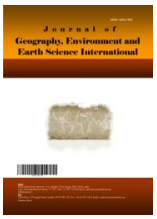

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Assessment of Community's Resilience to Flooding in the Flood-prone Areas of the Core Niger Delta, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The study assessed the community's resilience to flooding in the flood-prone areas of the Core Niger Delta, Nigeria. The study adopted the descriptive survey design. 790 respondents were selected using a multistage stratified sampling technique in Bayelsa, Delta and Rivers States. Descriptive and inferential statistics were used in the analysis of data. Findings showed that the level of community's resilience to floods in the core Niger Delta included distribution of relief materials by community flood control committee (61.9%); helping flood control committee to effectively use the equipment to detect early flood warning (56.5%), the response committee effectively measured and assessed the extent and risk after every flood incident (52.1%), National Emergency Management Agency (NEMA) or the State Emergency Management Agency (SEMA) engaging members of the community flood control committee on capacity building on ways of mitigating flood menace (51.7%); and community constructing flood barks, drainage, dam, etc. in order to control or manage flood incidents (51.1%). The study revealed that the frequency ($F=2.661$, $p<.05$) and magnitude ($F=1.355$, $p<.05$) of flood determined its intensity in communities in the study area. The study recommended among others that communities should set up an

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efficient and effective flood control committee in order to effectively tackle the impacts of flood menace, including the Ministry of Agriculture enhancing the knowledge of local farmers in using new and improved inputs and techniques (i.e. smart agriculture) for planting crops that can be harvested before the flooding.

Keywords: Core Niger Delta; flood; flood prone areas; resilience; Nigeria.

1. INTRODUCTION

Flooding is seen as a major consequence of climate change which has threatened many communities, thus there is a need for greater understanding of drivers to community resilience [1]. Flood is a natural disaster that falls into one of the types of hydrometeorological disasters which relate to water and weather which include rainfall, flood, drought, hail, windstorm, and tropical cyclone. Flooding is arguably the weather-related hazard that is most widespread around the globe. It can occur virtually anywhere. Flood causes calamity to people and property, such as loss of life, injury, and destruction of buildings and communications. Besides, flood causes damage to infrastructures, agriculture and livestock and depression of the economic and social state [2].

Therefore, communities living along the river banks predominantly depend on the flood plains for their livelihoods and this automatically exposes them to natural hazards like floods. The negative impacts of floods are related to and worsened by inadequate institutional, social, organizational, individual and community-based resilience required for managing flood disasters. Disaster risk reduction strategies can be hazard-specific, sector-specific or commonly applicable across different types of disasters and involve multi-sectorial disciplines regardless of their nature and scale. Amongst them, community-based resilience has been widely accepted as a disaster risk reduction strategy that builds the resilience of targeted groups for better prevention through developing the preparedness and response strategies against disasters, which can be focused at institutional, community and individual levels.

In Niger Delta, the flood-related problems are far-reaching, affecting the environment and development of the region. Impacts of flood on food security practices and livelihood have been a major issue, especially in the rural areas, where agriculture and aquaculture are the major sources of food and livelihoods [3,4]. Impacts on health caused by the flood have been a topic of major discussion for several years. An analysis by Few et al. [5] has suggested that improving coping response of the communities is the key to the success to reduce health risk, and this is closely linked to economic and cultural issues. For these reasons, flood mitigation in the Niger Delta should be considered as a combination of hard and soft measures. In this connection, restoring the natural functions of rivers and floodplains, planning and management practices, involving the local communities in the river basin management, capacity development of the local institutions are found to be effective measures of sustainable flood management in the flood-prone areas.

