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Statistical Assessment Of Recent Flood Management Policies In Selected Flood Prone Areas In Nigeria - Gaps And Opportunities For Improvement

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Abstract: ***Due to the devastating consequences of flooding on the environment, health and economic prospects, proactive flood risk management offers the best option in curbing flooding. With increased effort made towards addressing flood related disasters in Nigeria through relevant agencies saddled with this responsibility, the trend of occurrence stands in stark contrast to the current realities. To address this reoccurring menace, the present study investigated the link between the existing flood management policies and its bearing on the extent of its efficacy in flood control. The study was conducted using sample questionnaires, prepared and administered to both flood plain administrators (FPAs) and non-flood plain administrators (nFPAs) across a total of 23 states that formed the study location. The areas were chosen due to their vulnerabilities to repetitive flooding over the past years. The collated data was analysed descriptively and statistically using the Kruskal Wallis test by grouping the responses into subgroups spread across respondents from FPAs and nFPAs for statistical comparison. The findings show that current effort made in the management of flooding can be termed as only reactive especially with regards to provision of palliatives and relied materials to the victims as required. This conclusion was reached by both the FPAs and nFPAs within the domain of the study area. Preventive initiatives targeted at reducing or preventing future flood reoccurrence in the short and long term are not in place. Coordinated flood remedy design by the FPAs is completely out of the activities of the FPAs who have been reduced to provision of relief materials to flood victims. Additionally, the results demonstrate nonexistence of a legitimate agency that is holistically saddled with the responsibility of designing flood preventive measures for implementation in the country. Furthermore, results also show that the use of structural flood control measures is almost non-existent except in very few areas like Lagos with protective walls and levees built along the Atlantic Ocean coastline in Victoria Island. The use of several non-structural remedies for curbing flooding can be seen along the lines of warning signals broadcast over the news media about impending flooding from weather forecasts. Other effective non-structural flooding remedies are reported very slightly by the nFPAs and the FPAs. Among the many recommendations made, there must be commitment by relevant agencies in planning flood resistant communities by strict adherence to building codes, land use and control act, as well as the use of local policies amongst others.***

Keywords: Flood management, Flood risk management, Flood reduction.

I. INTRODUCTION

Flooding constitutes one of the major ecological disasters in Nigeria creating environmental, economic, health, and social problems (Oladokun and Proverbs, 2016; Nwankwo, 2015; Agbonkhese et al., 2014). In recent times, flood cases have rather become unparalleled. Globally, climate change, rising sea levels, increasing population growth, economic

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development on flood plains, poor flood management policies amongst other factors have exposed up to 70 million people to severe flooding (Peduzzi et al., 2009; Raaijmakers et al., 2008). Between 1985 and 2016, up to 3800 cases of flood disasters have been recorded globally (EM-DAT, 2018), resulting in deaths in the order of hundreds of thousands, rendered billions of persons homeless with physical injuries and contaminated the environment with various forms of diseases (Ahern et al., 2005; Tapsell and Tunstall, 2008; Hunter, 2003; Tunstall et al., 2006). In just 2016 alone, flood related damages totalling almost US$ 59 billion was reported in 31 countries out of the 79 that experienced such disasters. This sum is about 38 % of all flood damages in 2016, which is above the average of 24.6 % reported for the years 2006-2015 (CRED, 2016).

In Nigeria, hundreds of thousands of people have already been impoverished due to flooding resulting in the loss of property and severe health implications; and policies for addressing flood challenges are critical (ActionAid, 2006; Obeta, 2014). Obviously, the country has been hit by severe flooding affecting millions of people and resulting in property loss amounting to billions of naira propelled by climate change, poor urban planning, and building in waterways (NEMA, 2013; Adeloye and Rustum, 2011; Cline, 2007).

Health related issues are often associated with flooding especially in rural areas with long-term effects (Aliyu 2015; Olanrewaju et al. 2019). Flooding has both direct and indirect impacts on health. Increased deaths and injury are direct effects of flooding with 90% of these direct effects having occurred in developing countries like Nigeria (Zorn 2018). Nigeria's fledgling health sector suffers setbacks from annual flooding disasters. Water-borne life-threatening disease epidemics like Typhoid, Cholera, and Dysentery are common during flooding (Okaka and Odhiambo 2018; Rieckmann et al. 2018). Floods provide a perfect breeding ground for parasites like mosquitoes which leads to a rise in the incidence of parasite borne diseases like Malaria.

