ASSESSING THE EXTENT OF EFFECTIVENESS OF INDIGENOUS ADAPTATION PRACTICES TO FLOOD DISASTERS IN BENIN METROPOLIS, NIGERIA

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Abstract
Globally flood has become a serious menace in the recent times, the environmental, socio-economic, human all the settlements coexistence are felt with the urban flooding, and Nigeria has been battling with the effects. Many flood disasters are seen in Nigeria's developed cities, the 2012 flooding menace cut across all the urban centers in Nigeria call for a sustainable flood adaptation inputs. The theory of urban resilience to floods stands as a background in this research that provide for reorganization if there is any damages in the process. The research assesses the extent of effectiveness of indigenous adaptation practices to flood disasters in Benin metropolis in addressing flood disasters in the study communities. Case study approach methods were used to collect and analyses data of the effects of adopted methods in addressing the flood hazard from the selected flood plain communities in Benin Metropolis. A Total of 174respondents were sampled to collect data from households, fishermen, business owners, institutions on the extent of the effectiveness of the adopted flood adaptation practices. The study revealed that flood zones dwellers in Benin Metropolis are engaged in indigenous adaptation responses such as block-walls revetment, and placing of sandbags, using of sand-walls as flood channelling to the moat, land filling and constructions of wooden bridges. The study also revealed that the adopted indigenous adaptation practices to flood disasters by flood plain dwellers are effective to an extent in curbing the menace to flooding in Benin Metropolis.

Keywords: Floods, Adaptation, Effectiveness, Disaster, Benin Metropolis.

1. Introduction

Climate change is one of the major effects to Floods disasters in the recent time, causing devastation to natural and human lives and severe economic damage throughout the world, (Khan et al.., 2011). It is understood that flood risks will not subside in the future, and with the onset of climate change, flood intensity and frequency will threaten many regions of the world (Jonkman and Dawson 2012). Floods occur because of the rapid accumulation and release of runoff waters from upstream to downstream, which is caused by very heavy rainfall (Borga et al.., 2014).

The potential for flood casualties and damages is also increasing in many regions due to the social and economic development, which imply pressure on land-use, e.g., through urbanization. Flood hazard is expected to increase in frequency and severity, through the impacts of global change in climate, severe weather in the form of heavy rains and river discharge conditions (Dihn et al.., 2014). As reported by Chang and Guo (2006), heavy convective rainfall often results in flooding in urban areas. Urbanization results into conversion of agricultural land, natural vegetation and wetlands to built-up environments and construction on natural drainages as well increase in the population of those living in flood vulnerable areas such as flood plains and river beds. The urban areas in particular suffer from a comparatively high flood risk due to their high population and density, multiple economic activities and many infrastructure and property values, which in turn interferes with the natural infiltration processes.

Moreover, urbanization results into conversion of agricultural land, natural vegetation and wetlands to built-up environments and construction on natural drainages as well increase in the population of those living in flood

vulnerable areas such as flood plains and river beds (Adeoye et al, 2009).

Adequate adaptation measures to cope for floods hazards is required to be able to mitigate the floods disasters. Hazard risk vulnerability coping strategies is considered one of the most reliable steps in disaster risk reduction since it helps to manage the effects of the floods areas liable to flood, runoff rates often far exceed those of other water flow types due to the rapid response of the catchments to intense rainfall, modulated by soil moisture and soil hydraulic properties. The small spatial and temporal scales of floods, relative to the sampling characteristics of conventional rain and discharge measurement networks, make also these events majorly difficult to determine and to predict the outcome (Borga, et al., 2014).

Urban streams can also easily rise after heavy rainfall due to high run off and less concentration time and space (Ozcan and Musaoglu, 2010). Changes in the urban area and in storm intensity produce higher flows that exceed the capacity of small culverts under roads designed for non-urbanized areas. Moreover, such structures can be adequate when they are well designed, their capacity may turn out to be inadequate and thereby result to overflows onto the roads creating new water paths and then flood the built up urban areas.

