DETERMINING FLOOD MITIGATION MEASURES IN SELECTED LOCAL GOVERNMENT AREAS IN ANAMBRA STATE

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Abstract
This study was driven by the need to determine flood mitigation measures already adopted by the five selected local Government Areas of Anambra State which have had persistent flood incidence. It is hoped that findings of this research will help to improve on the areas where mitigation measures are inadequate. Purposive sampling technique was used in selecting the study area, and simple random sampling technique was used to select the respondents. In all, a total of 392 out of 400 structured questionnaires administered for data collection were retrieved. Analysis of the responses revealed that public education and early flood warning on overall mean responses of 3.33 was highest. Subsequently, overall mean responses on flood warning being issued by government before any flood incidence was seen on 3.31; enforcement of environmental sanitation law was seen on 3.27; enforcement of periodic sanitation was seen on 3,23; clearing of drainages and water ways was seen on 2.92; construction of drainages by the government war seen on 2.67; and construction of drainages through community effort was seen on 2.50. Analysis of responses also revealed that poor flood mitigation measures on the area of construction of artificial levees; building of dams; and afforestation of waterways. Their overall mean responses are 2.14; 2.22; and 2.32 respectively. The research therefore recommended among others that intensive agro forestry along major drainage networks to regulate river flooding, and within fast developing areas to minimize incidence of surface runoff that is associated to increasing paved surfaces. Additionally, it recommended construction of dams at the upper catchment in the basin, and artificial levees to regulate excess water and floods during heavy rains. It also recommended regular clearing of existing water ways as well as construction of more drainage channels to enable easier and freer water flow within their channels.

1. Introduction

Floods are said to be environmental hazards of meteorological phenomena and origin, but very often induced by man's improper use or abuse of the physical environment, and studies in recent times have shown certain human activities that aggravate the chances and make it worse whenever they come. Certain anthropogenic activities such as land use/land cover change, channel river modification, deforestation and urbanization within flood-prone areas have influenced the occurrence of flood disasters (Ebuzoeme, 2015, Berbante, 2017). These human activities, especially the expansion of impermeable surfaces through urbanization processes, decreased the soil moisture retention capacity, resulting in more surface runoff and, hence, more sudden torrential floods (Panahi et al., 2010).

However, long before man started interfering, altering and modifying the natural environment to suite his economic interest, most communities bordering with river Niger in the present Anambra state were naturally forested. But with the advent of man's interventions, his continuous distortion and modification of the natural environment, forest covers gradually started disappearing, the soil was left bare and exposed to various types of erosion and soil degradation, and buildings of various heights also started springing up, roads and many open spaces becoming paved and man due to quest

for more space, competition on land for other economic uses and due to poor urban planning and weak urban governance have extended his encroachment on the floodplains and natural waterways. Such activities, according to Lwena and Yongo (2010); and Acheampong and Anokye (2013), are capable of silting the rivers, distorting the natural land cover in the area and exposing lives and properties to griever dangers of flashflood.

Today, Anambra State is in the list of the states in Nigeria with frequent flood disasters. Records of persistent flooding and disaster occurrence in the nearest time include that of 2012, 2018 and 2022, with that of 2012 being one of the worst in history, and which significantly impacted the state with her 57 communities in 8 local government areas underwater. Among these affected local governments, Anambra West, Anambra East, and Ogbaru were among the four most affected, Onitsha North and Onitsha south were also among the eight affected but at varying level. By 2022, Anambra West, Anambra East, Onitsha North, Onitsha south and Ogbaru LGAs were affected by terrible flood disaster, leading to massive displacement of individuals and great damage to infrastructure (NEMA, 2022). It is also on record that each time there is such incidence, lives are lost, and hundreds of houses are submerged leaving thousands homeless and squatted in internally displaced persons (IDP) camps, crops are washed away, goods and properties worth millions are destroyed. For instance, in the most recent flooding incidence of 2022, a total of seventy-six persons were reported dead while fleeing from rising water levels in Anambra State alone (NEMA, 2022). This study however seeks to identify these human-induced drivers of flooding contributing to this continuous inundation of the area.

