economic activities	67	19.5
	Total	344	100

From table 1.2, it is observed that 56 respondents representing 16.2 percent opine that rainfall, temperature and humidity are spatial variation in climate change and that increase in rainfall necessitated flood. 37 respondents representing 10.7 percent consented that blockage of flood path is also responsible for flood occurrence, which often time destroy crops and livestock, and food insecurity, is responsible for flora and fauna. While 55 respondents 15.9 percent added that frequent flooding also led to rise in poverty level in Niger Delta. 67 respondents representing 19.5 percent are of the opinion that flood destroys economic activities.

Conclusion and Recommendations

This study was carried out to evaluate climate change, flood disaster and socio-economic rehabilitation programmes for flood victims in Niger Delta Region of Nigeria. In course of the study the set objective include to examine the spatial variation in climate variables in Niger Delta, determine the flood disaster impacts on the livelihood of the people, to assess flood rehabilitation programmes in Niger Delta. The theory adopted by the study is disaster-vulnerability theory. Hence,

Frequent flooding in Niger Delta has been challenging, the study recommend the underlisted as solutions.

- (1) There is need for administrators to intensify the adoption of the approach of turning nature to managing flood considering the influence of climate change.
- (2) Early system warning and migration practice must be actively registered in the mind of the inhabitant through effective and continuous sensitization and support mechanism as proactive measure toward flood risk management.

- (3) Government should involve in various developmental project that would also serve as a mitigation approach towards flood risk reduction as well as provision of alternative to livelihood prior during and after flood event.

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