Reduction of the risk of flooding will depend largely on the amount of mitigating information on the flood that is available and the knowledge of the coping mechanisms available to the residents that are likely to be affected during a flood event. Therefore, it is necessary to develop measures and best practices that will help residents, relevant authorities and relief agencies in reduction of flood risk in flood prone areas and in planning against flooding events in the future. Determining the flood prone area is important for effective flood mitigations. For this study, it will explore the coping mechanisms of households adopted to curb flood disaster in Benin metropolis and it effectiveness. It will also investigate the type of building structures that is erected in the flood prone areas within the metropolis and whether residents adhere to buildings rules and regulations. Some of the causative factors of flooding in the study area will also be taken into consideration.

The 2012 unprecedented flood disaster experienced by Nigeria was considered the most devastating flood disaster in the past five decades. The disaster affected about 27 states of the federation (including Edo state) causing deaths of over 400 persons and displacing about 2 million people from their homes in the affected areas (NIHSA, 2013). The flood submerged houses, schools, clinics, roads, etc. causing severe damages and inconveniences to human and societal well-being. In addition, the flood destroyed over 1,525km2 of farmlands, and crops worth billions of naira all over the country. Konwea (2012) described the 2012 flood as the worst flood Nigeria has ever seen in half a century (during the last five decades), which led to the death of hundreds of people, displaced over 2 million people, and destroy several thousands of hectares of farmlands. Often time rainfall have taken a heavy dimension and wreaked so much havoc in the city of Benin metropolis. Benin metropolis fortunately is blessed with natural moat that acts as receptacles to flood but linkages hitherto present has been demolished or blocked as a result of human

activities (construction of roads, buildings etc) (Igbinoba et al, 2014).

The poor and illegal disposal of refuse on drainage channels, construction of roads and building of houses on stream channels and poor implementation of town planning laws were the major causes of flooding in the Benin Metropolis (Igbinoba et al, 2014).Despite the efforts of governments in reconstruction of Queen Ede gully erosion and in other different levels to mitigate or response to the flood disasters in Benin City, the attitude of people still remain almost the same. For instance, Benin metropolis people still block the drainages with refuges, builds on waterways without compliance to town planning laws.

There has been limited or no research on the extent of effectiveness of indigenous adaptation practices by flood plain dwellers in mitigating flood disasters in Nigeria (Okonkwo, 2013). There is however, need to embark on flood indigenous adaptive prevention and control/mitigation measures that would help to properly manage the flood disaster, as well as the extent and the effectiveness of the indigenous adaptation practices that will provides a lasting solution to the floods menace in Benin metropolis. These however form the basis of the study, and it is hopeful that findings and suggestions from the study will enable people in the flood prone areas to live with the flood, appropriate its positive elements and mitigate the adverse effects associated with flood disasters.

2. Review of Literatures

This chapter of the research reviewed literatures on flood hazards as regards to the types of flooding, causes of flooding, effects of flooding on households, flood risk and adaptation, flood control measures, coping and mitigation measure and the extent of the effectiveness of the indigenous adaptive measures adopted by the households.

2.1. Types of Flooding

Tidal Flooding: Sea and river defences can be overtopped by low pressure weather systems and high tides peaks. Storms with high wind speeds cause tall and powerful waves and low pressure fronts cause sea levels to rise above normal levels.

Fluvial Flooding: This type of flooding happens within river floodplains area when the capacity of river water body can carry is exceeded due to heavy rainfall within the catchment areas of the upstream. The blockages of flood channels or water drainages will also leads to the rise in water levels.

Ground Water Flooding: The increase in ground water above aquifers may happen periodically, the Low lying areas may experience flooding. It can be accurately be forecasted due to its seasonal and slow in nature.

Flash Flooding: Flash flooding occurs close to the river steep sloping areas of the river bank or catchments areas. Flash flooding can reliably be predicted for when it rains.