However it is becoming worrisome that the flood incidence and its accompanying losses is increasing progressively over the years. This suggests that if adequate measures are not put in place to regulate the rate at which man has continuously intervened on the natural environment, there is likelihood that more severe flood disaster not yet experienced will occur in future. Therefore in other to address the persistent incidence this research seeks to identify the flood mitigation measures already adopted in the five selected local government areas and to make recommendations were there are inadequacies.

1.1. Literature Review

The causes of flooding as well as their mitigation measures across the world differ. For instance, in the work of Tabiri (2015), the four main causes of floods in Accra metropolis, Ghana are negligence/ignorance or sheer megalomania, poor planning of the city, building on waterways and indiscriminate disposal of waste material. Tabiri observed that Accra is exposed to the challenges of flooding and that urgent measures need to be put in place in order to minimize the challenges of flooding in Accra. Among such include the development of good drainage channels to facilitate surface run-offs and the appropriate disposal of waste by relevant agencies.

Hansson, Manielson and Ekenberg (2008), also designed a framework for the evaluation of flood management strategies. They contend that flood management has remained a problem mostly in developing countries, due to weak economies. However, they argued that governments in developing countries lack adequate institutional system for applying cost effective and reliable technologies for disaster prevention, early warnings, and mitigation. Their study took northern Vietnam as an example of a developing region for the assessment. They observed that for flood hazards to be effectively managed, they are need for incorporation of stakeholders and effective environmental monitoring by experts in the built environment.

Rufa'i (2020) assessed household preparedness to flood risk hazard in Nigeria. He noted that climate change which triggers severe rainfall results in flooding. While flooding is increasing in terms of occurrences in Nigeria, the preparedness of households has not been given attention. He based his study on review of existing literature which point to the fact that households are losing properties, lives and other valuables to flooding. Poor preparedness of the residence as pointed out by the researcher could be associated to ignorance and poor disaster awareness by the responsible agencies. This points to importance of early warning and proper sensitization of people living in flood prone areas otherwise more properties, lives and valuables will continue to be lost.

In a similar study, Nwigwe and Embergo (2014) assessed the causes and effects of flood in Nigeria. Their findings showed that the development of illegal structures on or across drainage

channels, land reclamation or encroachment, poor physical planning, inadequate drainage channels, blockage of canals and drains, collapsed dams and nature of terrain were the primary causes of flooding in major cities and towns in Nigeria.

A study by Bradshaw, Sodhi, Peh and Brook (2007) looked at deforestation and its contribution to flooding. The study collected data from 1990 to 2000 from 56 developing countries around the world, and the results showed an increase of 4%- 28% in flood frequency due to a 10% decrease in natural forest area, and a 4%- 8% increase in total flood duration. This is acceptable because presence of vegetation modifies the climate, intercept rain water and slow its movement process up to secondary interception. This slowed movement reduces surface runoff and by extension flooding of rivers. The natural factors are excessive rainfall, topography and soil management strategies (Njoku et al., 2020). Anthropogenic factors that have the probability of causing flood risk include intentional sprawl to the riverbanks, deforestation, housing development on flood prone areas and indiscriminate waste disposal.

Fohrer et al. (2001) applied the physically based hydrological model to a meso scale catchment to assess the impact of land use changes on the annual water balance and temporal runoff dynamics. It was shown that surface runoff was most susceptible to land use changes. Though with diverge methodology and different periods of these investigation, one factor that remain constant is that removal of vegetation covers due to other land uses increased overland flow and subsequently led to flooding.

Solin et al. (2010) also concluded in this study that the frequency of flood events increases with the increasing total land cover change in a catchment and this tendency is clearly distinguishable. However, there is no difference in frequency of flood events as far as type of land cover change (accelerating or decelerating runoff) is concerned.

Njoku, Amangabara and Duru (2013), used GIS techniques in spatial analysis of flood vulnerability in Aba metropolis, finding that areas 35–39 m and 43–48 m above sea-level are prone to flooding as runoff from higher elevations flows through areas of lower elevations. Deforestation, agricultural activities, and rapid increase in barren land result in increased runoff and river discharge. From the findings it is seen that areas as low lying as 35m-48m experiences flooding in urban area, if same magnitude of deforestation is experienced along river banks high magnitude of flood could be felt due more increased runoff and more river discharge.

