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ASSESSMENT AND CONTROL MEASURES OF FLOOD RISK IN AJIBODE AREA OF IBADAN, OYO STATE, NIGERIA

Adetunji Michael, A and Oyeleye Oyewale I.

[1]Department of Urban and Regional Planning, Faculty of Environmental Sciences
[2]Ladoke Akintola University of Technology, PMB 4000, Ogbomoso, Oyo State Nigeria

ABSTRACT: *Flood is one of the major factors that prevent Africa's population from escaping poverty level. The most hit by flood are usually urban poor who have less choice, but to end up living in flood prone areas. Ravaging flood events in Nigeria can be dated back to 1963 in Ibadan city, when Ogunpa River was over-flown causing loss of lives and properties. Many factors have been attributed as the resultant factors leading to floods in literature. This study thus assesses flood risk and its control measures in Ajibode area of Ibadan, Oyo state, while appropriate recommendations are made in order to reduce flood risk in the study area. In order to achieve this, questionnaires were administered through random systematic sampling technique to the household heads of 216 buildings from 720 buildings as the sampling frame of the study. Chi-square test reveals significant relationships between annual house rent and monthly income of the respondents with their vulnerability to flood with p-values of 0.00 and 0.04 respectively.*

KEYWORDS: Flood, Risk, Control, River, Measures, Urban, Hazard, Channelization, Nigeria

INTRODUCTION

Flood continues to gain enormous research attention over the years, most especially in developing nations which Nigeria is not excluded. The essence of its attention in research is never unconnected to its causes, resultant effects of painful loss of properties and even irreparable loss of lives, and its control measures. Flood is one of the major factors that prevent Africa's population from escaping poverty level (Action Aid, 2006); and the most hit by flood are usually urban poor (Adetunji and Oyeleye, 2013). A flood results when a stream runs out of its confines and submerges surrounding areas (Stephen, 2011). Similarly, Kates (1985) defines flood as an overflow of an expanse of water that submerges land. European Union (2007) sees flood as a temporal covering of land by water, not covered by water before the incidence. Nelson (2001) defines flood as a natural consequence of stream flow in a continually changing environment. Sada (1988) sees flooding as unusually high rates of discharging; often leading to inundation of land adjacent to streams, and it is usually caused by intense or prolonged rainfall.

Risk is defined as the combination of the probability of an event and its negative consequences (UNISDR, 2009a). Hazards on the other hand as opined by Hewitt (1980) do not result into disaster but pose threats. However, for actual assessment of the disaster situations and losses, various elements such as vulnerability and exposures have to be included (Birkmann, 2013). Flood risk therefore is the product of the flood hazards, the vulnerability and the exposure of the people (Bates and De Roo, 2000 and UNISDR, 2009b). Thus, flood risk assessment is actually the assessment of the possibility of occurrence of flood hazards.

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Though, flood may be temporal covering of land by water as opined by the European Union, but the effects may not be temporal when such occurrence claims lives and properties. Flood does not only affect the victims, but also has a great gross effect on the national economy of the country where poverty level rises due to the incidence (Adetunji and Oyeleye, 2013). Nigeria has been assessed in literature to be very vulnerable to flood (Agbonkhese, et al. 2014; NCAR, 2012; and Adetunji and Oyeleye, 2013); and the measures put in place by governments, communities, individuals and any other groups to control flood are very inadequate and even poor.

Many communities in Nigeria that are in coastal region especially in Niger-Delta zone, and Ibadan among other towns are generally characterized by poor drainage system and are therefore prone to flooding. An estimated 25 million people or 28% of Nigeria's population live in the coastal zone and are at risk from flooding (NCAR, 2012). The occurrence of flood represents a major risk to riversides populations and floodplains, in addition to causing substantial impacts on the environment, including aquatic fauna and flora, and bank erosion (Agbonkhese, et al. 2014). In Nigeria, human lives and properties have been destroyed by flood. The losses from flood of August 1980 in Ibadan were estimated at over 300 Million Naira or 1.92 Million USD, while over 500 lives were lost (Akintola 1994). The estimated amount to fix the culverts and bridges damaged by the 2011 flood is 2.1 Billion Naira (Oyo State Government 2011). This study thus assesses flood risk and its control measures in Ajibode area of Ibadan, Oyo state, with a view to suggesting possible recommendations to reduce flood risk.