Sadly, while floods continue to damage properties, the after-effects of the 2012 incidences were unparalleled (NEMA, 2013; CRED, 2016). At Kainji, Jebba and other surrounding dams around the Rivers Niger, Benue, and Gongola, heavy rains triggered the flooding of human settlements between July and October 2012. On some occasions, the dams were damaged, while others experienced an overflow due to forceful release of turbulent waters. (NEMA, 2013; CRED, 2016). In 2012, the floods killed 363 people; injured 5,851 and displaced 3,871,531 (NEMA, 2013; CRED, 2016). The 2012 flooding impact was devastating following grave loss of lives and properties. Several persons were displaced, while properties in the order of billions of US dollars were damaged, with more than 207 cases of deaths. It led to the closure of many schools and denied access to healthcare facilities (NEMA, 2013). Furthermore, in September 2018, there was over 100 deaths stemming from floods in some Nigerian states due to heavy rains that triggered an overflow of the Niger and Benue rivers, respectively (Premium times, 2018). At the same time, eight other states including Kwara, Edo, Kebbi, Taraba, Adamawa, Rivers, Benue, and Bayelsa were being monitored.

In the light of the developments, however, there have been potent measures across all levels of government and communities to curb flooding in Nigeria. However, these measures have not been well established (Olorunfemi, 2011; Obeta, 2014). Most of these measures are often established after a severe flood event in order to cushion the sufferings caused by it. This post flood remedies have impacted negatively on various communities that have lost homelands, crops and loved ones to severe repetitive flooding.

In a bid to reduce the frequency of flooding, proactive policies are used in developed countries. This often involves non-structural measures in the form of research on the assessment and prediction of flood events and their impact (Freer et al., 2011). These model methods are used extensively in mapping of flood hazard (Apel et al., 2006; Dutta et al., 2006), flood damage valuation (Bhuiyan and Dutta, 2012; Merz et al., 2010), time based flood forecasting (Arduino et al., 2005), flood related engineering (Gallegos et al., 2009), and water resources development (Vaze et al., 2013). They also serve as prelude in the investigation of river bank erosion and transportation of floodplain sediment (Marriott, 1992), toxins, floodplain conservationism (Karim et al., 2015) and river structure hydrology (Dutta et al., 2013). Flood modelling is also applied in the formulation of climate adaptation and risk mitigation strategies when combined with river models, climate models and hydrological models (Teng et al., 2017). Sadly, this policy method of flood preparedness is entirely lacking in Nigeria. The existing structural and non-structural based flood management policies have yielded little or no result in flood risk management as more flood continue to occur.

At the moment, Nigerians have not effectively braced up to the challenges of fighting floods as shown in the basic environmental risk research themes like Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) (DEFRA, 2013; EC, 2004). Apparently, following the growing number of flood victims and its impact on the economic cycle of affected places, tangible research to providing flooding remedies is weak, and can be concluded to be non-existent in Nigeria. The attention of related research on flood is centred on theoretical provision of remedies in several communities, geopolitical zones and states in the country (Adelekan, 2010; Ologunorisa, 2004; Ojigi et al., 2013; Aderogba et al., 2012; Ogwuche and Abah, 2014; Nwilo et al., 2012). Accordingly, it has been strongly suggested that more involved discussions are necessary for an elaborate understanding of the extensive flooding which is presented in some related research (Obeta, 2014; Bashir et al., 2012; Adeoye et al., 2009; Ali and Hamidu, 2014; Agbonkhese et al., 2014). As shown in literature, there are very minimal studies on flood risk management via hydrodynamics, geographic information system, cellular mechanisms and statistical techniques (Adegbola and Jolayemi, 2012; Garba et al., 2013; Nkwunonwo et al., 2014; Nwilo et al., 2012; Adewale et al., 2010; Thompson and Hollis, 1995; Pinho et al., 2014). For instance, Egbenta et al., (2015) showed that very little research is available in Nigeria on the effects of flood risk management, while Nkwunonwo et al., (2015) showed that the available information on some key features of flooding in Nigeria are non-quantitative. Although there are various

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interventions in the past, an integrated flood management policy system and planning capacity which reflects the ecological structure, infrastructural growth, institutional performance and other socioeconomic features of the Nigerian environment is missing (Adedeji et al., 2012; Storbjörk, 2007; Tran et al., 2009). This missing link has resulted in repetitive flooding in all flood prone areas of the country. Consequently, this study proposes to present a detailed study on the assessment of flood management policy, planning capacity and health implications in selected flood prone areas in Nigeria. It will contribute to the effective understanding of the present flood risk management policy scheme in Nigeria and offer a context for exploring options to enhance resilience and achieve sustainable solutions.