Similarly, Hirji et al. (2002) reproduced a flow time series for the Iringa catchment in Tanzania and the study showed equal runoff coefficient for the forested as well as cultivated land. Runoff from the forested catchment was markedly lower in dry the season. This again showed how vegetation played vital roles in regulating excessive runoff.

2. Method

2.1. Study Area

The study was conducted in five selected local government areas of Anambra State that always witness flood incidence. The local government areas involved are: Anambra East, Anambra West, Onitsha North, Onitsha South and Ogbaru. The area is bounded by Kogi State in the north; Ayamelu, Awka North, Oyi, Idemili North, Idemili South, Ekwusigo and Ihiala local government areas by the east; Oguta local government of Imo State by the south; and River Niger by the west. The total landmass of the five local government areas is 1,777.6 km^2. The area is geographically located between latitude $5^0 10^1$ N and $6^0 50^1$N and between longitude $6^0 38^1$ E and $6^0 80^1$E (Fig 1 and 2).

Figure 1. Map of Nigeria Showing Anambra State

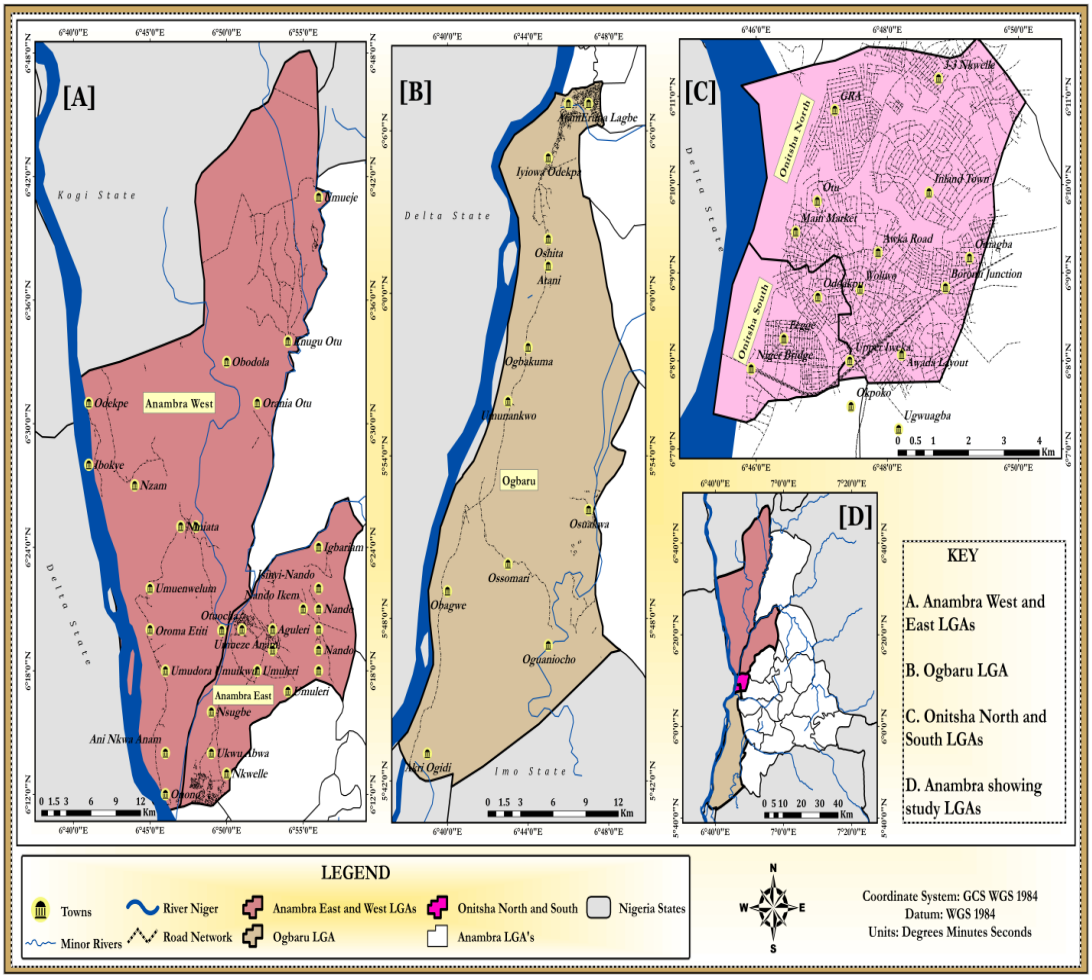

Figure 2. Map of the Study Area

Climate of the area under Koppen's classification falls within the tropic wet and dry type (Aw), otherwise called tropical savanna. The rainfall is patterned so that the long-wet season usually occurs from April to October, while the dry season occurs from November to March. The Mean annual rainfall is about 1805mm, while the maximum and minimum temperatures are 32.1^0C and 23.5^0C, respectively. Geologically, the area lies in the recent deposit of the (Holocene Epoch/Quaternary Period, occupying and extending to the active floodplain of River Niger. Its soil type is majorly of alluvium formation from the Niger River sediment, and topographically, it is majorly low-lying topographically and characterized by plains and gentle slopes (Ejikeme *et al.,* 2015). The area is also drained by river Niger and its numerous tributaries, all in the East-west direction and emptying into river Niger. These major tributaries include Omambala/Anambra, Nenge/Oyi, kisa/Nkisi and Idemili. According to the National Population Commission, as projected to 2023, the population of Anambra West is 297,655; Anambra East is 223,157; Onitsha North is 317,691; Onitsha South is 354750; and Ogbaru is 483826 persons. This amounts to a total population of 1,677,079 persons in the five local government areas.

2.2. Data Need