Study Area

The study area, Ajibode is a community located in Akinyele local government area within Ibadan Township which shares boundaries with the University of Ibadan and Orogun communities at the southern part and shares boundaries with Ojoo, Shasha, IITA and Moniya communities at the northern part. Using 3.2% growth rate from 2006 census figures, the 2010 estimated population for Akinyele local government where Ajibode is located is put at 239,745 (Wikipedia, 2016). The study area is located in the southwest region of Nigeria around longitude 7"N and latitude 4"E at an elevation of about 235.2 m above sea level (Akuma, 1995).

The area lies in the humid and sub-humid tropics (Udo, 1970). The area around Ajibode has undulating plains with some rolling landscape. The unevenness of the land surface is punctuated by pediment plains, streams, rivers, well incised valleys forming trellis patterns, ridges and flat table lands (Akuma, 1995). In this area are three rivers, the Lalewan, Yamuje and Odoana which flows from north to south down into the Orogun river. The rainy season of Ajibode starts around April and usually ends in November with average dry period in August. The dry season falls between November and February yearly.

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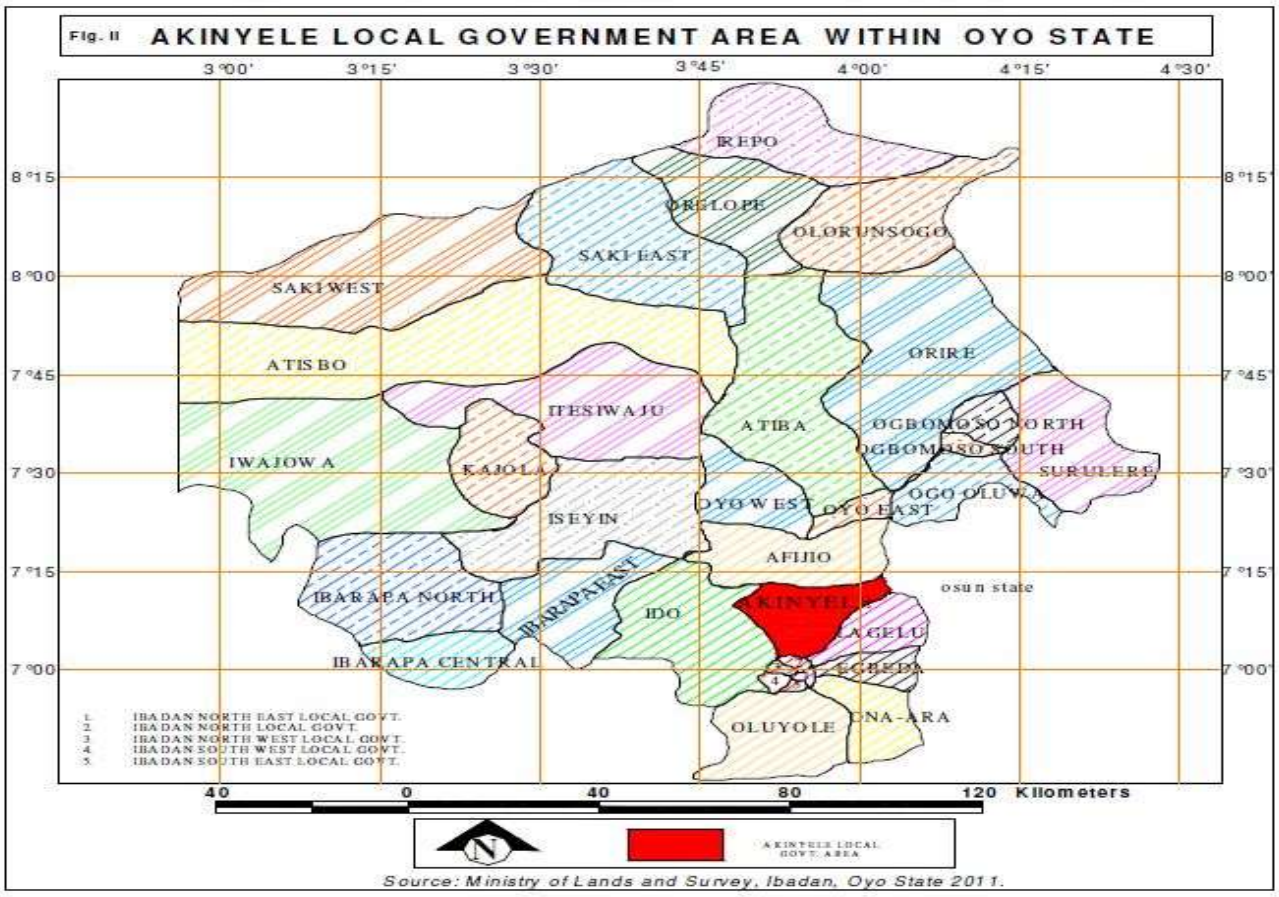