II. STUDY AREA

The study was conducted in Nigeria with emphasis on states having history of repeated flooding in recent times. Several states fell in the category but 23 states were selected to represent the six geopolitical zones of the country. All flood prone areas in each of the six geopolitical zones were selected for the study. In the south-east region, Anambra, Enugu and Imo states were selected. In the south-south, the states used for the study were Akwa-Ibom, Bayelsa, Cross-River, Delta, Edo and Rivers. Furthermore, Ekiti, Lagos, Osun, Ondo, Ogun and Oyo represented the south-west. In the north-east, the states that fell in the category were Adamawa, Taraba and Yobe. The north-west had Kano, Sokoto, Jigawa and Zamfara, while Niger state represented the north-central. Nigerian map with indicated regions covered in the study is shown in Fig. 1. The rainfall data is similarly shown in Fig. 2. Although there are several communities, and urban centres that are prone to flooding in each Nigerian state, the research collectively considers the statistical analysis of the opinion expressed by a representative sample of the states. Nigeria is a Western African sub-Saharan country on the Gulf of Guinea to the East, Greenwich to the North, and the Equator to the North. It has 36 states with a total land area of 923,768 km^2 and is bounded by Benin and Niger Republics, Chad and Cameroon (Nkwunonwo et al., 2015). The coastline has a wide range of hydrological features, over 853 km wide and includes the Niger and Benue rivers which both meet Lokoja (Nkwunonwo et al., 2015).

Figure 1: Map of Nigeria showing flood prone areas considered in the study

III. METHODOLOGY/RESULTS

A. PRIMARY DATA SOURCES

The primary data comprises collected first-hand data from the both the people who are affected by flood in the flood prone areas and flood management experts/agencies or institutions in the affected Nigerian states using the designed flood management policy and planning capacity questionnaire (FM&PC-Q). The flood management agencies include Nigeria Hydrological Services Agency (NIHSA), Nigerian Metrological Agency (NIMET), Federal Environment Protection Agency (FEPA), and National Emergency Management Agency (NEMA).

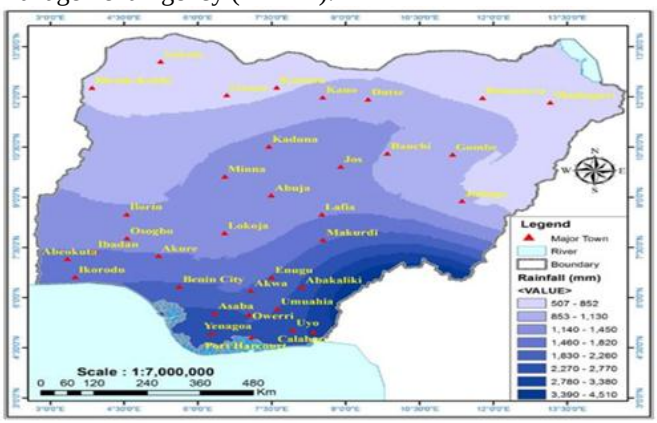

Figure 2: Rainfall characteristics in Nigeria

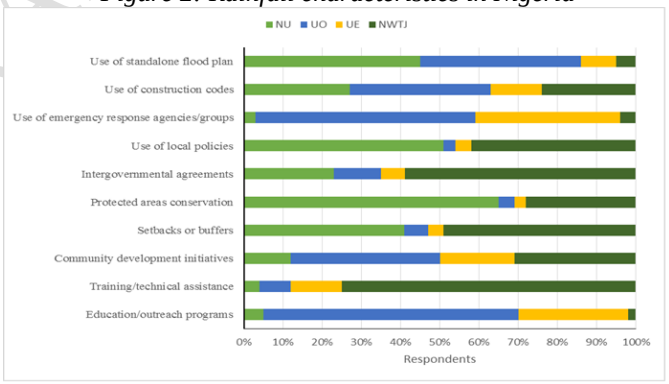

Figure 3: Questionnaire response (FPAs) on the frequency of use of non-structural/policy approaches for responding to repetitive flooding in their jurisdiction over the past five years