2.2. Causes of Flooding

Several factors lead to cause of flooding and it proceeds by heavy rainfall. Flooding is as a result of natural rainfall-runoff process.

Flooding is a phenomenon which is natural and the magnitude of floods is periodic. This means that yearly some places around the river will experiences flooding. Other period, may be (two, five, ten, fifty, one hundred and even a thousand years) is related with increasing areas around the

river which gets inundated (Ajayi *et al*, 2012). Areas that are being flooded and adjacent to the river, stream and water body are known as flood plains. The occurrences of flooding may be as result to natural or anthropogenic (man-made) factors (Ajayi*et al*, 2012; Egunjobi, 2006).

Man does not have much control over the magnitude and the frequency of rainfall which is a natural phenomenon. Moreover, man has control over the anthropogenic factors that causes floods, such as control of solid waste disposal, clearing of drainage channels and drains to allow free passage of flood water and increasing the capacity of hydraulic conveyance structures through periodic dredging to conveniently carry flood flows. Conventional, man should avoid living in floods prone areas or be ready to face the hazards that are associated with encroaching on the flood prone areas. Disasters caused by floods are as results of the unnecessary risks individuals involved themselves within the flood plains.

Flood disasters will not happen if human beings stay away from the flood plain (Ajayi *et al*, 2012). Ajayi *et al* (2012) opined that the prevailing cause of flooding in urban center is uncontrolled urbanization; in a way that some of the buildings were constructed during the dry season on what constitutes the river flood plain areas. They also observed large scale encroachment into the river floodplains throughout the area. According to them, majority of the drainages system such as culverts, bridges and other hydraulic infrastructures that were constructed many years ago are now inadequate to carry the present water and waste generated because of the rise in urbanization of Benin Metropolis. Lansigan (2007) explains the natures of the anthropogenic factors that influence the occurrence of floods. Thus, human activity can go a long way to eliminate or reduce vulnerability to flooding.

Flood resilience can be sustained or enhanced by adopting proper strategies and measures to be implemented. Effective measures and implementation of plans require a full combination of coping, mitigation and adaptation methods. Coping mechanisms must be developed at different levels of community and government, and must involve coping, mitigation, adaptation program. These strategies require combination of households and governmental plans of actions and concerted efforts (Lansigan, 2007).

The interactions between human activities, flood hazards and risks is an area of particular interest given climate change and heavy rainfall, and the increasing urban growths and stresses on the physical environment that such developments initiate (ESPON Hazards project, 2003; IPCC, 2007a). Human behaviours to the environment are increasingly becoming a factor that is aggravating the occurrence and incessant disasters worldwide (Nirupama & Simonovic, 2006). Several instances have showed that human activities and changing of the face of the physical environment have increased the risks of environmental hazards.

Another way how human activities have increased risk and flood hazards is the area of urbanization (Akintola, 1994; Oguntoyinbo, 1994) and all forms of agricultural activities. Some other ways urbanization can cause or increase flooding is through urban storm water runoff (Adedeji et al., 2012) if that is combined with burst sewers, as pressure builds up in a

severe situation, resulting to the opening of manholes and flooding to take place (Nirupama & Simonovic, 2006).

The behaviours of human activities such as deforestation, land degradation, surge of population density along flood prone areas, in adherence to land use planning and control of flood prone areas; and poor drainage system are contributing factors to the increased in flood incidence.

2.3 Effects of Flooding on Households

The effects of losses associated with flood disasters resulting to displacement of materials and resettlement can be seen as losses to customary housing and resources (Klein, 2002). People who are displaced by flooding activities are often cut off from their sources of livelihood (land, water, forests, farmland etc.), or urban markets and customers. Disasters and displacement may break the identification with an environment that may once have been one of the principle features of cultural identity (Nirupama and Simonovic, 2006).