The administrative shapefiles delineating the boundaries of the study area were obtained from the Office of the Surveyor General of the Federation (OSGOF). Population density data were sourced from the National Population Commission (NPC) for the year 2006 and subsequently projected to 2023. Furthermore, relevant published and unpublished records, as well as supplementary materials, were gathered from online journals, departmental archives, and other institutional sources.

2.3. Data Collection

The instrument used in collection of data was a structured questionnaire. The construction of the questionnaire was guided by the research question raised in this study. The items in the questionnaire were made up of two parts (Section A and B). Section A of the questionnaire contains question on the personal data of the respondents, while section B requested information regarding the research question which the respondents were requested to tick on a four-point Likert scale. The response categories indicated the level of agreement or disagreement on each question item.

These response categories were:

Strongly agree = SA

Agree = A

Disagree = D

Strongly disagree = SD

The instrument was given to experts in measurement and evaluation who made necessary corrections that established it content and face-validities. So, it was validly adequate for use in the collection of data for the study.

The raw data collected through the questionnaire were analyzed using frequencies and statistical mean based on the four-point scale (4=SA, 3=A, 2=D & 1=SD). The mean was used to determine respondents' opinions towards human-induced drivers of flooding in the study area. Items with a mean of 2.50 or above were accepted while any items with a mean less than 2.50 were rejected. The statistical mean formula used for the analysis is as follows:

$$X = \frac{\Sigma FX}{\Sigma F} \quad (1)$$

Where:

Σf = Sum of all the frequency

Σfx = When all the figures in column fx are added

Σ = is the Greek letter Zigma which instruct one to sum

X = the symbol for mean
X = is the score
F = frequencies

2.4. Sample Size and Technique

A total of four hundred (400) persons were sampled based on Taro Yamane's formula of 1967. Thus, Taro Yamane's formula:

$$n = \frac{N}{(1+N\,(e)2)}$$

Where:
n = the sample size
N = the population of the study is 1677079 (NPC 2023 projected population)
e = the margin error in the calculation is 0.05

The respondents were spread across residents, local government staff and agencies responsible for disaster and flood management. According to (NPC) is as follows:

Anambra West = 297,655; Anambra East = 223,157; Onitsha North = 317,691; Onitsha South = 354,750; and Ogbaru = 483,826 making a total of 1,677,079 persons for the study area. Therefore, the 5% sample size for proposed respondents in Anambra West is 71; Anambra East is 53; Onitsha North is 76; Onitsha South is 85; and Ogbaru 115, respectively.