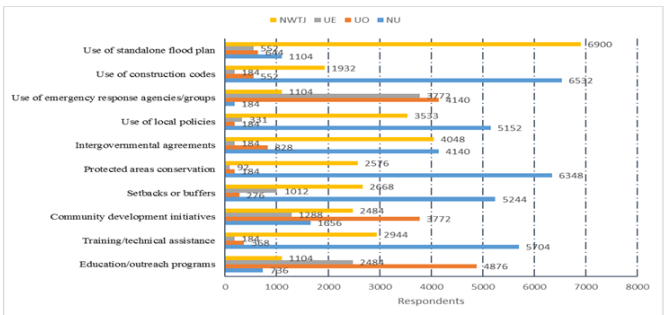

Figure 4: Result of questionnaire response (nFPAs) on the frequency of use of non-structural/policy approaches for responding to repetitive flooding in their jurisdiction over the past five years

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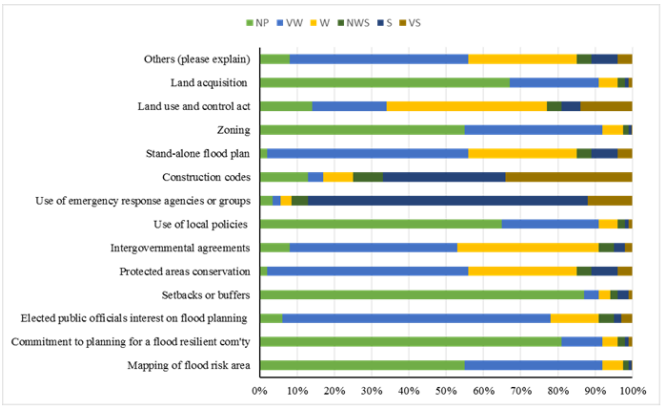

Figure 5: Questionnaire response on how strong some flood planning and/or hazard mitigation features have been in the last 5 years

IV. DISCUSSIONS

Several research questions were formed to get the minds of stakeholders and the local residents on past flood management efforts. Accordingly, the frequency of use of non-structural or policy approaches for response to repetitive flooding in the respondents' jurisdiction's over the past five years shown in Figs. 3 and 4 for FPAs and nFPAs.

The results of the response from the FPAs on some planning and mitigation features against flooding in the study area is shown in Fig. 5. Up to 55 percent are of the opinion that there are virtually no provisions for mapping of flood risk areas and a lack of commitment to planning for flood resistant communities. To an extent, there is an interest on flood planning by elected public officials. However, the implementation has been weak, as attested to by 72 percent of the FPAs. There is also little or no construction of buffers along the coastline to prevent coastal flooding with very minimal reservation of protected areas conservation for disaster risk reduction. Protected areas such as wetlands provide essential overflow reservoirs to reduce peak flood height and minimize impacts on people, agriculture and infrastructure. Forests and woodlands buffer and absorb flood waters, slowing the rate of flow (Dudley et al. 2015). Such practice is reported to be absent in the study area by about 85 percent of the FPAs.

Intergovernmental agreements which is intended to formalise and standardise services provided to states and emergency services agencies, agree on clear allocation of responsibilities of the federal government, the states, and local governments for management of flood, extreme weather and hazard impact events was also captured in the questionnaire and shown in Fig. 5. The FPAs opinion reflects a weak arrangement for intergovernmental agreements on issues related to flood management. The response also shows very poor arrangements in terms of the creation and utilization of local flood management policies, construction codes, stand-alone flood plan, zoning, land use and control act, as well as land acquisition for effective flood management strategies.

Further features of the questionnaire response are shown in Fig. 6, on the strength of some flood planning and hazard mitigation practices in the last 5 years within the experts in the study areas. Zeal and commitment to planning for a flood resilient community was observed to be generally poor as accounted for by up to 70 percent of the respondents. The same trend was observed with elected public officials' interest towards proper flood planning and management; sharing of information or ideas among staff members (in the same organization or in other organization within the same jurisdiction); and verbal communication among staff and members (in the same organization or in other organisation within the same jurisdiction) with regards to provision of flooding remedies.