Displacement for the indigenous group can be stressful; it can result to loss of cultural attributes and other severe impacts. Some severe cases can force households or community relocate, migrate or abandon their habitants as a result of flood disasters. Climate change-forced displacement data has not been really exulted, it is assume that majority climate change outcomes will be categorised as disasters by the populations who be affected by the flood disasters (Nirupama and Simonovic, 2006).

Household livelihoods are not only affected by floods, but it also affects the local economy within which populace operates (Action Aid, 2001). The recovery and sustainability of household livelihood are mostly patterned by the local economy. Stakeholders, often disregards the impact of their response to the flood hazards on the immediate economy and market system.

These effects can comprise business interruption costs to firms unable to access inputs from their suppliers or service their customers, income losses of households unable to get to work, or the deterioration of the fiscal stance post-disasters as less taxes are collected and significant public relief and reconstruction expenditure is required.

Disease outbreaks are likely to experience after the occurrence of a disaster. Preference of water and sanitation conditions, disease control, adequate response to warning, and above all, preparedness of health agencies are the preconditions to reduce the spread of diseases and preserve the quality of the environment after disasters (McCluskey, 2001).

Research revealed that the risks of disease are very high where there is overcrowding of population and where there is compromise on the standards of water and sanitation (PAHO, 1981). This often happens in situations of massive population displacement away from the flooded area and prolonged stay in flood shelters without adequate water supply. Water-borne diseases, such as diarrhoea diseases, acute respiratory infections (ARI) and skin infections, are common among flood affected people, especially children.

However, a number of public health impacts are expected to worsen in climate related disasters such as storms, floods, heat, drought, and wildfire. Children are also at high risk for transmission of faecal-oral diseases, and those who are constraints with mobility and cognitive can be at higher risk of injuries and deaths (Ahern *et al*, 2005), whereas, those people are on low incomes

categories are less likely to be able to pay for insurance against risks associated with flooding, such as storm and flood damage (Marmot, 2010). Mental health risk problems is said to be increase by flooding hazards in both adults and children (UK Department of Health, 2009). A study on UK of over 1,200 households who are affected by flooding advocated that there were greater impacts on physical and mental health among the vulnerable groups who are mostly poor households and communities (Werritty *et al*, 2007).

The effects of health-related by floods are severely context-specific but range from worsening of existing chronic illnesses (which could be widespread), through possible toxic exposures (in air, water or food), to deaths (expected to be few to moderate but may be many in low income countries) (Keim, 2008). Shelter is necessary to provide security and personal safety, protect from the climate and enhance resistance to ill health and disease. It is also important for human dignity and to sustain family and community life as far as possible in difficult circumstances (Sphere Project, 2004). The livelihood activities of many flood-prone communities are home-based or homestead-based and may be destroyed by flooding. The World Bank report on the Mozambique flood noted the improvement in the houses of people displaced through the floods has had a lasting positive psychological effect on the beneficiaries

3. Methodology

Research methods discuss the relevant procedures involved in the collection of all necessary data required for the study. Asika (1997) stated that research is a way of sourcing for information from a targeted population in a mind of arriving at a conclusion. More so, this chapter therefore focus on the philosophy of the process which includes the assumptions and rationale for taking a decision in the study and the standard criteria that was used for analyzing and interpreting data.

The study area comprises of the three local governments in Benin metropolis will be taking as the study area. The suggested local governments are Oredo local government, Ikpoba-Okha local government and Egor local government areas all in Benin metropolis. Areas that are liable to flooding were selected for the study. Questionnaires were administered on the household heads that are affected by the floods over time. While the interview guide was the principal instruments use to reach the planning agencies, identified ministries and other relevant stakeholders to ascertain the extent of the effectiveness of the adopted indigenous adaptation practices. Personal observations were used to identify areas that the adopted methods are effective.

Sampling frame is the total observations in a population. The sampling frame for the target population of households is 174 respondents that are affected by flooding in the study areas. However, any available number of populations was sampled for the allied professional bodies relating to the field of physical planning in Edo State.

