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Vulnerability Analysis of Flood Disaster in Ibadan, Nigeria

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ABSTRACT

The study examined vulnerability analysis of flood disaster in Ibadan, Nigeria. The data for this study were collected from two major sources namely: primary and secondary sources. Primary data was obtained from a field survey which includes personal observations and questionnaire, etc. The secondary data was obtained from relevant textbooks, journals, periodicals; published and unpublished works, maps, internet materials and other information. The study population for this study was the buildings in Eleyele and Apete, Ibadan, Oyo state. The choice of sample size was influenced by the need to actually target those who have been feeling the impact of flood in the area. The questionnaire was administered purposively to the buildings within 100 meters of the river network and systematically at five houses intervals. Data collected were analyzed using appropriate descriptive and inferential statistics based on the set objectives. Findings revealed that 88 respondents representing 48.4% are owner occupied while 94 respondents representing 51.6% are tenancy. Findings also revealed that residents opined that heavy rainfall is the highest cause of flooding in the study area and it accounted for 40.9%. Terrain of the area is the least cause of flooding in the study area and it accounted for 2.8%. The study concluded that flood risk management can be effective in Nigeria if its government place high priority on the issues related to environmental (protection, monitoring and control) and address them as soon as they come up.

Keywords: *Flood, vulnerability, environment, disaster and Ibadan*

INTRODUCTION

A flood is an overflow of water that submerges land that is usually dry. Flooding may occur as an overflow of water from water bodies, such as a river, lake or ocean in which the water overtops or breaks levees, resulting in some of that water escaping its usual boundaries, or it may occur due to an accumulation of rainwater on saturated ground in an area. Cities in developing countries are particularly vulnerable to climate change impacts, especially changes in rainfall because of the exposure to extreme weather events. Excessive rainfall leads to flooding especially in areas with poor natural drainage systems, adjourning land uses along the river channels and in areas where poor land use practices prevent drainages from channeling excess water away. Floods are defined as extremely high flows of river, whereby water inundates flood plains or terrains outside the water-confined major river channels. Flood hazard is measured by possibility of occurrence of their damaging consequences, conceived generally as flood risk, or by their impact on society, conceived usually as the loss of lives and material damage to society (Henry, 2006).

Flooding is one of the major environmental crises one has to contend with globally. This is especially the case in most wetlands of the world. The reason for this is the general rise in sea level globally, due to global warming as well as the saturated nature of the wetlands in the Niger Delta and other wetlands. Periodic floods occur on many rivers, forming a surrounding region known as flood plain. Rivers overflow for reasons like excessive rainfall dumping of refuse in streams and rivers. The good thing about river overflows is the fact that as flood waters flow into the banks, sand, silt and debris are deposited into the surrounding land (Abowei and Sikoki, 2005).

There is a relationship between flood water, surface and ground water pollution. The water cycle or hydrologic cycle describes the movement of water on, above and beneath the earth's surface. The quantity of water in the earth is fairly constant, meaning; water is almost never lost but transported from one location to

another, transformed and made available for usage. From the water cycle, it can be deduced that when there is increased rain fall, some quantities dry up while others seep or infiltrate into the earth to remain as soil moisture or groundwater. There is also subsurface flow of water in the vadose zone and aquifers. Subsurface water may return to the surface (e.g. as a spring or by being pumped) or eventually seep into the rivers, seas and oceans. Water returns to the land surface at lower elevation than where it infiltrated, under the force of gravity or gravity induced pressures.

In Nigeria, the pattern is similar with the rest of world. Flooding in various parts of Nigeria have forced millions of people from their homes, destroyed businesses, polluted water resources and increased the risk of diseases, just recently May,2017 Over three hundred (300) houses were affected by the flood that ravaged some parts of Ibadan, the Oyo State capital. According to the University of Wisconsin Disaster Management Centre (2006), a flood is too much water in the wrong place, whether it is an inundated city or a single street or a field flooded due to a blocked drain. It is defined further as any abnormally high stream flow that overtops the natural or artificial banks of a stream. It is widely acknowledged that human interference with the climate system has been the major cause of climate change and the observed global warming (Hansen et al. 2007; Ramanathan & Feng 2008; Rockström et al. 2009).