LITERATURE DISCOURSE

Flood Experience in Nigeria and Other Developing nations

The poor in the society have been identified to be the most of the victims of flood, by having no choice, but to end up living in flood prone areas (Lutz et al., 2008). In the view of Stephen (2011), the loss of life due to flood is lower in the developed countries compared to the developing countries. The assertions of Stephen (2011) and Lutz et al (2008) appear to be right because in developing nations, there are absence of effective zoning regulations, flood controls, emergency response to infrastructure and early warning systems.

For instance, Bangladesh is a developing nation and one of the most susceptible nations to flood disasters globally. About 30% of the country has been covered with flood waters; and in 1991, more than 200,000 lives were lost due to flood in Bangladesh (Stephen, 2011). Wright (2011) reports the devastating flood of Lahore, Pakistan in July 2011 where transportation systems were halted and businesses were closed down for days. Also in Lusaka, the capital of Zambia, flood risk has strongly increased because of the fast growth of the city in flood prone areas (Nchito, 2007). This is also the case of Alexandria in Egypt (Klein et al., 2003); the Senegalese capital, Dakar, and the Burkina Faso's capital, Ouagadougou, were seriously affected by floods in the year 2009.

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Ravaging flood events in Nigeria can be dated back to 1963 in Ibadan city, when Ogunpa River was over-flown causing loss of lives and properties; these hazardous events reoccurred in 1978, 1980 and 2011, with estimated damages and deaths of over 30 billion naira and 100 people respectively, thus making Ogunpa River nationally and internationally famous (Adegbola and Jolayemi, 2012 and Agbola, et al., 2012). Between 2011 and 2012 alone, Lagos state recorded at least 8 major floods with more than 30 people deaths and serious damage to properties (Komolafe et al., 2014). In Nigeria, apart from the Ogunpa Stream in Ibadan that killed several people and completely grounded socio-economic activities in 1980 (Emeribeole, 2015). In August 2008, the residents of Makurdi were thrown out of their residences and their farmlands left impoverished after two days of heavy down pour of rainfall. It was described as very disastrous, (Taiwo, 2008).

Despite the earlier warnings of Nigerian Meteorological Agency (NIMET) in March 2012, that there would be above normal rainfall which might lead to floods in 12 out of 36 states in Nigeria; it is uneasy to just forget the havoc caused by floods of July-September 2012 in Nigeria as 363 lives were lost and about 2.1 million persons were displaced (NEMA, 2012). Furthermore, National Emergency Management Agency (NEMA) Report in 2012 reveals that 256 local government councils out of 774 local government councils were adversely affected by floods in 2012 with Kogi and Adamawa states having the highest casualty figures. Kogi state was seriously hit by 2012 floods due to its strategic location at confluence of rivers Niger and Benue. Apart from the poor drainage systems across the country, the floods experienced in 2012 in Nigeria were not unconnected to the discharge of water from Lagdo Dam in Cameroon along with torrential rains as well as the climate change phenomenon (Agbonkhese, et al., 2014).

However, many developed nations are not also exempted from the ravage of flood disaster. Specifically, in May 2008, floods triggered by torrential rains killed dozens of people across China, while thousands of others were victims of landslides caused by the downpours (Emeribeole, 2015). In the United States of America, the Mississippi River caused damages put at several millions of dollars when it over flew its banks in 1993 and 1995; flooding some cities, towns, farmlands and major industrial installations over a distance of about 250 km and ravaging Iowa before it heaped downstream (Christopherson, 1997). Apart from the Mississippi-Missouri River Systems of 1993, and that of 1995, world records of flood in have it that recently severe floods were experienced in Norway, China, Netherlands and South Florida (Christopherson, 1997).

Though flood risks are more of global concern, but more alarming in developing nations which Nigeria is not exempted. Flood has continued to be yearly pains in the experience of most Nigerians and despite the loss of lives and properties usually recorded; little measures have been put in place to forestall havoc caused by floods in Nigeria. Similarly, Komolafe, et al., (2015) opine that despite the almost yearly occurrence of flood hazards and the risks associated with them in Nigeria, it appears not much works have been done presently on effective management and adaptation to the flood hazards and also on the preparation for potential future hazards.