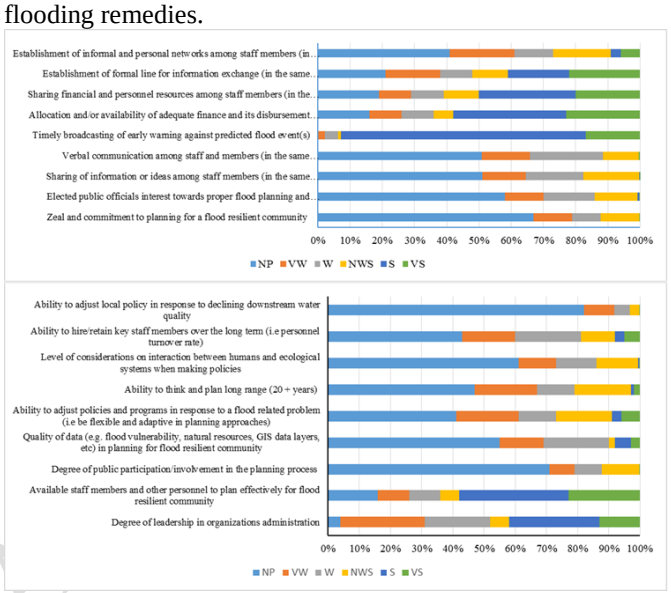

Figure 6: Results of questionnaire 4 response on how strong some flood planning and/or hazard mitigation features have been in the last 5 years

B. FINDINGS ON RELATIONSHIP BETWEEN FLOOD INCIDENCE/MAGNITUDE AND OUTBREAK OF DISEASES WITHIN FLOOD PRONE AREAS

The study showed that there is a direct bearing of flooding on the outbreak of diseases in the flood prone areas. Nigeria's fledgling health sector suffers setbacks from annual flooding disasters. Water-borne life-threatening disease epidemics like Typhoid, Cholera, and Dysentery are common during flooding (Okaka and Odhiambo 2018; Rieckmann et al. 2018). Floods provide a perfect breeding ground for parasites like mosquitoes which leads to a rise in the incidence of parasite borne diseases like Malaria. Women and children are especially vulnerable to these diseases which can lead to death. Flooded homes provide a good damp environment for mildews and molds to grow sporadically which triggers upper respiratory illnesses for people who have allergies and episodes for asthma patients. Such health problems mostly affect the elderly and children.

Pollutants like insecticides and pesticides, animal, and human faeces, sewage, fertilizers, and other contaminants are rife in floodwaters which also carry disease causing micro-organisms (Oriji, 2015). Contact of contaminated waters with agricultural crops and food items elsewhere makes food unsafe for human and animal consumption. Power outages are common during flooding disasters and this affects food stored

in the home and may cause serious health threats (DFTE 2017).

C. FINDINGS ON VARIOUS FLOOD MANAGEMENT POLICIES IN NIGERIA

The findings emphasized that flood incidence is on the increase and need urgent management strategies. The level of damage ranges from high cases of property damage, loss of lives, social amenities, and economic loss, amongst others. Although there is a national framework aimed at moving reactive flood response and recovery to pro-active risk management, however, not much have been done and a national FRM strategy to ensure harmonization of practice is still non-existent. At present, there is a relatively weak flood-planning system in Nigeria with no integration of planning with existing flood risk management (Oladokun and Proverbs, 2016). In the light of the foregoing, a critical assessment of the weak flood risk management status, and the necessary planning capacity is required to create a robust response strategy.

V. SUGGESTIONS AND PROSPECTS FOR IMPROVEMENT

Based on the results obtained from the analysis of the responses from the questionnaire, the following areas must be addressed to curb the menace of repetitive flooding in the considered study area. The recommendations are based on the missing link between the establishments of the policies tailored towards flood control and the severity of implementation.

A. MASSIVE AND SUSTAINED DEPLOYMENT OF STRUCTURAL FLOOD CONTROL MEASURES

Most of the responses has pointed to very little or zero practice of installation of structural flood control measures spread across the study area. The clearing of debris along waterways has only been implemented along certain districts in most of the metropolis in the study areas. During heavy rainfall, the cumulative effects of blockades on most uncleared waterways overwhelms earlier efforts and results in flooding. It is recommended that the clearing of debris in waterways should be holistic along all major water channels in the metropolis and other areas where fluvial flooding is reoccurring. Where practical, channelization of water should be implemented to ease the passage of water to abate fluvial flooding. Granted, local efforts are reported in the design of channels in the study areas. However, the role of the flood plain administrators on the design of water channels is virtually absent. The duties of the FPAs should include the design and implementation of water channels to reflect the topography of the localities. Also, the building of structures on water channels must be regularly checked by the FPAs.

The report of coastal flooding from the study area in the questionnaire is shown to be about 40 %. However, the building of levees and dams is almost absent in the study areas. The building of levees will assist in curbing coastal flooding especially in areas along the rivers Niger and Benue.