Given the inextricable connection between climate change and development (Douglas et al. 2008), the Intergovernmental Panel on Climate Change (IPCC) warns of the possibility of an increase in the frequency and intensity of catastrophic weather events such as temperature extremes and consistent rain and windstorms (Pachauri & Reisinger 2007; Parry 2007). The continuous unstoppable rapid urbanization, particularly in developing countries (Wong 2015), and poorly managed urban growth and land use, coupled with destructive effects of climate change, have been the dominant cause of natural and man-induced disasters such as earthquakes, cyclones, landslides, sea-level rise, tsunami, flooding and erosion among others (Hardoy, Mitlin & Satterthwaite 2013; Mitlin & Satterthwaite 2013). For instance, in African cities, hydro-meteorological hazards, including floods and droughts, are regarded as the most common of all hazards (Van Niekerk 2015; Van Niekerk & Wisner 2014).Floods are unarguably the most common of all natural hazards (Jha, Bloch & Lamond 2012) and also affect more people than all types of natural disasters put together (emergency events database [EM-DAT] 2015).

Flood vulnerability involves elements at risk such as the residents of a flood-prone area, a built environment or an ecosystem exposed to flood risk (Merz et al. 2007). Meanwhile, vulnerability is generally acknowledged by many researchers to consist of three components: degree of exposure, susceptibility and resilience or response capacity of a population in a particular area (Birkmann 2006; Jean-Baptiste, Kabisch & Kuhlicke 2013; Pandey, Manandhar & Kazama 2014; Wisner et al. 2004). Besides these components, vulnerable communities can be further evaluated through a variety of vulnerability determinant drivers such as physical, social, economic, environmental and political factors (Wisner et al. 2004).

A system is susceptible to floods because of its exposure, and its capacity or incapacity to be resilient, cope, recover or adapt to the extent of damage (Balica, Wright & Van der Meulen 2012). With growing evidence on cities' flood vulnerability; most flood-related disasters are not primarily caused by natural disasters. Many scholars acknowledge that the primary determinant factors are largely attributed to human activities that involve socio-political, historical and cultural relations (Birkmann 2007; Milly et al. 2002; Seyoum et al. 2011; Vojinović 2015; Vojinović & Abbott 2012).

It therefore infers that in a flood incident, there is the tendency for pollutants to be taken from surface to subsurface especially in areas with low water table. Other possible effects include transport of eroded sediment and phosphorus from land to water bodies, increased salinity of water bodies from and erosion and transport of dissolved salts and from land and cultural eutrophication of lakes from excess nutrients washed off agricultural fields during runoff. While the lack of basic knowledge and understanding of flood risk by the people living in flood-prone areas may have contributed to ineffective decision-making, (Pelling and Wisner (2012) note that poor governance and social and environmental injustice are the underlying causes of flood risk. For instance, a city with a very low quality of basic infrastructure, unplanned growth and rapid urbanization coupled with the effects of climate change means heavy rainfall can manifest as a

catastrophic flood (Baker 2012; Global Footprint Network 2012). However this study therefore examined the vulnerability analysis of an urban flood disaster in Ibadan, Nigeria.

LITERATURE REVIEW

It is not news that every year, the government sets apart huge funds to cater for infrastructural problems and insufficiencies, yet the case of perennial floods still stares the city in the face and wreaks havoc annually. Although various government sponsored studies and research works aimed at stalling this problem have been carried out yet the rate at which these floods occur seem to make all machinery set in motion to reduce or curtail its impact looks like child play. It should however be noted that the major causes of floods are the resultant effect of man's activities on his physical environment and this tells a lot on man environmental sustainability habits. Flood disaster management is usually hindered by certain factors such as the availability of necessary emergency services and the first set of people to respond to disasters in the disaster area(s), such as volunteers, National Emergency Agent (NEMA) and Non-governmental Organizations (NGOs) such as the Nigerian Red Cross (NRC) e.t.c.

In recent years, the frequency and intensity of rainfall events, flash floods, acute riverine and coastal flooding have been on the increase, corresponding with more reported cases of flood disasters across the world (Vojinović 2015). It is highly important to focus on proactive measures rather than common focus on responding to the disaster. In line with Hyogo framework for action (HFA) guidelines (UNISDR 2005), even the recently adopted Sendai Framework for Disaster Risk Reduction (SFDRR) (Kelman 2015) clearly recognizes the urgent need to create a holistic and robust flood risk management strategy that can effectively address the problem of urban floods. There is still little knowledge and poor understanding of specific types and causes of flooding, their probabilities of occurrence and the potential vulnerable population and/or assets, as well as areas affected particularly at the local level (Adelekan et al. 2015). Given the importance of exploring how flood risk and vulnerability are spatially distributed within urban cities in developing countries, including Nigeria, particularly at the community level, this paper provides a better understanding of the nature and scale of urban residents' vulnerability to flood risk, its effect and its impact.