Resilience, as originally developed in ecology, is the capacity to maintain a sustainable relationship with the habitat [6]. With increasing influences from outside the ecological field, such as human geography, cultural theory, and other social sciences in the 1990s [7,8,9,10,11] the concept of resilience began to embrace different dimensions of social change. Adger [12] described social resilience as the ability of social systems to deal with and withstand the external shocks to their organization and infrastructure caused by environmental, economic, or political crises. Currently, a popularized socio-ecological definition of resilience includes the notions of learning, reorganization, innovation, and transformability [13]. Resilience is perceived as a system's capability to absorb disturbances and continue or bounce back to a stable status in which the entity (e.g. community, individual, or household,) existed before a disturbance [14]. In common usage resilience typically relates to the ability of systems (and people) to effectively respond and adapt to changing circumstances and to develop skills, capacities, behaviours and actions to deal with adversity – 'resilience' can be described as a process of adaptation before, during and after an adverse event [15].

The IFRC (International Federation of Red Cross and Red Crescent Societies) defines resilience as the ability of individuals, communities,

organizations or countries exposed to disasters, crises and underlying vulnerabilities to anticipate, prepare for, reduce the impact of, cope with and recover from the effects of shocks and stresses without compromising their long-term prospects. It is conceptualized as the ability of a people, communities or even a nation to moderate, adjust to, and recuperate from distress in a way that diminishes chronic vulnerability and facilitates comprehensive development [16,13,17]. Its application to natural hazard management has increased in recent times [18] and it reflects the Disaster Risk Reduction (DRR) paradigm that advocates a shift from post-disaster response pattern of disaster management to a proactive Disaster Risk Reduction approach. The concept of resilience concerning social-ecological systems conveys the idea of adaptation, learning, self-organization and ability to resist disturbance.

Additionally, community-based resilience involves the use of professionals with specific training, expertise and capability to manage, evaluate, analyze and interpret pre and post-flood data, warnings and signals towards the amelioration of the effect of flood disasters on food security and livelihood. Raynor et al. [19] viewed community-based resilience as a deliberate response strategy adopted to assuage or pacify victims as they cope with flood disasters. This response strategy takes the form of humanitarian and relief assistance and interventions designed to reduce the vulnerability of communities to flood disasters. Corroborating this view, Olorunfemi and Raheem [20] and Pathak and Ahmad [21,22] emphasized that disaster risk reduction is a new paradigm in disaster management with a body of policies, strategies and practices geared toward curtailing vulnerabilities and disaster risks in society through appropriate prevention, mitigation, preparedness and early warning programmes and facilities. Obeta [23] emphasized that the success towards mitigating and tackling the multiplicity of flood disasters in Nigeria thrives on institutions and research agencies empowered to work out a template, programmes and models for responding to flood alert and early warning thereby improving flood awareness and management. Although, Isbandono et al. [24] stated that disaster mitigation is a series of efforts to reduce disaster risk, through physical development and awareness and capacity building in the face of disaster.

However, understanding the composition and peculiarities among members of the flood management committee (FMC) is a deliberate cohesion strategy that enhances the capacity of FMC to proactively identify potential alterations in the biophysical and socio-economic systems [25] that could promote the vulnerability of the fragile coastal Niger Delta communities to flood disaster. These are crucial to improve the resilience and reduce the flood vulnerability of coastal communities. Raynor et al. [19] believed that putting structural methods of flood control tend to give a wrong sense of security to dwellers on the flood plain and thus promoting investments in flood-prone areas. In addition, Pathak [26] asserted that disaster crisis communication is essential for providing adequate and successful disaster management process during disaster events using flood crisis of 2011 in Thailand as the newspapers and government agencies found it difficult to provide timely and accessible flood information to the public. Enhancing socio-economic and ecological resilience, improving food security practices and livelihood will, therefore, play a vital role in minimizing the vulnerability of coastal communities in the Niger Delta to flood disasters.

Consequently, building resilience is predicated on using indigenous knowledge in tackling disasters. Indigenous knowledge is the set of traditionally practised flood coping and resilient strategies that have helped many communities survive natural or manmade calamities. Hence, utilizing indigenous knowledge in coping with or mitigating flood disasters whilst deriving economic and social gain is predicated on adopting sound principles of interaction between humans and nature [27]. Also, the use of indigenous knowledge or practices (like putting sandbags along the shoreline, digging of a ditch, raising the plinths of houses and cattle sheds and installing toilets on raised ground in likely or actual submerged environs, etc.) in alleviating the threat of flooding is appropriate amid scarce resources. This is due to the ready convenience, ease of use, cost-effective, and highly environmentally friendly local materials, skills and practices (like smart agriculture) used in tackling the flood disaster which should not naturally disrupt any activity that enables individuals and households to reasonably maintain their source of income, feeding, sustenance and livelihood [28].