Table: 1 Affected Buildings and Farmland in the Study Areas

The Local Government	Total Number of Affected Buildings	Total Number of Affected Farm lands	Number of Selected Buildings/Farm Land (50%)
Oredo	153	-	77
Egor	107	-	54
Ikpoba-Okha	45	40	43
Total	**305**	**40**	**174**

Source: Field Work (2022)

The local government area was grouped according to places where buildings and farmlands were affected and samples were taken from each. A random sample of 50% of households and farmlands were interviewed from each of the selected local government areas, making a total of 174 samples representing the target population. The business owner, farmers, communities youth leader, communities associations and others stakeholders were asked about their indigenous knowledge and practices to flood hazards, and the extents of the effectiveness of the adaptation, opinions and attitudes towards the prevention of flood hazards and effects of the flooding on livelihood.

Table 2: Sector of Employment by Case Study Local Government Areas

Sector of Employment	**Oredo Local Government Area**		**Egor Local Government Area**		**Ikpoba-Okha Local Government Area**		**All Communities**	
	No of Interviewee	%	No of Interviewee	%	No of Interviewee	%	No of interviewee	%
Service	22	29	15	28	9	21	46	26
Agriculture	10	13	6	11	18	42	34	20
Commerce	30	39	20	37	12	28	62	36
Industry	15	19	13	24	4	9	32	18
Total	**77**	**100**	**54**	**100**	**43**	**100**	**174**	**100**

Source: Field Survey, 2022

The climatic variations of households whose livelihood is dependent on business and natural resource-based activities such as farming, business and shop-owners have the potential of increasing their adaptiveness because such natural hazard can reduce farmer's production and business sales (Evasriste et. al., 2017). The research revealed that the respondents are majorly employed in the agricultural, commerce, service and the industrial sector in all the three case study local government areas as can be seen in Table 2. From the proportion of the interviewees that were gainfully employed in the study areas, 36% were business owners while 20% were engaged in the agricultural and 18% in industrial sector (according to Table 2). A response was sorted from a respondent in a community in Oredo local government areas who informed that: "My parents were traders and I learnt this business from them from my birth. Indigenous adaptation measures have helped us to protect our properties over the years" (Respondent 1, Oredo Local Government Areas, June 2022).

From the above statement, it can be deduced that employment history is based on the family patterns of employment income sources. It was also observed during the interviews with the adult businessmen that they have also incorporated their children into the trading activities and these activities come to place as a result of the urbanization of Uselu, Ogbe and Etete communities in Oredo local government areas. More, so only few places are involved in farming activities. This puts that residence of Oredo local government Areas are more sensitive to indigenous adaptive measures to climate

related disaster impacts on their business activities such as flood disasters.

Indigenous Approaches to Flood Adaptation and Mitigation

This sub-section examined what flood plain dwellers are doing locally to cope with flood disasters in all case study local government communities. The results from the field studies revealed that flood plain dwellers are coping with flood disasters with indigenous adaptation approaches such as block walls revetment, placing of sandbags as barricade, sand walls as barricade, placing of rubber tyres, construction of waterways, tree planting, land filling in all three case studies local government communities (see Table 3). From the Table, 25% (43 out of 174) of the interviewees in all case study communities responded that they use block wall as a barricade to curtail flood disasters. Also, 2% (3 out of 174) of the respondents intimated that they are not engaged in any indigenous adaptation approaches to flood disasters.

Table 3: Indigenous Adaptation Approaches to Flood Disaster by All Three Case Study Local Government Communities

Indigenous Adaptation Approaches	Oredo Local Government Area		Egor Local Government Area		Ikpoba-Okha Local Government Area		All Communities	
	No	%	No	%	No	%	No	%
Block Walls Revetment	22	29	13	24	8	19	43	25
Land Filling	14	18.1	12	22	6	14	32	18
Construction of waterways	8	10.3	4	7	3	7	15	9
Sand Wall Revetment	7	9	7	13	10	23	24	14
Placing of Sandbags	11	14.2	8	15	5	12	24	14
Placing of Rubber Tyres	13	17	7	13	3	7	23	13
Tree Planting	1	1.2	2	4	7	16	10	5
No Adaptation Approach	1	1.2	1	2	1	2	3	2
Total	**77**	**100**	**54**	**100**	**43**	**100**	**174**	**100**

Source: Field Survey, 2022.