Flood risk is described by Bates and De Roo (2000), UNISDR (2009) and Birkmann (2007) as the product of flood hazards, the associated vulnerability and exposure of the people and their physical environment. According to Merz et al. (2007), flood hazard is 'the exceedance probability of potentially damaging flood situations in a given area and within a specified period' (p. 236). The magnitude and scale of flood damage are not only influenced by the flood's characteristics but also depend on the vulnerability profile of a particular area (Birkmann 2007). It is also regarded as 'the combination of the hazardous phenomenon of flooding and a vulnerable system susceptible to suffer loss' (Eleutério 2012:2). Not all hazards automatically result in disaster, the determinant drivers that turn hazards into catastrophic events are the level of vulnerability and the degree of susceptibility of a population to disaster risk (Birkmann et al. 2013).

There is also the need to compensate the victims of these disasters which is usually neglected by the government. The government is usually very inefficient in meeting the needs of the disaster management team and this often affects the victims in question. This is due to the fact that the government and individuals alike do not view disaster management as dependent on socio economic conditions resulting in disasters. Furthermore, due to the nature of the flooding problems the effect on the environment can be viewed from a dual perspective i.e the effects of flooding on the residents and on the physical structures. Some of the problems faced by residents include health problems as a result of water pollution that occurs during flooding and also escalation of water borne diseases.

Studies in Nigeria have shown that serious flood disasters have occurred in Ibadan 1985, 1987, 1990, 2011,2015,2016,2017; Osogbo 1992, 1996, 2002, 2011,2015,2016,2017; Yobe in 2000; Akure 1978, 1996, 2000, 2002, 2004 and 2006; and Lagos 2010, 2011, 2012,2016,2017; Kwara State 1991, 1992, 1993, 1994, 1997,2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008; Sokoto 2010; and other parts of the country, has shown that flooding is a major environmental phenomenon in Nigeria (Olajuyigbe, Rotowa and Durojaye, 2012; Justin, 2010; Jimoh and Iroye, 2011; Akinola et al, 2013; Olorunfemi and Raheem, 2013; Aladelokun and Ajayi, 2014; Akukwe, 2014), with Coastal cities like Lagos, Port Harcourt, Calabar, Uyo, Warri among others have severally experienced incidences that have

claimed many lives and properties worth millions of dollar (Olajuyigbe, Rotowa and Durojaye, 2012). This study therefore examined vulnerability analysis of an urban flood disaster in Ibadan, Nigeria: A case study of Eleyele and Apete, with the view of providing guidelines which will aid effective disaster and management control.

Study Area

The city of Ibadan is the administrative headquarter of the old western region of Nigeria and now Oyo state's capital. It is the third largest metropolitan area, by population, in Nigeria. It has a long history of flood events and is recognized as a flood-prone area with many floods recorded since 1902 (Tomori, 2008), but only officially recorded from 1951 (Agbola et. al., 2012). A series of unprecedented floods have killed hundreds of people and destroyed residents' properties worth millions of Naira. For instance, more than 600 hundred people lost their lives in flood disasters that occurred on 31 August 1980 and 26 August 2011 (Agbola et. al., 2012). While the heaviest rainfall recorded (274 mm in August 1980) was during a single flood episode, the next heaviest was 258 mm in August 1963. The devastating flood in August 2011 (187.5 mm) affected the city's public assets, urban settlements and agricultural land, causing domestic and economic damages worth around 30 billion Naira (Agbola, Ajayi, Taiwo and Wahab, 2012).

Methodology

The data for this study were collected from two major sources namely: primary and secondary sources. Primary data was obtained from a field survey which includes personal observations and questionnaire, etc. The questionnaire will be designed to collect data on issues related to flood related activities in the various areas, characteristics of buildings, and their level of satisfaction with flood and other information considered necessary in attaining the objectives of the research. The secondary data was obtained from relevant textbooks, journals, periodicals; published and unpublished works, maps, internet materials and other information. Maps and photographs will used for this research.