Furthermore, individuals and household's adoption of many indigenous coping mechanisms and risk management practised in

flood-prone areas necessitates the using of strong bamboo or other wooden planks to repair and strengthen houses, make the thatched walls of their houses stronger to resist or withstand the intensity of floodwaters [29,30]. Similarly, Dufty [31] stated that proper assessment or appraisal of indigenous emergency management practices instills the consciousness of planting trees around homes or houses to enhance the soil texture and protect it from being eroded and bare to the necessary provisions and nutrients needed for the survival of crops (like yam, cocoyam, sugar cane, okra, vegetable, etc.) and other farm produces planted in even a disaster (flood) susceptible area like the Niger Delta. Hence, other indigenous coping mechanisms like rafts made of banana-tree trunks were used for displacement, traversing over inundated roads and floating base/platform during the cultivation of improved or fast-growing crops, seedlings, vegetables and agricultural produce (i.e. smart agriculture) with the whole cycle of planting, cropping, and harvesting linked to the rise and fall of rivers and occurrence of flooding [27,32]. It is based on this background that this present study seeks to examine and assess the community's resilience to flooding in the flood-prone areas of the core Niger Delta, Nigeria.

2. STUDY AREA

The study was carried out in the Core Niger Delta of Nigeria comprising Bayelsa, Delta and Rivers States (Fig. 1). These States were selected because of the frequent occurrence of flood being experienced every year. The Core Niger Delta is located on the latitudes 4° 30' 00''N and 6° 30' 00''N and longitudes 5° 0' 0'' E and 7° 30' 00''E. It is one of the world's largest wetlands covering an area of approximately 70,000 km2, located in the south-south geopolitical region of Nigeria.

Along the coast, the Niger Delta stretches from the Benin River in the West to Bonny River in East [33]. The region experiences very high annual rainfall ranging between 3000 to 4500 mm with double maxima characteristics of July and September peaks [34]. Although the Niger Delta can be roughly categorized into four ecological sub-zones (coastal barrier Islands, mangrove, freshwater swamp forest and the lowland rainforest), the mangrove is the largest and dominant eco-subzone. In terms of socio-economic development, the region could be described as being a "rich region with poor people". It is blessed with abundant crude oil and natural gas, which is the mainstay of Nigeria's