Effectiveness of Indigenous Adaptation Practices in Addressing Flood Disaster

The study investigate the perceptions of flood plains dwellers on how the indigenous adaptation practices they have adopted are addressing flood disasters in all three case study local government communities. The study asked the question: How effective are the indigenous adaptation practices addressing flood disaster? The following sections discuss the extent of effectiveness of each of the indigenous adaptation practices by flood disasters is addressing flood disasters or otherwise.

Block Wall Revetments

Block wall revetment as an indigenous adaptation practice to flood disaster, according to interviewees is addressing flood disaster as they prevent the inundation of the flood forces and transporting sediments by the flood away from the property. This results in the stability of sediments around flood plains properties and as such eventually preventing the disaster of the flood plains. An interviewee from Ikpoba-okha LGA reported that: *"The block wall revetment is effective in preventing the flood from taking sand along my property. It is very strong in stopping the flood forces from transporting sediments away from my property. This has stopped the disasters of my property. It has sustained my property for almost 10 years now" (R3, Ikpoba-Okha, June 2022.* Observations from the field survey indicate that though block wall revetments were protecting properties of flood plains dwellers using this indigenous adaptation practices, it was causing disasters to others properties because the pressure of the flood forces has shifted to other adjoining properties without hard structural defence as an adaptation measure.



Figure 1: Block Wall Revetment as an Indigenous Adaptation Approaches in Oredo LGA
Source: Field Survey, 2022

Placing of Sandbags as Barricades

Placing sandbags as barricades is a soft indigenous adaptation practices to flood disasters identified in the case study local government communities. The placing of sandbags as barricades is to prevent the inundation of the flood against properties along the flood plains. Interviewees reported that this indigenous adaptation practices cannot stand the severity of the flood forces and that the flood washes them away. A community interviewee in Oredo during the field interviews was of the view that: *"The power of the flood forces carries the sandbags along. We need something very strong to match the strength of the flood forces because the sandbags are too soft for the aggressive nature of the flood. We however use it because it is cheap and less costly. The result is that it is not able to protect our properties adequately against the oncoming flood towards our properties" (R4, Oredo, June 2022)*

This was also corroborated by one of the community interviewees who has a home around the flood plains and took part in the focus group discussions in Oredo commented that: *"The volumes at which the water comes is too much for anything to stop it. The sandbags cannot match the volumes of the oncoming flood forces. We can use the sandbags as a barricade in the week and by next week all has been washed away by the flood. The situation is becoming very unbearable" (R17, Oredo, June 2022).*

The field observations revealed that placing of sandbags as a barricade against the flood forces from inundating properties around the flood plains is not addressing flood disasters in the case study local government communities. This is because the flood forces and volumes which are stronger especially during high raining seasons wash them away. It was also observed that the sand used by flood plains dwellers for sandbags was creating disasters in other

parts of the flood plains due to the loss of sediments created by the winning of the sand for sandbags



Figure 2: Sandbags as a Barricade in Egor LGA and Ikpoba-Okha LGA
Source: Field Survey, 2022.

Sand Walls

Sand walls are constructed with mud sand and as a barricade to prevent the flood from inundating flood plains properties and to also channel the water to the moat or drains. According to interviewees, using sand walls made of mud sand indicate that the sand walls are robust in stopping the flood forces from inundating their properties and this has significantly reduced disasters around their properties. However, they complained that sometimes the continuous inundation of the flood against the mud sand gradually washes them away and thereby exposes their properties to the flood and they have to continuously fortify them from time to time.