Table 1. Questionnaire Return Rate

Local Government Area (Study Area)	Administered Questionnaires	Returned Questionnaires	% of Returned Questionnaires
Anambra West	71	69	97
Anambra East	53	51	96
Onitsha North	76	75	98
Onitsha South	85	84	99
Ogbaru	115	113	98
Total	400	392	98

3. Results and Discussion

This section discusses the results of the analysis of this research based on the earlier stated objective. All the items were rated above the cut-off point of 2.50 on a four-point rating scale, and respondents responded to a series of questions related to human induced drivers of flooding in all the selected Local Government Areas making up the study area.

Table 2. Mean Ratings on Flood Mitigation Measures Adopted in Anambra West L.G.A

No	Question Item	Mean	S.D	Decision
1	Clearing of drainages and water ways have been adopted as a measure against flooding	2.59	1.09	Agree
2	Construction of drainages is a preventive measure adopted by the government against flooding.	2.42	1.13	Disagree
3	Construction of drainages is one of the measures adopted by your community against flooding.	2.43	1.14	Disagree
4	Enforcement of Environmental sanitation law has been initiated by the government	3.20	1.14	Agree
5	Enforcement of periodic environmental sanitation is conducted and monitored by the government	3.17	1.01	Agree
6	Public education and early warning are carried out and adequately	3.20	0.96	Agree
7	Relocation of flood affected victims is carried out in time.	3.39	0.85	Agree
8	Afforestation of waterways and basins has been adopted by the government.	2.20	1.03	Disagree
9	Building of dams to regulate water flow has been adopted by the government.	2.11	1.07	Disagree
10	Construction of artificial levees to regulate flooding has been initiated by the government.	2.04	1.11	Disagree
11	Flood warning is always issued by government before any flood incidence	3.49	0.88	Agree
	Cluster mean	2.75		Agree

The data presented on Table 2 show the mean responses of respondents of Anambra West Local Government Area on the flood mitigation measures already adopted in the area. From the study as indicated in the table, respondents strongly agreed, that enforcement of environmental sanitation law has been initiated by the government, enforcement of periodic environmental sanitation is conducted and monitored by the government, that public education and early warning is carried out and adequately, that relocation of flood affected victims is carried out in time, and that flood warning is always issued by government before any flood incidence. Thus, mean scores obtained from the respondents are as follows: 3.20, 3.17, 3.20, 3.40 and 3.49 respectively. The respondents also agreed at a mean score of 2.59 that clearing of drainages and water ways have been adopted as a measure against flooding in the area. However, respondents vehemently disagree that construction of drainages as a preventive measure have been adopted by the government against flooding, that afforestation of waterways and basins has been adopted by the government, that building of dams to regulate water flow has been adopted by the government, and that construction of artificial levees to regulate flooding have been initiated by the government. Respectively, their mean score are as follows: 2.42, 2.43, 2.20, 2.10, and 2.04. Thus, the cluster mean of 2.75 as shown in the table indicates presence of flood mitigation measures though underscores the need to afforest the river basin in other to regulate surface runoff and frequency of river flood events which is on the increases in the area, increasing in the process, the total land cover change in a catchment (Solin et al., 2010).

Table 3. Mean Ratings on Flood Mitigation Measures Adopted in Anambra East L.G.A

No	Question Item	Mean	S.D	Decision
1	Clearing of drainages and water ways have been adopted as a measure against flooding	3.02	1.06	Agree
2	Construction of drainages is a preventive measure adopted by the government against flooding.	2.51	1.13	Agree
3	Construction of drainages is one of the measures adopted by your community against flooding.	2.53	1.14	Agree
4	Enforcement of Environmental sanitation law has been initiated by the government	3.41	0.89	Agree
5	Enforcement of periodic environmental sanitation is conducted and monitored by the government	3.25	1.01	Agree
6	Public education and early warning is carried out and adequately	3.43	0.95	Agree
7	Relocation of flood affected victims is carried out in time.	3.22	0.94	Agree
8	Afforestation of waterways and basins has been adopted by the government.	2.12	1.08	Agree
9	Building of dams to regulate water flow has been adopted by the government.	2.22	1.13	Disagree
10	Construction of artificial levees to regulate flooding has been initiated by the government.	2.06	1.04	Disagree
11	Flood warning is always issued by government before any flood incidence	3.39	0.86	Agree
	Cluster mean	2.83		Agree