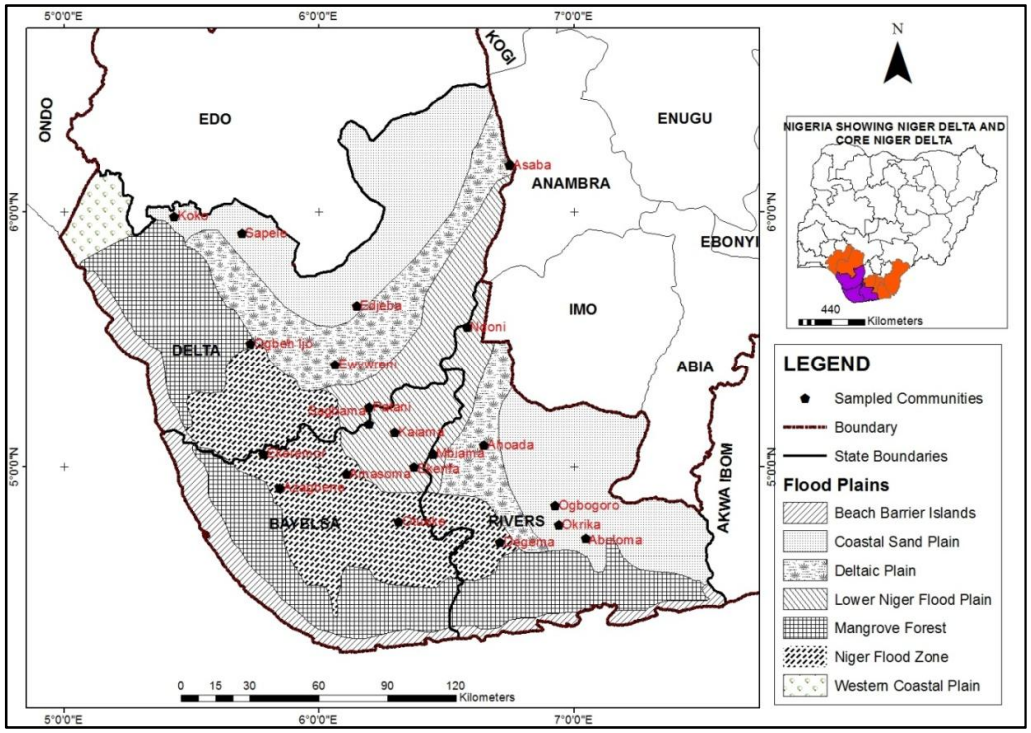

Fig. 1. Core Niger Delta

economy. Apart from crude oil and natural gas, the mangroves offer a lot of biological resources on which the rural livelihood depend [34].

The relief of the area is low-lying and the rivers are influenced by tidal fluctuation [35]. A substantial part of the Niger Delta region lies at an average altitude of about 12 m above mean sea level. In terms of general surface features, the area falls within the coastal belt dominated by Low-Lying coastal plains which structurally belong to the sedimentary formation of the recent Niger Delta [36,37]. The people of the Niger Delta get their source of livelihood from the natural resource around the coastal and swampy area; this is why flooding is a serious disaster for the people in the Niger Delta region. The coastline of about 560 km of the Niger Delta is covered with mangrove swamp. The Mangrove swamp is rich in the southernmost part of Nigeria covering over 20,000 km within a wetland of 70,000 km [38]. Similarly, the Niger Delta region is underlain by the basement complex and sedimentary rock most noticeably in the Oban and Obudu areas while the coastal areas consist mostly of sedimentary rock. Also, around the coastal area is the hydromorphic and organic soils developed on alluvial marine and fluvial marine deposits of variable texture.

Before the discovery of crude oil, agriculture was the dominant occupation of the people. Crude oil was discovered in commercial quantity in the region specifically in the present Bayelsa State in 1956 [39]. Since then oil exploration and exploitation has continued resulting in what is termed environmental destruction due to neglect and less concern of the multinational companies in environmental management in the area. Apart from environmental degradation resulting from Oil & Gas mining activities, the Niger Delta is plagued with the problem of perennial flooding and shoreline erosion which has accounted for severe loss of lives & properties in the region owing to its physiographic configurations. The Niger Delta with a population of over 10 million people is one of the industrial and commercial hubs of Nigeria. It is the home of Nigeria's Oil and Gas Industries and a commercial nexus in Nigeria because of its coastal location. The area is currently witnessing rapid economic growth and little or no development [34].

3. MATERIALS AND METHODS

A sample of 790 respondents (otherwise residents) was selected, 50 heads of household each from 5 communities each in the selected states (i.e. Bayelsa, Delta, and Rivers) including 30 NEMA and 10 SEMA (i.e. 5 BASEMA and 5 DESEMA) officials participated in the study. The multistage sampled study was in three phases. Firstly, the random sampling technique (using a blindfold) was used in the selection of the 5 prone communities from each of the 3 States. This led to the researchers consecutively picking 5 numbers from each of the three states to arrive at flood-prone communities like (in Bayelsa State), (in Delta State), and (in Rivers State). In the second phase, the random sampling technique was used in the selection of 50 respondents from each of the 5 selected communities spread across each of the 3 selected states.