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Fig. 1: Situations during the 2012 flood in Anambra state, Nigeria. *(Source: Udo, et al., 2012)*

Causes of Flood

Many factors have been attributed as the resultant factors leading to floods in literature. Generally, Oyeleye (2013) opines that accidental urbanization results to urban flooding. From the view of (Emeribeole, 2015), flood events in many capital cities in Nigeria, are mostly due to the poor consciousness of the inhabitants on environmental information, inadequate (or sometimes absolute lack) of spatial information on the flood prone areas, waste dump and construction of buildings (both commercial and residential, even public offices) on river channel without adequate measure for water flow. Agbonkhese, et al., (2014) believe that heavy rainfall coupled with bad human activities in relation to the environment and lack of drainage infrastructure in most Nigerian cities has left hundreds of people distressed and homeless as a result of floods. Similarly, indiscriminate dumping of refuse on drainage channels to channel adjustment and poor drainage conditions have been observed by Agbonkhese et al. (2013) to lead to floods. Also, floods that occur in Nigeria are as a result of extensive rainfall, drainage blockages and dam failures (Jeb and Aggarwal, 2008). Flooding are common features in Nigeria during urban flooding which occurs in towns, on flat or low-lying terrain especially where little or no provision has been made for drainage, or where existing drainage are blocked with municipal waste, refuses and eroded soil sediments (Folorunsho and Awosika, 2001).

Over the years and in almost every part of the world, excessive rainfalls due to climate change have resulted in flooding, which has claimed lives and properties (Komolafe, et al., 2015). In some literatures, climatic change has been viewed to cause floods. For example, Karley (2009) believes that the main causes of flooding in Ghana are intense rainfall that generates massive run-off that leads to floods. Criss (2009) asserts that the increasing frequency of flood events

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could not be unconnected to climatic change. While, some other scholars argue that the increasing flood is not only due to the extreme climate changes, but a continued encroachment of people and properties in areas at risk of flooding leading to an increasing potential damage (Hooijer, et al.,2004). The ravaging floods of 2012 that affected many states in Nigeria have also been attributed to the release of water from Ladgo dam into river Benue; and Shiroro and Kanji dams also released water into river Niger, as well as climate change itself which led to excess precipitation (NEMA, 2012).

Furthermore, Komolafe, et al., (2015) believe that causes of floods are both natural and anthropogenic; the natural causes are basically heavy rainstorm and ocean storms along the coast while the human causes are as a result of burst water main pipes, lack of effective drainage systems, dam failure and spills. As there is little or nothing we can do to make nature obey *"No to Ravaging Floods"*; and no doubt, man is a major culprit behind flooding. Thus, man should take caution from the way he uses the environment, as human interaction with the environment can never be exonerated from the ravaging floods.

Measures to Control Flood in Nigeria

Flood control according to Bariweni, *et al.* (2012) refers to all methods used to reduce or prevent the detrimental effects of flood waters. The consequences of flooding are detrimental as Kolawole, et al., (2011) highlight the basic consequences of flooding to include loss of human lives, submerging of residences and streets, inflow to sewage, municipal pollution, damage to properties, health hazards, cleanup cost, disruption of services, traffic obstruction, aesthetic discolouring, economic loss and infrastructural damage. Thus, taking all measures to combat floods are more than necessary in any society. Some methods of flood control that have been in practice in the past include: planting vegetation to retain extra water, establishing flood forecasting systems, drainage and dams' constructions, ensuring population awareness and preparedness, proactive town planning and discouragement of development in flood prone areas, and development of other institutional capacities that are charged with environmental consciousness and management.

Jeb and Aggarwal (2008) opine that reduction of flood risk will depend largely on the amount of information on floods that is available and knowledge of the areas that are likely to be affected during a flooding event. Agbonkhese, et al., (2014) suggest "*Early Warning"* as a proactive measure to curbing flood menace in Nigeria. Early warning is a proactive mechanism in which certain recognized bodies or agencies take to the study of climate and human interactions with the environment towards foretelling the occurrences of floods and thus issuing warnings to both individuals and government structures with a view of effectively being prepared and curbing the occurrence of floods, averting loss of lives and properties and checking the outbreak of epidemics (Agbonkhese, et al., 2014).