The study population for this study was the buildings in Eleyele and Apete, Ibadan, Oyo state. The sample frame refers to the study area population within which the sample will be chosen. The scope of the study area is expected to cover Eleyele and Apete in Ibadan city. The choice of sample size was influenced by the need to actually target those who have been feeling the impact of flood in the area. This is so as to get enough input from each section of the town as almost all areas of the work are vulnerable to one form of flooding or another. The sampling technique that was adopted by this research is purposive and stratified sampling techniques. The questionnaire was administered purposively to the buildings within 100 meters of the river network and systematically at five houses intervals. This ensured that the questionnaire was carefully administered to the target population, so as to get a better input in evaluating the effects of floods. Data collected were analyzed using appropriate descriptive and inferential statistics based on the set objectives.

Analysis and Discussions

Socio-Economic Background of the Respondents

The gender distribution of the respondents is contained in table 4.1. The study revealed that both genders were well represented across the study area as; ninety-eight (98) are male representing 53.8%, while eighty-four (84) of the respondents are female at 46.2%

The summary of data collected and analyzed on marital status of the residents is as presented in table1. Marital status was categorized into: single, married, divorced and separated and widow/widower. It is revealed that seventy-four (74) respondents representing 40.7% are single then one hundred and four (104) respondents representing 57.1% are married while two (2) respondents representing 1.1% are divorced then one (1) respondent representing 0.5% are separated while one (1) respondent representing 0.5% are widow/widower which makes the married the most frequent in the field. Analysis of data collected on the educational qualification of residents as presented in Table 1 showed that two (2) respondents representing 1.1% has no formal education, six (6) respondent representing 3.3% level of education is primary, seventy-six (76) respondents representing 41.8% level of education is secondary, while ninety-eight (98) respondents representing 53.8% level of education is tertiary which shows that most of the respondents level of education is tertiary.

As contained in the questionnaire, the residents were made to state their occupations and it was categorized into seven (student, self-employed

civil servant, private sector employed, retiree, farmers and unemployed) as presented in table 4.4, (30) respondents representing 16.5% are students, while (23) respondents representing 12.6% are self-employed. While (105) respondents representing 57.7% are civil servant then (15) respondents representing 8.2% are private sector employed, while (1) respondent representing 0.5% are retired while (2) respondents representing 1.1% are farmers, while (6) respondents representing 3.3% are unemployed which makes majority of the respondent civil servants.

Findings revealed the summary of the type of houses occupied by the residents in the study area. Findings showed that (18) respondents representing 9.9% live in bungalow while 17 respondents representing 9.3% live in duplex then 53 respondents representing 29.1% lives in room apartment while 94 respondents representing 51.6% lives in flat. This shows that majority of the respondent live in flat. Findings revealed the summary of status of ownership of residents in the study area. Findings revealed that 88 respondents representing 48.4% are owner occupied while 94 respondents representing 51.6% are tenancy. This shows that majority of the respondent are tenants.

Findings revealed the age distribution of respondents. 93 respondents representing 51.1% are within the age of 18-30 years, then 66 respondents representing 36.3% are within the age of 31-40 years, while 20 respondents representing 10.9% are within the age of 41-50 years, while 3 respondents representing 1.7% are within the age range of above 50.It is revealed in table 4.10 that 72 respondents representing 39.6% household size falls within 1-3, while 101 respondents representing 55.5% household size falls within 4-6, while 9 respondents representing 4.9% falls within the range of 7-9.

The findings in table 4.11 revealed that 21.6% of the respondents earned below #20000 income, while 58 respondents representing 31.9% are within the range of 20000-40000 income, 62 respondents representing 34.1% are within the range of 41000-60000 income, 18 respondents representing 9.9% are within the range of 61000-80000 income, 10 respondents representing 5.5% are within the range of 81000-100000, while 11 respondents representing 6.0% earn 101000 and above as their income.

Respondents' duration of stay was categorized into four namely: those that have spent 0-5 years, those that have spent 6-10 years, those that have spent 11-15 years, those that have spent 16-20 years and those that have spent above 20 years in the study area. Table 4.12 shows that 115 respondents representing 63.2% stay in a place within 0-5 years, while 50 respondents representing 27.5% stay in a place within 6-10 years, 5 respondents representing 2.8% stay in a place within 11-15 years, 9 respondents representing 4.9% stay in a place within 16-20 years, while 3 respondents representing 1.6% stay in a place above 20 years (Table 1).