This gave a sample of 250 per state totalling 750 in the 3 selected states. In the third phase, the random sampling technique was used in the selection of 30 National Emergency Management Agency (NEMA) staff or official in all three states (i.e. 10 each per state). In the fourth and final phase, random sampling was adopted in the selection of 10 SEMA officials (i.e. 5 from Bayelsa State Emergency Agency (otherwise BASEMA) and 5 from Delta State Emergency Agency (DESEMA) staff or official. This constituted a sample of 780 respondents (comprising 30 NEMA officials in the three States, 10 BASEMA official and 750 residents across 5 communities in each of the three selected States) that was used for the study. Similarly, the entirety of these 15 communities in the 3 states constituted the sampling frame for the study.

Furthermore, the coordinate (i.e. Northings, Eastings, and Elevation) were taken at specific locations (otherwise sampling points) across all the 15 communities using certain landmarks like a market, stream, river, bridge, school, canal, road/drainage and farmlands. The instruments for data collection for this study included Community-based Resilience Inventory (CRI), Food Security Inventory (FSI), Flood Disaster Scale (FDS) and Community Livelihood Assessment Scale (CLAS). The CRI was a 15 item self-structured instrument patterned after a four-point rating scale of "Always Available" = (AA, 4-Points) "Available" = (A, 3-Points) "Sometimes" = (S, 2-Points) and "Rarely Available" (RA, 1-Point). Similarly, the CRI instrument consisted of two sections. Section A consists of the personal or demographic data or information of the respondents while Section B consisted of items that aided the researcher to

elicit information or data on the dimensions of community resilience via mobilization, collaboration, alertness, emergency response and management.

Also, the FSI was another 27 items self-structured instrument patterned after a four-point rating scale of "Always Always" (AA, 4 Points), "Always" (A, 3 Points) "Sometimes" (S, 2 Points), and "Sometime Applicable" (SA, 1 Point). In the same vein, the FSI instrument consisted of two sections. Section A consists of the personal or demographic data or information on the respondents while Section B consisted of items that elicited information or data on the extent and effect of the flood on food security.

The FDS was a 22 item self-structured instrument patterned after a four-point rating scale of "Strongly Agree" (SA, 4 Points), "Agree" (A, 3 Points), "Disagree" (D, 2 Points), and "Strongly Disagree" (SD, 1 Point). The FDS instrument also comprised of two sections. Section A consisted of the demographic data or information on the respondents while Section B consists of items on approaches to flood disaster management (via planning and right attitude). The flooded area map of these communities across Bayelsa, Delta, and Rivers States (study area) were also identified and overlaid with its topographic features.

Furthermore, the CLAS was a 35 item self-structured instrument patterned after a four-point rating scale of "Strongly Agree" (SA, 4 Points), "Agree" (A, 3 Points), "Disagree" (D, 2 Points), and "Strongly Disagree" (SD, 1 Point). The CLAS instrument also consisted of two sections. Section A consisted of the demographic data or information on the respondents while Section B consisted of items on livelihood and socioeconomic characteristics. Similarly, the flooded area map of these communities across the study area was also identified and overlaid with its topographic features. Descriptive statistics in the form of frequency and percentages were used to explain the results while inferential statistics in the form of analysis of variance (ANOVA) were used to test the hypotheses at 0.05 level of significance.

4. RESULTS AND DISCUSSION

Table 1 indicates that the frequency and percentage rating on the level of community's resilience to flood always carried out in the core Niger Delta includes: community members contributing to the central funds used for managing flood disasters with 398 representing 63.0% of the sample, and developing community flood response system that helps individuals and households to conform to early flood warning or signals with 330 representing 52.2% of the sample.

It further shows that the frequency and percentage rating on the level of community's resilience to flood rarely carried out in the core Niger Delta includes: Community flood control committee distributes relief materials like foam, pillow, blankets, mosquito nets, buckets, etc. to flood victims with 391 representing 61.9% of the sample, helping flood control committee to effectively use the equipment to detect early flood warning with 357 representing 56.5% of the sample, the response committee effectively measuring and assessing the extent and risk after every flooding incident with 329 representing 52.1% of the sample, NEMA or SEMA engaging members of the community flood control committee on capacity building on ways of mitigating flood menace with 327 representing 51.7% of the sample, and community constructing flood barks, drainage, dam, etc. in order to control or manage flood incidents with 323 representing 51.1% of the sample.