Also, Aderoju, et al., (2012) believe that it is necessary to use modern day techniques in developing measures that will help government and relief agencies in identification of flood prone areas and in planning against flooding events in the future. The knowledge of remote sensing and geographical information system (GIS) is a tool which can be used to investigate and map areas that are less or more vulnerable to flooding in conjunction with forecasting techniques to predict the precipitation intensity and duration in the nearest future (Aderoju, et al., 2012).

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Among the objectives to tackle floods by national government in Nigeria in 2003 Agenda, include providing a master plan for flood control and relief measures for victims; mitigate floods through the relevant land use laws and edicts; proactive planning in controlling development especially along the flood prone areas; improve institutional capacity for flood prediction and public awareness programmes and minimize the impact of floods through the provision and maintenance of appropriate infrastructure.

Agbonkhese, et al., 2014) give vivid view on how structural and non-structural measures could curb the menace of floods. The structural measures such as check dams, levees, flood walls and adequate drainage systems will help control periodic inundation in the areas that are liable to flooding in the following ways: The construction of structures for irrigation and the use of excess run-off water for inter-basin transfer as an alternative to absorb excess water from the Cameroons; Check dams will reduce peak flows; Levees and flood walls confines flow within predetermined channels; Adequate drainage systems will reduce peak flow stages of flood and divert excessive flow; In communities where the rate of flow of storm water is high, embankments should be constructed to breakdown storm water so as not to result into floods (Agbonkhese, et al., 2014). Non- structural measures on the other hand are behavioural adjustments to reduce the possibilities of floods and cushion the effects of floods. Smith and Tobins (1979) provide six types of non-structural measures (behavioural adjustments) to include; loss bearing; public relief funds; flood insurance; floodplain zoning; flood forecasting and warning schemes; and lastly weather modification.

Within flood research, it has been widely accepted that absolute flood protection cannot be achieved (Schanze, 2006). Instead, growing attention has been given to a new paradigm of flood management, based on the effective establishment of both risk mitigation (structural, technical flood defence measures, such as dams, dikes, or polders) and adaptation (non-structural, soft measures, such as preparation of the local people, flood insurances, information management, and social networks) measures (Kubal et al., 2009).

STUDY METHODS

In carrying out this study, both primary and secondary data were employed. Data obtained from primary source were through direct observation, questionnaire administration, Google Earth and Geographic Information System (GIS) mapping. Direct observation was used to examine the general conditions of the study area (Ajibode community in Ibadan, Oyo State Nigeria). Questionnaires were administered to the household heads of the study area and Geographic Information System was used to generate flood vulnerability levels of different parts in the study area. Relevant literature on assessment and control of floods were used for this study and Google Earth for the aerial view of the study area.

The survey carried out in the study area revealed a total of 720 buildings and the names of the streets were also collected. A sample size of 216 (i.e. 30% of 720 buildings) was used for the study. Questionnaire administration was done through random systematic sampling technique, where the first building was selected randomly and subsequent buildings were selected at the interval of every 3 buildings along the street. The questionnaires were administered to the household heads of all the sampled buildings. The data collected for this study was analyzed using SPSS Version 20, and the hypothesis tested for the study was whether vulnerability to

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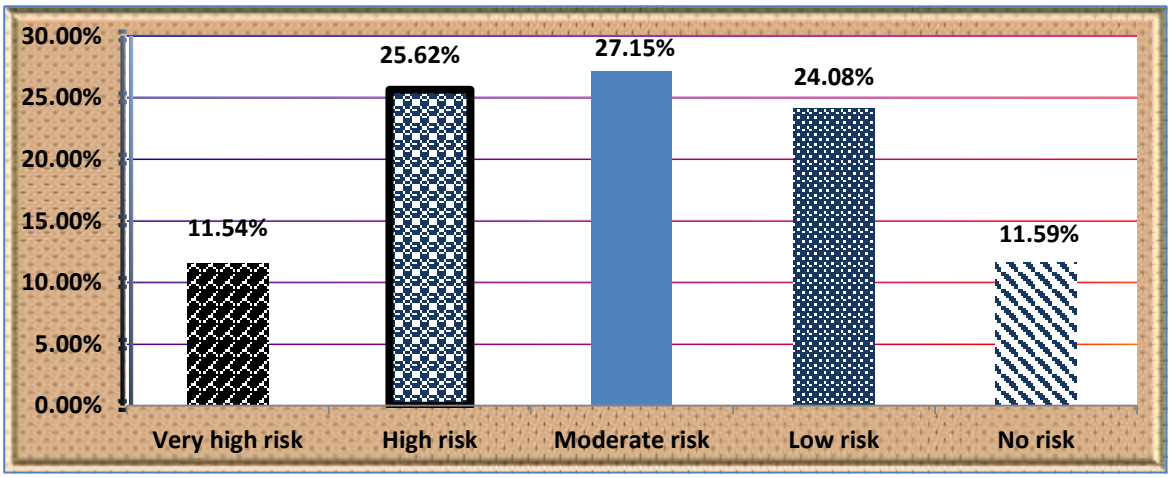
flood has no relationship with the socio-economic characteristics of the respondents using Chi-square.