A respondent from Ikpoba-Okha who uses sand walls as an indigenous adaptation practices commented that: *"The sand wall has been helping to channel the water to the sea and the drains for years. The only problem is that the continuous advancement of the flood volumes against the wall weakens the mud sand and sometimes I have to spend more money strengthening the mud sand" (R25, Ikpoba-Okha, June 2022)*





Figure 3: Sand Wall as Flood Channels in Ikpoba-Okha LGA and Egor LGA
Source: Field Survey, July 2022

The use of sand walls as flood channels to address flood disasters in all the three case study local government communities revealed that they are effective in channelling the water into the river or nearby drainage and have helped to reduces the inundation of the flood on their properties. There are situations where the flood surges will be very strong but the sand wall will help to curtail the inundation of the water against the building properties.

Landfilling

Interviewees in Egor reported that land filling is able to address flood disasters to an extent in the community. Land filling is done in all the three case study communities probably because of the low terrains of the study communities. Some of the fillings are done with sand and stones which according to community interviewees are sustainable to an extent but later washed away by the flood forces during the raining season if they are not reinforced with concrete. The implication is that land filling is not able to address flood disaster in all the three case study communities.

Tree Planting

Tree planting as an indigenous adaptation practices to flood disasters in Ikpoba-Okha and Oredo according to interviewees can hold the intensity of flood forces from inundating properties around the flood plains. The reduction in the intensity of the flood forces, therefore, slows flood disasters as less sediments of sand are transported away from our properties by the flood water. However, observations from the field revealed that the roots of the orange trees and plantains are exposed over time causing the trees to fall. This implies that new orange trees and plantains will have to be planted overtime to replace the old ones almost every time.



Figure 4: Banana and Maize Plantation lost to Flood Disaster in Ikpoba-Okha
Source: Field Survey, 2022

Placing of Old Tyres as Walkways

Construction and placing of old tyres as walkway by flood plain dwellers as an indigenous adaptation approaches to flood disasters was also identified in all case study local government communities. Field observations and perceptions of community interviewees using old car tyres as walkways as an indigenous adaptation approaches to flood disasters revealed that the placement of old tyres as walkways by flood plains dwellers are addressing flood disasters by curtailing the extent of inundation by the flood surges against their properties and also serves as walkway to enable them have access to their properties. However, the placement of old car tyres are not addressing flood disasters in the case study local government communities because most of the tyres are run over by the strong volume of waters and does not stand in test of time.



Figure 5: Placing of Old Tyres as walkways in Ikpoba-Okha LGA
Source: Field Survey, 2022

Conclusion

In summary, out of the indigenous adaptation responses to flood disasters reported by community interviewees in all case study communities revealed that sand walls and block wall revetment are effective in addressing flood disasters to an extent. Tree planting also though less expensive compared to other hard structural defence options such as block wall revetment and sand walls is also addressing flood disasters by reducing the intensity of flood forces from inundating flood plains properties. However, sandbags as a barricade and land filling do not address the problem of flood disaster adequately in the case study communities. Sandbags as barricades are rather worsening flood disasters because sandbags cause disasters on other parts of the flood plains.

REFERENCE

Action Aid. (2006). Climate change, urban flooding and the rights of the urban poor in Africa: Key findings from six African cities. London: Action Aid International.

Adedeji, O. H., Odufuwa, B. O., and Adebayo O. H. (2012). "Building Capabilities for Flood Disaster and Hazard Preparedness and Risk Reduction in Nigeria: Need for Spatial Planning and Land Management", Journal of Sustainable Development in Africa, 14(1): 1-15. Pennsylvania: Clarion University of Pennsylvania, Clarion.