Table 2 indicates that the frequency and percentage rating on the level of community's resilience to flood always carried out in the core Niger Delta includes: Engaging some persons during flood season to dig and clear drainage or channels for the flow of floodwaters to nearby streams with 383 representing 60.6% of the sample, the community provide camp or shelter for residents and households displaced by flood incident with 365 representing 57.7% of the sample, the committee periodically provides information that increases the level of preparedness of individuals and households to the incidence of flood with 340 representing 53.8% of the sample, and engineers and other professionals from my community come together to proffer solutions to flood menace with 328 representing 51.9% of the sample.

It further shows that the frequency and percentage rating on the level of community's resilience to flood rarely carried out in the core Niger Delta includes: Individuals and households willingly donate their used materials/items to increase the community storehouse with 422 representing 66.8% of the sample, privileged

Table 1. Frequency and percentage rating on the level of community's resilience to flood in the core Niger Delta

S/N	Community-Based Resilience to Flood entails:	N= 632				Total	Decision
		AA	A	S	RA		
1.	Community flood control committee distributes relief materials like foam, pillow, blankets, mosquito nets, buckets, etc. to flood victims	91 (19.4%)	150 (23.7%)	124 (19.6%)	267 (42.3%)	632 (100%)	#
2	Developing community flood response system that helps individuals and households to conform to early flood warning or signals	133 (21.0%)	197 (31.2%).	146 (23.1%)	156 (24.7%)	632 (100%)	*
3	Helping flood control committee to effectively use the equipment to detect early flood warning	93 (14.7%)	182 (28.8%)	128 (20.3%)	229 (36.2%)	632 (100%)	#
4	The response committee effectively measuring and assessing the extent and risk after every flood incident	128 (20.3%)	175 (27.7%)	130 (20.6%)	199 (31.5%)	632 (100%)	#
5.	Community members contributing to the central funds used for managing flood disasters	224 (36.4%)	174 (27.6%)	156 (24.7%)	78 (12.3%)	632 (100%)	*
6.	Community constructing flood barks, drainage, dam, etc. in order to control or manage flood incidents	111 (17.6%)	198 (31.3%)	167 (26.4%)	156 (24.7%)	632 (100%)	#
7.	NEMA or SEMA engaging members of the community flood control committee on capacity building on ways of mitigating flood menace	179 (28.3%)	126 (19.9%)	157 (24.8%)	170 (26.9%)	632 (100%)	#

** =Always while #=Rarely*

Table 2. Frequency and percentage rating on the level of community's resilience to flood in the Core Niger Delta

S/N	Community-based resilience to flood entails:	N= 632				Total	Decision
		AA	A	S	RA		
1	Privileged individuals and households encouraged to acquire tools for tackling the menace of flooding	142 (22.5%)	134 (21.2%)	167 (26.4%)	189 (29.9%)	632 (100%)	#
2	The committee periodically provides information that increases the level of preparedness of individuals and households to the incidence of flood	150 (23.7%)	190 (30.1%).	192 (30.4%)	100 (15.8%)	632 (100%)	*
3	Engineers and other professionals from my community come together to proffer solutions to flood menace	108 (17.1%)	220 (34.8%)	139 (22.0%)	165 (26.1%)	632 (100%)	*
4	Engaging some persons during flood season to dig and clear drainage or channels for the flow of flood waters to nearby streams	140 (22.2%)	243 (38.4%)	106 (16.8%)	143 (22.6%)	632 (100%)	*
5	Certain seedlings are given to individuals or households whose farmlands are destroyed by flood	134 (21.2%)	142 (22.5%)	171 (27.1%)	185 (29.3%)	632 (100%)	#
6	Community members participate in building their local capacity for managing flood in short and long term	92 (14.6%)	220 (34.8%)	128 (20.3%)	192 (30.4%)	632 (100%)	#
7	The community provide camp or shelter for residents and households displaced by flood incident	236 (37.3%)	129 (20.4%)	151 (23.9%)	116 (18.4%)	632 (100%)	*
8	Individuals and households willingly donate their used materials/items to increase the community store house	109 (17.2%)	101 (16.0%)	249 (39.4%)	173 (27.4%)	632 (100%)	#