B. IMPLEMENTATION OF NON-STRUCTURAL FLOOD CONTROL MEASURES

The level of education and outreach programs on flood control measures is poor. Regular outreach programs on the role the locals can play to reduce flooding is imperative especially with respect to the disposal of waste in waterways. The FPAs staff may need to undergo regular training and technical assistance from relevant bodies to boost their planning and response strategy in case of flood issues. Community developments may also enhance the overall response to subtle flood causes and may enhance the behavioural patterns of local residents with the need to restrain from building in waterways and disposal of refuse into water runoff during rain.

Proper regulation of land use and control act, strict adherence to building codes and conservation of protected areas are equally necessary flood management policies which should be implemented. The mapping of flood risk areas with the view to consolidating on the establishment of structural control measures in anticipation of flooding is recommended. The use of emergency response agencies has only assisted in catering for the needs of flood victims with virtually empty public officials' interest towards proper flood planning and management as shown the collated data. A blueprint for flood management must be established for both pre- and post-flood occurrence that will reflect specific geographical features.

C. STRENGTHENING OF FPAS FLOOD PLANNING HAZARD MITIGATION

The role of FPAs in flood planning and hazard mitigation was shown to indicate a weak approach in the design of effective flood management. The features of the FPAs was shown largely to be hinged on provision of relief materials to flood victims after flooding and minimal timely broadcasting of early warning against predicted flood events. There must be zeal and commitment to the planning of flood resistant communities by strict adherence to building codes, land use and control act, as well as the use of local policies. Verbal communication among staff and members in the same organization or in other organisations within the same jurisdiction is encouraged. This is to assist in early timely design of local flood disaster strategies. In addition to timely broadcasting of early warning against predicted flood events, there should be allocation and availability of adequate finance and its disbursement toward proper flood management/planning. Furthermore, designs of long-term flood planning must be implemented considering the interaction between humans and ecological systems when making such policies.

D. LEVEL OF PREPAREDNESS IN REDUCING FLOOD EVENTS

The level of preparedness in tackling repetitive flooding is low according to the responses from the FPAs as shown in

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Fig. 7. There is poor adaptation plan with regards to the peculiarities of the study area, limited public information on the role of local communities in assisting in the implementation of flood control measures, and relatively little structural measures dedicated to flooding. Recovery plans, water retention structures especially along the coastline, and re-naturalization of repeated flooded areas are strongly needed to tackle coastal flooding in the study area.

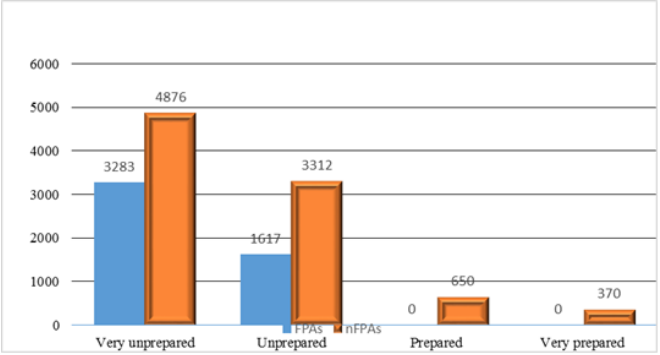

Figure 7: Results from the level of government preparedness in tackling flooding

VI. CONCLUSION

The present study investigated the link between the existing flood management policies and its bearing on the extent of its efficacy in flood control. Sample questionnaires were prepared and administered to both flood plain administrators (FPAs) and non-flood plain administrators (nFPAs) across a total of 23 states that formed the study location. The areas were chosen due to their vulnerabilities to repetitive flooding over the past years. The findings are that the current effort made in the management of flooding can be termed as only reactive especially with regards to provision of palliatives and relief materials to the victims as required. This conclusion was reached by both the FPAs and nFPAs within the domain of the study area. Preventive initiatives targeted at reducing future flood reoccurrence in the short and long term are not in place. Coordinated flood remedy design by the FPAs is completely out of the activities of the FPAs who have been reduced to provision of relief materials to flood victims. Additionally, there is no legitimate agency that is holistically saddled with the responsibility of designing flood preventive measures for implementation in the country. The study suggests the streamlining of relevant agencies who form the bulk of FPAs with emphasis on proper design of flood risk management as it relates to prevention other than reaction and strict implementation of their recommendations.

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