The data presented on Table 3 show the mean responses of residence of Anambra East Local Government Area on the flood mitigation measures already adopted in the area. From the study as indicated in the table the respondents agreed in strong term that clearing of drainages and water ways have been adopted as a measure against flooding in the area, that enforcement of environmental sanitation law has also been initiated by the government, that enforcement of periodic environmental sanitation is conducted and monitored by the government, that public education and early warning is also carried out and adequately, that relocation of flood affected victims is carried out in time, and that flood warning is always issued by government before any flood incidence. Thus, their mean scores are as follows: 3.02, 3.41, 3.25, 3.43, 3.22 and 3.39 respectively. The respondents also agreed marginally on a mean score of 2.51, that construction of drainages is a preventive measure adopted by the government against flooding in the area and on a mean score of 2.53, that construction of drainages is also one of the measures adopted complimentarily by the communities against flooding. But respondents however disagree that afforestation of waterways and basins have been adequately adopted by the government, that buildings of dams to regulate water flow, and that construction of artificial levees to regulate flooding have been initiated by the government. Their mean scores are: 2.12, 2.22 and 2.06 correspondingly. However, with a cluster mean of 2.83, there are fairly indications of presence of flood mitigation measures in Anambra East. It indicated high sensitization and early flood dictation and warning to the residents but also underlines notwithstanding the importance of vegetation and afforestation as continuous removal of its cover due to other land uses increases overland flow and subsequently leads to flooding (Fohrer et al. 2001, Hirji et al. 2002).

Table 4. Mean Ratings on Flood Mitigation Measures Adopted in Onitsha North L.G.A

No	Question Item	Mean	S.D	Decision
1	Clearing of drainages and water ways have been adopted as a measure against flooding	3.21	0.89	Agree
2	Construction of drainages is a preventive measure adopted by the government against flooding.	3.05	0.99	Agree
3	Construction of drainages is one of the measures adopted by your community against flooding.	2.56	1.13	Agree
4	Enforcement of Environmental sanitation law has been initiated by the government	3.23	0.88	Agree
5	Enforcement of periodic environmental sanitation is conducted and monitored by the government	3.24	0.88	Agree
6	Public education and early warning is carried out and adequately	3.36	1.01	Agree
7	Relocation of flood affected victims is carried out in time.	2.25	1.13	Disagree
8	Afforestation of waterways and basins has been adopted by the government.	2.43	1.13	Disagree
9	Building of dams to regulate water flow has been adopted by the government.	2.27	1.15	Disagree
10	Construction of artificial levees to regulate flooding has been initiated by the government.	2.25	1.16	Disagree
11	Flood warning is always issued by government before any flood incidence	3. 19	1.02	Agree
	Cluster mean	2.89		Agree

The data presented on Table 4 show the mean responses of residence of Onitsha North Local Government Area on the flood mitigation measures already adopted in the area. The respondents significantly agreed that, clearing of drainages and water ways have been adopted by both the residents and government as a measure against flooding in the area, that there is also substantial improvement in construction of drainages in the area by the government, and complimented by the communities in the area. There is also enforcement of environmental sanitation law by the government as indicated by the response, besides that conducting, monitoring and enforcement of periodic environmental sanitation by the government. Public education and early warning on flood is also carried out adequately, and that flood warning is always issued by government before any flood incidence. The mean scores of the respondents to these adopted flood mitigation measures are: 3.21, 3.05, 2.56, 3.23, 3.24, 3.36, and 3.19 respectively. The respondents however disagree that, relocation of flood affected victims is carried out in time possibly because the residents of the area. The assertion may be possible due to the fact most places in Onitsha North are not in the emergency zone as seen in other lower terrain riverine local government areas, where more attentions are focused. They also rejected that afforestation of waterways and basins has been adopted by the government, that building of dams to regulate water flow has been adopted by the government, and that construction of artificial levees to regulate flooding have been initiated by the government. Their corresponding mean scores are as follows: 2.25, 2.43, 2.27 and 2.25. However, the result shows through the cluster mean of 2.89 that there are generally fair flood mitigation measures in Onitsha North.