Table 3. Analysis of Variance (ANOVA) on the Mean rating of the variation in the level of community resilience in the flood-prone zone of the Core Niger Delta

Source of variation	Sum of Squares	Df	Mean Square	F	Sig.	Decision
Between Groups	531.677	34	15.638	.818	.760	NS
Within Groups	11412.524	597	19.116			
Total	11944.201	631				

Decision rule: if p<.05 reject H_o, else retain H_o. NS= Not Significant, p>.05

individuals and households encouraged to acquire tools for tackling the menace of flooding, and certain seedlings are given to individuals or households whose farmlands are destroyed by flood each with 356 representing 56.3% of the sample, and community members participate in building their local capacity for managing flood in short and long term with 320 representing 50.7% of the sample.

Table 3 shows that the level of community resilience has no significant variation in the flood-prone zones of the core Niger Delta (F34, 597=.818, p>.05). This indicated that there is no variation in the level of community resilience in the flood-prone zones of the core Niger Delta. This means that there is no difference or disparity in the level of resilience adopted by flood-prone communities.

5. DISCUSSION OF FINDINGS

The result in Tables 1 and 2 revealed that level of community's resilience to flooding rarely carried out in the core Niger Delta includes community flood control committee distributes relief materials like foam, pillow, blankets, mosquito nets, buckets, etc. to flood victims, helping flood control committee to effectively use the equipment to detect early flood warning, the response committee effectively measuring and assessing the extent and risk after every flooding incident, NEMA or SEMA engaging members of the community flood control committee on capacity building on ways of mitigating flood menace, community constructing flood barks, drainage, dam, etc. in order to control or manage flood incidents, individuals and households willingly donate their used materials/items to increase the community storehouse, privileged individuals and households encouraged to acquire tools for tackling the menace of flooding, certain seedlings are given to individuals or households whose farmlands are destroyed by flood, and community members participate in building their local capacity for managing flood in short and long term. This finding is consistent with Kellens et al. [40] who reiterate that the non-existence of certain practices like poor drainage, non-constructing of flood barks, dam, etc., indifference in acquiring the expertise and materials for tackling any danger, and the government's (like ministries, NEMA, SEMA, etc.) failure to collaboratively work with various communities/stakeholders in putting in place effective and proactive localized measures (like provision of improved seedlings, relief materials, etc.) that reduce risk exposure or mitigate the impact of a hazard (like flooding) increases the vulnerability of the people to such a disaster.

In this regard, Adelekan [41] reiterates that poor resilience and utilization of appropriate indigenous and modern techniques or strategies heightens the lack of capacity, deficient knowledge, poor planning, ineffective collaboration, and lack of requisite infrastructure and equipment for effectively mitigating, tackling, coping and recovering the menace of flooding in any community or area. This could be deduced as the remote factor that incites individual or group apathy, negligence and un-enthusiast to instituting or engaging in the acquisition of personal knowledge, competence, and materials/equipment to be incorporated in flood mitigation or control measures. Hence, the perception of residents and families or households in flood-prone communities has always been driven by psycho-social factors that predict their devising response strategies for tackling the menace of flooding including their (i.e. individuals and households) obvious/perceived inability to leverage on the past experiences and lessons learnt from previous flooding incidents. Consequently, the researcher considers the appropriateness of especially local or indigenous mitigation strategies which are tended to increase individuals, households and community responsiveness and level of vigilance to early flood warning signals based on the initial acquisition of knowledge or training for enhanced capacity building, establishment of local structures (like flood control communities) distinct

from existing community structures (like Community Development Committees, Council of Chiefs, and other groups).