RESULTS AND DISCUSSION

Flood Vulnerability of the study area

The Figure 2 describes the flood vulnerability of Ajibode in Ibadan, Oyo State. The flood vulnerability chart provides useful information on the various levels of risk to flooding in the area as generated using GIS. Classified LandSat TM image revealed that almost 38% of the study area in terms of land mass is highly vulnerable to flood. Most of these areas are found close to River Ona in the Southern part of the study area. The vulnerability of this area to flood is highly disastrous because of absence of drainage system, waste disposal to streams and increasing built-up area around stream. However, about 24% of the area experience low flood risk, while 11.59% of the area is not at risk of flood, as this part of the study area is hilly.

Figure 2: Flood Vulnerability of the Study Area



Source: Author's Survey, 2016.

Causes of Flood in Ajibode Area, Ibadan Oyo State

Considering the various factors that may have contributed to flooding as shown in the Table 1, the cause of flood with the highest mean of 4.74 is heavy rainfall and while the cause of flood with the lowest mean of 2.15 is car wash operation. However, the average mean for the Causes of Flood Index (CFI) is 3.62. Causes of flood with mean above the average mean value include heavy rainfall, flooding from rivers, inadequate drainage channel, failure of flood defenses, building along water channel, slope, violation of planning regulations and poor physical planning with 4.74, 4.15, 4.36, 4.25, 3.98, 4.03, 4.17 and 4.21 respectively. Actions to control and/or cope with the factors that are mainly responsible for flooding in the study area are more than necessary in order to save human lives and forestall loss of properties to flood ravage.

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Table 1: Residents' level of agreement on causes of vulnerability to flood in the area

S/N	CAUSES OF FLOODING	RATING					Total	SWV	CFI	$x - \bar{x}$	$(x - \bar{x})^2$
		SA	A	I	D	SD					
		5	4	3	2	1					
1	Heavy rainfall	810	208	6	0	0	216	1024	4.74	1.12	1.2544
2	Flooding from rivers	435	400	27	28	6	216	896	4.15	0.53	0.2809
3	Poor condition of drainage	495	320	30	16	0	216	861	2.59	-1.03	1.0609
4	Inadequate drainage channel	495	412	18	16	0	216	941	4.36	0.74	0.5476
5	Failure of flood defenses	520	316	51	28	2	216	917	4.25	0.63	0.3969
6	Building along water channels	280	516	27	30	7	216	860	3.98	0.36	0.1296
7	Climate change	245	184	216	50	24	216	719	3.33	-0.29	0.0841
8	Waste disposal in water channels	385	472	21	14	7	216	514	2.38	-1.24	1.5376
9	Slope	330	452	51	36	2	216	871	4.03	0.41	0.1681
10	Violation of planning regulations	370	456	57	16	1	216	900	4.17	0.55	0.3025
11	Farming along flood plains	170	200	57	76	75	216	578	2.68	-0.94	0.8836
12	Car wash operations	70	120	78	100	96	216	464	2.15	-1.47	2.1609
13	Poor physical planning	460	396	27	26	2	216	911	4.21	0.59	0.3481
	TOTAL								**47.02**		**9.1552**

Source: Author's Survey, 2016. (Note: SA: Strongly Agree; A: Strongly Disagree; I: Indifferent; D: Disagree, and SD: Strongly Disagree).

Effects of Flood in Ajibode Area, Ibadan Oyo State

From the Table 2 below, it can be inferred that the severity of the effects of flood disaster in the study area with the highest mean is 4.09, while the least is 1.37. The average mean is 2.85. The range of severity of the effects of flood disaster index (SFI) variables is 2.72. The effects with mean above the average mean value are considered to be very severe in the area while those below the average mean are considered no so severe in the area. Effects with high severity of flooding index (EFI) are loss of houses and/or houses' items, loss of farm land and erosion of building foundation with 3.46, 3.81 and 4.09 respectively. The least mean of the effects of flood is 1.37 which stands for loss of lives in the study area. Though, loss of lives as effects of flood has the least mean of severity statistically from the perceptions of the respondents, but is the greatest loss as it is the only effect of flood that is irreplaceable.