Adeoye, N. O., Ayanlade, A. and Babatimehin, O., (2009). Climate change and menace of floods in Nigeria Cities: Socio-economic implications, *Advances in Natural and Applied Sciences*, ***3***(3), pp 369-377

Ajayi, O., Agbola S. B, Olokesusi, B. F., Wahab B., Taiwo O. J., Gbadegesin M., Taiwo D. O., Kolawole, O., Muili, A., Adeola, M. A., Olutade, O. G., Shiji, F. and Abiola, N. A. (2012). "Flood Management in an Urban Setting: A Case Study of Ibadan Metropolis", Special Publication of the Nigerian

Association of Hydrological Sciences.pp65-81. Available at (Retrieved in January, 2013) http://www.unaab.edu.ng/journal/index.php/NAHS/article/download/914/882

Borga, M., Anagnostou, E.N., Blöschl, G. and Creutin, J. D., (2011). Flash flood forecasting, warning and risk management: The hydrate project. *Journal for Environmental Science Policy.**14***, 834–844.

Dihn, Q., Balica, S., Popescu, I. and Jonoski, A., (2012). Climate change impact on flood vulnerability, vulnerability and risk of the Long Xuyen Quadrangle in the Mekong Delta. *International Journal River Basin Management.**10***, 103–120.

Egunjobi, L. (2006). "Perception of Urban Environment Problems: A Pilot Study Centred in the City of Ibadan, Nigeria". African Urban Quarterly. Vol. 1 and 2, pp. 23-29.

ESPON Hazards project (2003). The spatial effects and management of natural and technological hazards in general and in relation to climate change. 1st Interim report of the European Spatial Planning and Observation Network (ESPON) project 1.3.1.GeologicalSurvey of Finland.

Evariste, F.F., Jean, S. D., Victor, K., & Claudia, M. (2017). Assessing climate change vulnerability and local adaptation strategies in adjacent communities of the Kribi Campo coastal ecosystems, South Cameroon. Urban Climate, https://doi.org/10.1016/j.uclim.2017.12.007

IPCC (2007) Climate change 2007: impacts, adaptation, and vulnerability. Contribution of Working Group II to the Fourth Assessment Report (Ch. 9). Cambridge University Press, Cambridge

O'Brien, K., Leichenko, R., Kelkar, U., Venema, H., Aandahl, G., Tompkins, H., & West, J. (2004). Mapping vulnerability to multiple stressors: climate change and globalization in India. Global environmental change, 14(4), 303-313.

Pelling M (1997) what determines vulnerability to foods; a case study in Georgetown, Guyana. Environ Urban 9(1):203–226

Itulua, P. A. (2008). Environmental Assessment of urban flooding in Benin City Edo State. M.Phil Thesis submitted to the Rivers State University of science and Technology, Port Harcourt; Nigeria.

Jonkman, S. N. and Dawson, R.J., (2012). Issues and challenges in flood risk management. *Editorial for the Special Issue on Flood Risk Management.**4***, 785–792.

Keim, Mark E. (2008). "Building Himan Resilence – The Resource Innovation Group". Available at trig.squarespace.com/ storage /Keim.pdf.

Khan, S. I., Hong, Y., Wang, J., Yilmaz, K. K., Gourley, J. J., Adler, and R.F., Irwin, D., (2011). Satellite remote sensing and hydrologic modelling for flood inundation mapping in Lake Victoria basin: Implications for hydrologic prediction in ungagged basins. *IEEE Transportation Geoscience Remote Sensing.**49***, 85–95.

Klein, R. (2002). Coastal Vulnerability, Resilience and Adaptation to Climate Change: An Interdisciplinary Perspective. PHD Thesis submitted to MathematischNaturwissenschaftlicheFakultät of the Christian-Albrechts-Universität.

Lansigan, F. P. (2007). Assessing Vulnerability of Urban Areas to Floods for Effective Disaster and Risk Management in Local Government Units. Brief paper presented at the International Workshop on the Science and Practice of Flood Disaster Management in Urbanizing Monsoon Asia, Chiang Mai, Thailand.

Munich Re (2005): Megacities: Trends and challenges for Insurances and Risk Management, http:// www.munichre.com/ publications/302-04271 en.pdf