For instance, Anyama-Ijaw Community in Southern_Ijaw Local Government Area of Bayelsa State has a functional and distinct Flood Control Committee (FCC) saddled with the responsibility or task of first galvanizing local resources, materials, expertise, and information dissemination medium in improving individuals and households capacity, knowledge, preparation; accurate analysis, response planning, stockpiling of relief materials, volunteering, follow up and other widely accepted and cost-effective resilience strategies instituted to mitigate the impact of flooding in that flood-prone community. This FCC in Anyama-Ijaw community ensures the effectiveness or functionality of the local flood resilience system before consulting or collaborating with other public and private emergency service providers (like Ministry of Environment, NEMA, SEMA, Environmental watch, etc.) at either local government, state or federal levels for often assistances, relief, equipment, materials, and skills beyond their carrying capacity and budgetary allocations or provisions.

Furthermore, Fabiyi et al. [42] stressed the importance of adopting or using indigenous knowledge in remediating and mitigating the impact of flooding. In view of this, indigenous communities living in flood-prone areas extensively use traditional knowledge for forecasting imminent flooding and preparing effective resilience strategies like raising platform or elevation above flood level, using sandbags for shoreline protection, constructing wooden or makeshift bridges, embarking on floating cultivation in floodwater etc. as an improved emergency management and post-disaster recovery method incorporated to avoid the flood not completely disrupting their source of income, food supply and livelihood [31,28].

Similarly, indigenous knowledge is the set of traditionally practised coping strategies that have helped many communities survive natural calamities almost at seeming and comparatively low cost (i.e. both financially and ecological). Hence, utilizing indigenous knowledge in coping with or mitigating flood disasters whilst deriving economic and social gain is predicated on adopting sound principles of interaction between humans and nature [27]. For instance, Kpakiama community in Bomadi Local Government Area of Delta State adopted indigenous knowledge in providing sandbags along the shoreline of the Bomadi River to prevent the overflow of the shoreline of the shallow Bomadi River to lowlands in the community. Also the use of indigenous knowledge or practices in mitigating flood menace is considered apt in the midst of scarce resources, due to the readily availability, accessibility, affordability (i.e. cost-effective), and highly ecologically safe local materials, skills and practices (like smart agriculture) used in tackling the flood disaster [28]. This could suffice for the reason behind Kpakiama community intention for constructing a wall/flood breaker but the paucity of funds made this wall not to go higher, thereby leading to the continual and severe flooding of the Kpakiama community.

6. CONCLUSION AND RECOMMENDA-TIONS

The study revealed that flood-prone communities adopted resilience strategies like contributing funds, developing a response system (like dug and cleared drainage channels, providing camp or shelters for displaced residents and households, etc.), engaging local experts or professionals (like engineers, environmentalists, etc.) in the team controlling the yearly occurring flooding which ravaged the entire or large area of community farmlands causing food insecurity, income reduction, and poor livelihood in the core Niger Delta States. Although, there exist an apparent risk and vulnerability to the imminent threats (like a possible outbreak of diseases, malaria, typhoid fever, diarrhoea, etc., loss of traditional occupation or employment like boat carving, farming, fishing, etc.) from any hazard like flooding. However, the functionality and effectiveness of individuals, households and communities in building their capacity and adopting indigenous knowledge would increase their resilience and conformity to the practices that would mitigate the effect or impact of flooding destroying crops, and feeling of economic trees (like raffia palm, etc.) and their associated marketing, income and employment benefits or derivatives. The study, therefore, recommends that:

1. NEMA, SEMA and other emergency agencies should continue to embark on regular sensitization, meetings, training, programmes, and funding tended to holistically build the capacity of the NGOs, flood control committees, residents, and households in flood inclined areas.

2. Communities must set up an efficient and effective flood control committee that will work assiduously to provide early flood signals, and enhance the capacity of community residents.
3. Finally, communities should proactively exhibit their resilience by first adopting cost-effective and easy comprehensible traditional or indigenous flood coping practices (like using bamboo or wooden planks for bridges, footpaths, settlement, etc.) that will be accepted and implemented by individuals and households before seeking governments support.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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