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Table 2: Residents' agreement index on the effects of flood disaster in the area

SN	Severity of effects of flood disaster	RATING					Total	SWV	CFI	(x-x)	$(x-x)^2$
		VS	S	NTS	NT	NSA					
		5	4	3	2	1					
1	Loss of lives/Injury	20	32	39	28	177	216	296	1.37	-1.48	2.1904
2	Disease Outbreak	10	12	60	102	140	216	324	1.50	-1.35	1.8225
3	Loss of house value	260	228	186	56	17	216	747	3.46	0.61	0.3721
4	Loss of farm land	295	360	141	16	12	216	824	3.81	0.96	0.9216
5	Erosion of building foundation	470	304	75	26	8	216	883	4.09	1.24	1.5376
	TOTAL								**14.23**		**6.8442**

Source: Authors' Field Survey, 2016. (Note: VS – Very Severe, S – Severe, NTS – Not too Severe, NT – Not Severe, NSA – Not so severe, SWV – Summation of Weighted Value).

Residents' Views on Effectiveness of Flood Control Index

There are various measures that have been employed in the control of flood in the area. Among these measures include drainage system, creating environmental awareness on the danger of flood, sorting of waste before disposal, and construction of bridge among others. But the constant experience of flood in the study area has been very enormous in the recent time as if no action has been taken in the community. The level of effectiveness of flood control within the study area is explained using Likert's scale. From Table 3, the highest mean is 4.16, while the least is 3.75. The average mean is 4.03. The range of effectiveness of flood index (EFI) variable is 0.41. The control measures with high positive deviation above the mean include; proper use of drainage system (4.13), proper refuse disposal (4.06), construction of drainage where there is none (4.07), raising of building foundation (4.25), construction of bridges (4.09) and River channelization (4.16). These factors are considered to be effective in the study area in the control of flooding.

It could also be deduced that government efforts in the construction of drainage where there is none before, construction of bridge and the dredging of the river Ona in the study area has been effective in the control of flood, it is left for the government to undertake another phase of the dredging of the river before the commencement of another raining season. More efforts from the community, governments, individuals, private sectors, and NGOs as regards all these aforementioned measures as well as strict adherence to town planning regulations by the residents of the community and the prospective developers in the area.

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Table 3: Residents' Level of Agreement on Effectiveness of Flood Control Index

S/N	Effectiveness of Flood Control	RATING					Total	SWV	EFI	(x-x)	$(x-x)^2$
		HE	E	ME	NE	NEA					
		5	4	3	2	1					
1	Proper use of drainage system	450	288	135	18	0	216	891	4.13	0.1	0.01
2	Constant opening of drainage	165	508	159	6	0	216	838	3.88	-0.15	0.0225
3	Proper refuse disposal	345	380	144	8	0	216	877	4.06	0.03	0.0009
4	Construction of drainage where there is none	385	336	147	12	0	216	880	4.07	0.04	0.0016
5	Proper land use planning	315	332	186	8	4	216	845	3.91	-0.12	0.0144
6	Creating environmental awareness on the danger of flood	360	380	114	6	8	216	868	4.02	-0.01	0.0001
7	Sorting of waste before disposal.	275	328	174	26	8	216	811	3.75	-0.28	0.0784
8	Use of Sandbags	280	424	144	4	4	216	856	3.96	-0.07	0.0049
9	Raising of building foundation	455	340	120	2	0	216	917	4.25	0.22	0.0484
10	Construction of bridge	350	388	141	4	0	216	883	4.09	0.06	0.0036
11	River channelization	380	396	120	2	0	216	898	4.16	0.13	0.0169
	TOTAL								**44.28**		**0.2017**

Source: Authors' Survey, 2016. (Note: SWV- Summation of Weighted Value,

HE – Highly Effective, E – Effective, ME – Minimally Effective, NE – Not Effective, NEA – Not Effective at all)

Vulnerability of Respondents to Flood and their Socio-economic Characteristics

The results of the relationship between vulnerability of respondents to flood and their socio-economic characteristics using Chi-square (X^2) are presented in the Table 4 below. Age of the respondents, sex of the respondents, marital status, occupation and educational qualifications of the respondents have no significant relationships with the residents of the study area being vulnerable to flood as their p-values are greater than confidence level of 0.05 as presented in Table 4. However, annual rent of house and monthly income of the respondents have significant relationships with their vulnerability to flood, with p-values of 0.00 and 0.04 respectively.