Table1. *Socio-economic Characteristics of the Respondents*

Gender	**Frequency**	**Percentage (%)**
Male	98	53.8
Female	84	46.2
Status	**Frequency**	**Percentage (%)**
Single	74	40.7
Married	104	57.1
Divorced	2	1.1
Separated	1	0.5
Widow/widower	1	0.5
Qualification	**Frequency**	**Percentage (%)**
No formal education	2	1.1
Primary	6	3.3
Secondary	76	41.8
Tertiary	98	53.8
Occupation	**Frequency**	**Percentage (%)**
Student	30	16.5
Self employed	23	12.6
Civil servant	105	57.7
Private sector employed	15	8.2
Retiree	1	.5

Farmer	2	1.1
Unemployed	6	3.3
Owner occupied	88	48.4
Tenancy	94	51.6
Age	**Frequency**	**Percentage (%)**
18-30 years	93	51.1
31-40 years	66	36.3
41-50 years	20	10.9
Above 50 years	3	1.7
Income	**Frequency**	**Percentage (%)**
Below 20000	23	12.6
20000-40000	58	31.9
41000-60000	62	34.1
61000-80000	18	9.9
81000-100000	10	5.5
101000 and above	11	6.0
Years	**Frequency**	**Percentage (%)**
0-5	115	63.2
6-10	50	27.5
11-15	5	2.8
16-20	9	4.9
Above 20	3	1.6
Total	**182**	**100**

Source: *Author's Field Survey, 2018.*

Higher than the total survey because of multiple response.

Residents Perception on the Physical/Building Characteristics of Flood Prone Areas

This section analysis and interprets data collected on the residents physical characteristics in the study area, with respect to the following; respondents use of building, among others.

Respondents' use of buildings was categorized into: residential, commercial, recreational, educational, industrial and public. Findings showed that 150 respondents representing 75.4% use of building is residential, then 6 respondents representing 3.0% use of building is commercial, then 2 respondents representing 1.0% use of building is recreational, then 22 respondents representing 11.1% use of building is educational, then 7 respondent representing 3.5% use of building is industrial, while 12 respondents representing 6.0% use of building is public. Therefore the major use of buildings in the study area is residential.

Land acquisition of respondents was categorized into: purchased, inherited and gift. Findings revealed that 146 respondents representing 80.2% purchased their land while 27 respondents representing 14.8% inherited their land while 9 respondents representing 4.9% acquired their land through gift. Therefore majority acquire their land by purchasing (Table 2).

Table2. *Respondents' Use of Buildings and Land Acquisition*

Use of buildings	**No of responses**	**Percentage (%)**
Residential	150	75.4
Commercial	6	3.0
Recreational	2	1.0
Educational	22	11.1
Industrial	7	3.5
Public	12	6.0
Total	**199**	**100**
Acquisition	**Frequency**	**Percentage (%)**
Purchased	146	80.2
Inherited	27	14.8
Gift	9	4.9
Total	**182**	**100**

Source: *field survey, 2018.*

Higher than the total survey because of multiple response.

Findings revealed in Table 3 below that the most good of the assessment of element of building and neighborhood facilities is the condition of road, with an index of 2.69, while the least is the foundation with an index of 1.47.

Table3. *Assessment of Element of Building and Neighborhood Facilities*

	VG(5)	G(4)	N(3)	B(2)	VB(1)	SWV	CROI
Roof	97	76	3	5	1	283	1.55
Foundation	105	71	4	2	0	267	1.47
Window	90	77	10	5	0	294	1.61
Wall	87	79	7	5	4	306	1.68
Floor	77	72	8	16	9	354	1.94
Condition of road	36	63	20	46	17	491	2.69
Accessibility	37	91	22	21	11	424	2.33
Waste management	38	64	22	39	19	483	2.65
Drainage	52	51	13	46	20	477	2.62

Source: *Field survey, 2018*.

Higher than the total survey because of multiple response.

Respondents Opinion of When Flood Occurrence is Usually High

Findings revealed in table 4 below that residents opined that flood occurrence is usually high in the month of July. Furthermore, residents perceived that flood least occur in April.