Table 5. Mean Ratings on Flood Mitigation Measures Adopted in Onitsha South L.G.A

No	Question Item	Mean	S.D	Decision
1	Clearing of drainages and water ways have been adopted as a measure against flooding	3.21	0.89	Agree
2	Construction of drainages is a preventive measure adopted by the government against flooding.	3.05	0.99	Agree
3	Construction of drainages is one of the measures adopted by your community against flooding.	2.56	1.13	Agree
4	Enforcement of Environmental sanitation law has been initiated by the government	3.23	0.88	Agree
5	Enforcement of periodic environmental sanitation is conducted and monitored by the government	3.24	0.88	Agree
6	Public education and early warning is carried out and adequately	3.36	1.01	Disagree
7	Relocation of flood affected victims is carried out in time.	2.25	1.10	Agree
8	Afforestation of waterways and basins has been adopted by the government.	2.43	1.13	Disagree
9	Building of dams to regulate water flow has been adopted by the government.	2. 27	1.15	Disagree
10	Construction of artificial levees to regulate flooding has been initiated by the government.	2.25	1.16	Disagree
11	Flood warning is always issued by government before any flood incidence	3.19	1.02	Disagree
	Cluster mean	2. 82		Agree

The data presented on Table 5 show the mean responses of residence of Onitsha South Local Government Area on the flood mitigation measures already adopted in the area. From the study as indicated in the table, the respondents agreed highly, that clearing of drainages and water ways have been adopted as a measure against flooding in the area, that enforcement of environmental sanitation law has also been initiated by the government in the area, that enforcement of periodic environmental sanitation is conducted and monitored by the government, that relocation of flood affected victims is carried out in time though response is not high relatively, and that flood warning is always issued by government before any flood incidence. Thus, mean scores obtained respectively from the response are as follows: 3.21, 3.23, 3.24, 2.25 and 3.19. Respondents also agreed in strong term, at mean score 3.05, that construction of drainages is a high measure adopted by the government against flooding in the area, and also at mean score of 2.56, that construction of drainages is one of the measures already adopted by the communities in the area against flooding. On a strong term also, the respondents agreed at mean score of 3.36, that public education and early warning is carried out and adequately but objected, that afforestation of waterways and basins have been adopted by the government, that building of dams to regulate water flow has been adopted by the government, and that construction of artificial levees to regulate flooding have been initiated by the government. Thus, their mean scores are as follows: 2.43, 2.27, and 2.25. The result generally shows significant improved measures on clearing of drainage channels, construction of drainages by the government as well as complimentary effort by the communities in construction of more drainage channels to curb the frequent flooding. This observed high response may be associated to aggressive drainage clearing, demolition of structures on the waterways and rehabilitation of dilapidated canals and other waterways at the inception of the present state government. There is also high response on periodic sanitation exercise being enforced. But remarkably, early evacuation of flood victim by the government did not generate high response as expected from the sampled population. This shortcoming by the relevant agencies may be connected to heterogeneous makeup of the population in the area which could create gap in communication among affected residents, there is also low response in the area of afforestation mechanism, provision of artificial levees, and damming of the rivers to regulate excess water flow and by extension reduce the incidence of flooding in the area.

Table 6. Mean Ratings on Flood Mitigation Measures Adopted in Ogbaru L.G.A

No	Question Item	Mean	S.D	Decision
1	Clearing of drainages and water ways have been adopted as a measure against flooding	2.56	1.11	Agree
2	Construction of drainages is a preventive measure adopted by the government against flooding.	2.31	1.15	Disagree
3	Construction of drainages is one of the measures adopted by your community against flooding.	2.40	1.13	Disagree
4	Enforcement of Environmental sanitation law has been initiated by the government	3.12	0.92	Agree
5	Enforcement of periodic environmental sanitation is conducted and monitored by the government	3.27	0.82	Agree
6	Public education and early warning is carried out and adequately	3.31	0.86	Agree
7	Relocation of flood affected victims is carried out in time.	3.27	0.88	Agree
8	Afforestation of waterways and basins has been adopted by the government.	2.35	1.09	Disagree
9	Building of dams to regulate water flow has been adopted by the government.	2.25	1.11	Disagree
10	Construction of artificial levees to regulate flooding has been initiated by the government.	2.11	1.03	Disagree
11	Flood warning is always issued by government before any flood incidence	3.29	0.88	Agree
	Cluster mean	2.74		Agree