It not incorrect to opine that the financial capability of a man could determine his choice of location especially in competitive area. Consequently, this action is not unconnected to vulnerability of man to flood as many studies (Adetunji and Oyeleye, 2013; Agbonkhese et al., 2014 and Aderoju, et al., 2012) among others, conclude that people with less income or less privilege in most cases inhabit flood prone areas especially in areas where there is no acute competition for real estates.

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Table 4: Vulnerability of Respondents to Flood and their Socio-economic Characteristics

Variables	X^2	DF	P-Values	Remarks
Age	4.035	3	0.258	Not significant
Sex	0.054	1	Nil	Not significant
Marital status	2.291	3	0.514	Not significant
Occupational status	8.929	5	0.112	Not significant
Educational qualification	2.409	3	0.492	Not significant
Annual rent of house	19.026	3	0.000	Significant
Average monthly income	7.990	3	0.040	Significant

SUMMARY OF FINDINGS

The area at high risk to flood hazard is found close to River Ona in the Southern part of the study area, the high level of risk is due to the presence of the river. This area is largely covered with vegetation, farmlands and buildings. The vulnerability of this area to flood is highly disastrous because of absence of drainage system, solid waste disposal in streams and old nature of houses. The areas that are at moderate risk to flooding are characterized with blocked drainage channels, commercials areas and infrastructural facilities such as major road, transformer, health Centre among others. The low risk and no risk areas are the elevated part of the area.

Among the causes of flood in the study area include heavy rainfall, flooding from rivers, inadequate drainage channels, failure of flood defenses, building along water channel, slope, violation of planning regulations and poor physical planning.

From the study the severe effects of flooding in the area include loss of farmland, erosion of building foundation and/ or loss of house, loss of human lives and other valuables. The study reveals that the following measures were considered effective by the residents in the control and management of flood: proper use of drainage system, proper refuse disposal, construction of drainage where there is none, raising of building foundation, construction of bridges and river channelization; while proper land use planning, creating environmental awareness on flood and use of sandbags are not effective measures of controlling flood in the area. It was also revealed that the members of the community have tried their best in controlling or avoiding flood occurrence through various community projects like constructing drainage and clearing of water ways in the community. However, major projects like dredging of river, construction of drainages and bridges where necessary and proper adherence to planning regulations are expected from government for implementation.

The study shows that there are significant relationships between the annual rent and average monthly income of respondents, with their possibility to be vulnerable to flood occurrence.

CONCLUSION AND RECOMMENDATIONS

Flood has continually ravaged many parts of Ibadan Township which is the capital city of Oyo State Government in Nigeria. Among the areas that are seriously affected by floods in Ibadan is Ajibode which continues to witness more influx of people to the area for habitation. Urgent action in order to be able to control, cope and adapt with flooding in terms of its causes and

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effects are more than necessary at this point. In achieving this, the study concludes by providing the following recommendations;

i. There is need for massive campaign against improper dumping of refuse in the drainage system. Members of the community should desist from dumping of refuses on water ways or river and severe fines should be placed on the violators.
ii. Government should separate developments along water ways and provide necessary incentives for the relocation of the affected persons.
iii. Community members of Ajibode could as well relentlessly write some private organizations to help them as part of their Corporate Social Responsibilities provide fund or embark on projects that could reduce both the causes and effects of flooding in the area.
iv. Drainages and bridges are to be constructed or reconstructed where they are needed to be done.
v. Channelization and dredging of River Ona in the study area are important in order for the river to accommodate more volume of water whenever there is excessive rainfall
vi. There is need for flood insurance schemes for residents of flood prone area in Ajibode community as a way of reducing the loss arising from flooding in the area.
vii. Government should plant trees and encourage citizens to plant trees.
viii. Government should provide more funding to conduct studies on hazards management in Nigeria; and also adequate funding for disaster management bodies and agencies in order to carry out their duties when necessary.
ix. Community should cooperate with government, private sectors and NGOs in ensuring that projects embarked upon are not frustrated but successful.
x. Further development in the area should be in utmost conformity with Town Planning standards and must get necessary approval before embarking on such development.

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