Table4. *Respondents Opinion of When Flood Occurrence is Usually High*

Months	No of responses	Percentage (%)
January	3	1.3
February	1	0.5
March	1	0.5
April	0	0
May	3	1.3
June	30	13.4
July	91	40.6
August	62	27.7
September	25	11.2
October	5	2.2
November	1	0.5
December	2	0.8
Total	**224**	**100**

Source: *Field survey, 2018*

Higher than the total survey because of multiple response

Respondents Method of Waste Disposal

In table 5 least considered of respondents method of waste disposal was Burying. It accounted for1.5% of resident's method of waste disposal in the study area. The most used method of waste disposal among respondents is Public waste collector which accounted for 22.8%. Other methods of waste disposal include; vacant plots of land, private waste collector, burning, taken to dump sites, waste trucks, designated dump site, barrow pushers, use of uncompleted buildings, nearby bush and disposal in drainage.

Table5. *Respondents Method of Waste Disposal*

Method	No of responses	Percentage (%)
Vacant plots of land	20	7.4
Public waste collector	62	22.8
Private waste collector	35	12.9
Burning	26	9.6

Burying	4	1.5
Taken to dump sites	19	7.0
Waste trucks	37	13.7
Designated dump site	6	2.2
Barrow pushers	7	2.6
Use of uncompleted buildings	17	6.3
Nearby bush	27	9.9
Disposal in drainage	11	4.1
Total	**199**	**100**

Source: *Field survey, 2018,*

Higher than the total survey because of multiple response

Residents' Perception on Likely Causes of Flooding, Consequences of Flooding and its Planning Implications in the Study Area

This section analyses and interprets data collected on the residents perception on likely causes of flooding, consequences of flooding and its planning implications in the study area, with respect to the following; impact of flood on respondents, causes of flooding, government effort, community involvement; among others. Residents perceived that the death of family members has the highest impact of flood on residents in the study areas at an index of 3.88. Furthermore, residents perceived that Unemployment was the least considered impact of flood on residents in the study areas (Table 6).

Table6. *Impact of Flood on Respondents*

Impacts	H(5)	V(4)	N(3)	L(2)	VL(1)	Sum	Mean
Collapse of buildings	34	27	35	56	30	567	3.12
Sinking of buildings	27	16	30	74	35	620	3.41
Carrying away of building by flood	28	18	25	64	47	630	3.46
Soaking or wetting the wall of the building	42	24	32	56	28	550	3.02
Death of family member	15	6	26	73	62	707	3.88
Loss of property	31	21	39	55	36	585	3.23
Psychological effect	20	22	55	58	27	596	3.27
Loss of farmland	29	48	29	54	22	538	2.96
Unemployment	40	51	44	29	18	480	2.64
Loss of economic fortune or business	28	40	47	44	23	540	2.97
Spread of diseases	26	27	39	57	33	590	3.24
Damage of physical body	16	24	41	60	41	632	3.47

Source: *Field survey, 2018*

Causes of Flooding

Findings revealed that residents opined that heavy rainfall is the highest cause of flooding in the study area and it accounted for 40.9%. Terrain of the area is the least cause of flooding in the study area and it accounted for 2.8% (Table 7).

Table7. *Causes of Flooding*

Causes	No of responses	Percentage (%)
Heavy rainfall	103	40.9
Poor river channel	68	26.9
Indiscriminate waste disposal	43	17.1
Terrain of the area	7	2.8
Unplanned settlement	18	7.1
Climate change	13	5.2
Total	**252**	**100**

Source: *Field survey, 2018.*

Higher than the total survey because of multiple response

Governments Effort

The least government effort towards curbing flooding is tackle climate change. It accounted for 5.6% of what the government does about flooding in Oyo state. Respondents opined that the Provision of proper waste management facilities is the highest government effort

towards flooding and it accounted for 29.9%. Construction of dams, Restore river's to their natural courses, development control and public education are also viewed also as part of what the government engage in to curb flooding (Table 8).

Table8. *Governments Effort*

Effort	No of responses	Percentage (%)
Construction of dams	69	25.8
Provision of proper waste management facilities	80	29.9
Restore rivers to their natural courses	30	11.2
Development control	36	13.5
Public education	37	13.9
Tackle climate change	15	5.6
Total	267	100

Source: *field survey, 2018.*

Higher than the total survey because of multiple response.

COMMUNITY PARTICIPATION

The least community participation towards curbing flooding is planting vegetation to retain extra water. It accounted for 8% of what the community does about flooding in Oyo state. Construction of flood ways, removal of waste from water ways, temporary barrier and provision of waste disposal facilities are also viewed also as part of what the community engages in to curb flooding (Table 9).