The data presented on Table 6 show the mean responses of respondents in Ogbaru Local Government Area on the flood mitigation measures already adopted in the area. From the results on table, respondents affirmed in a stronger term, that enforcement of environmental sanitation law has been initiated by the government, that enforcement of periodic environmental sanitation is conducted and monitored by the government, that public education and early warning is carried out and adequately, that relocation of flood affected victims is carried out in time, and that flood warning is always issued by government before any flood incidence. The mean scores of the agreed measures already in place in the area are: 3.12, 3.27, 3.31, 3.27, and 3.29. However, on a relative lower mean score of 2.57, respondents also accepted that clearing of drainages and water ways have been adopted in most communities within the area as a measure against flooding, But on the contrary, respondents disagreed, that construction of drainages is a preventive measure adopted by the

government against flooding, that construction of drainages is also one of the measures adopted by the communities, that afforestation of waterways and basins have been adopted by the government, that building of dams to regulate water flow has been adopted by the government, and that construction of artificial levees to regulate flooding have been initiated by the government. Thus, corresponding mean scores to the responses are: 2.31, 2.40, 2.35, 2.25, and 2.11. However, the clusters mean score of 2.74 shows acceptability of presence of mitigation measures but not very high considering the lowly nature of the area, its proximity to water bodies and how heavily built up it has become.

4. Conclusion

This paper addressed the critical research problem of identifying flood mitigation measured already adopted in the five selected Local Government Area of Anambra State, Nigeria where flooding has persisted in the recent time. Result of this research is hoped to improve the existing flood measures and also address other measures that are not adequately implemented. Consequently, results from respondents exposed varying responses. Certain flood mitigation measures were seen to have been widely adopted and implemented in the selected areas while some measures were peculiar to some areas. For instance, measures concerning regular enforcement of environmental sanitation law; adequate public education and early warning; timely flood warning before any incidence; and adequate public education and early warning to the residents are seen to have been adopted in the entire selected Local Government Areas. Similarly, there is inadequate flood mitigation measures on the areas concerning, construction of dams; construction of artificial levees; and adequate afforestation of the areas to regulate incidence of flooding. However, improved clearing of waterways and drainages were seen to better in more urbanized areas like Onitsha North and Onitsha South Local Government Areas. Relocation of flood victims was also seen to be higher in less urbanized areas with more social cultural homogeneity like Anambra West, Anambra East and Ogbaru Local Government Area. Generally, findings revealed that public education and early flood warnings recorded the highest overall mean response of 3.33, followed closely by flood warnings issued by the government before flood incidence (3.31), enforcement of environmental sanitation laws (3.27), periodic sanitation exercises (3.23), and clearing of drainages and waterways (2.92). The construction of drainages by the government (2.67) and community based drainage construction (2.50) were found to be less effective. Further analysis indicated that flood measures such as the construction of artificial levees (2.14), building of dams (2,22), and afforestation of waterways (2.32) were poorly implemented. Consequently, serious mitigation measures are needed in areas such as afforestation of the major drainage bodies, to regulate processes of rainwater movement through series of interception. It is believed that afforestation will enhance regulation of river flooding, and reduce overland flow due to increasing paved surfaces associated to urbanization. Building of dams at the upper catchment area of the river is also necessary to regulate flooding during heavy rains. Construction of artificial levees at the lower course of the river is also a necessary flood measure to act as embankment, regulate flood waters and shelter settlements located along the river banks from being submerged. It also recommended construction of dams, regular clearing and dredging of existing water ways as well as construction of more drainage channels.

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