Table9. *Community Participation*

Participation	No of responses	Percentage (%)
Construction of flood ways	91	33.1
Planting vegetation to retain extra water	22	8
Removal of waste from water ways	70	25.5
Temporary perimeter barrier	44	16
Provision of waste disposal facilities	48	17.4
Total	**275**	**100**

Source: *field survey, 2018.*

Higher than the total survey because of multiple response.

RESPONDENT'S OPINION ON POSSIBLE SOLUTIONS TO FLOODING

The least considered of all the possible solutions was harvesting rain water with an index of 3.08. The most considered of all the possible solutions to flooding was removal of waste inside drainage with an index of 4.05, of what government should do about curbing flood in Oyo state. Other possible solutions include; expansion of river channels and drainage, regulations on building permit, proper waste management, relocation of affected buildings, buildings canals, afforestation, construction of reservoir, diversion canals, flood plains and ground water replenishment and improving drainage in the state. These are what the residents opined that government should embark upon in order to curb flooding in the study area (Table 10).

Table10. *Respondent's Opinion on Possible Solutions to Flooding*

Possible solutions	DA(1)	SDA(2)	I(3)	A(4)	SA(5)	SWV	CROI
Expansion of river channels and drainage	21	7	3	82	69	717	3.94
Removal of waste inside drainage	8	13	6	90	65	737	4.05
Regulations on building permit	26	17	18	83	38	636	3.49
Proper waste management	19	10	8	84	61	704	3.87
Relocation of affected buildings	34	18	32	47	51	609	3.35
Harvesting rain water	37	28	23	71	23	561	3.08
Buildings canals	28	17	28	80	29	611	3.36
Afforestation	23	14	32	81	32	631	3.47
Construction of reservoir	13	11	22	103	33	678	3.72
Diversion canals	20	14	23	86	39	656	3.60
Flood plains and ground water replenishment	26	29	37	60	30	585	3.21

Improving drainage	18	11	13	71	69	708	3.89

Source: *field survey, 2018*

CONCLUSION AND RECOMMENDATIONS

The threat of flooding in Apete and Eleyele both in Ibadan has been highlighted in this study. Therefore, to enable proper understanding, management and mitigation; flood risk maps are required. Considering the magnitude of hazard flood event present, and the fact that floods occur unexpectedly, there is need for an effective risk mapping and risk management strategy to abate the problem. Finally, flood risk management can be effective in Nigeria if its government place high priority on the issues related to environmental (protection, monitoring and control) and address them as soon as they come up. This research presents a valuable tool that would help public and private agencies as well as concerned stakeholders and NGOs; in planning towards flood managements in the study area. However, this tool cannot be used in isolation and more information is needed for a full assessment and evaluation of flood risk. Hence, the following recommendations are made to augment flood risk management:

Environmental Teaching Program (Public Education) at all levels (community, local, state and national levels) on climate change, flood risks and appropriate response techniques: Investing in communities vulnerable to climate change impacts can reduce the damage brought on by extreme weather events and the need for government relief funding. Increasing the awareness of the population that lives close to water courses is essential for a healthy environment. Also, awareness can be in the form of printouts in newspapers, electronic media, as well as the use of drama sketches and plays on flooding- related hazards and risks associated with encroaching on flood plains. Encouraging and enabling a culture of flood resilience enhances the preparation capacities of citizens and their community as a whole.

Urban Development and Environmental Protection agencies must ensure full compliance of development guidelines for the study area as regards the encroachment of flood plains especially along the River as well as its tributaries. Flood control structures should be constructed and the existing ones should be cleared of blockages (refuse) particularly in high vulnerability areas. Land use Planning and development should be done with the incorporation of data from flood maps and appropriate land use policies. Delimitation of Set-Backs: The existing statutory set-backs to the major streams and rivers appear to be inadequate in the face of increased urbanization in the city. It is highly necessary to review existing laws and regulations to accommodate the extent of natural flood plains of the streams and rivers for flood control. Restrict Dumping Refuse in Unauthorized Locations: Empower and equip the Environmental Health Department of Local Governments within Ibadan Metropolis to enforce laws and regulations to prevent indiscriminate dumping of refuse and wastes in unauthorized locations.

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