COMMUNAL FLOOD MITIGATION STRATEGIES IN IBADAN, NIGERIA

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ABSTRACT
Efforts towards flood risks mitigation supposed to be a bottom-up approach; because local communities are usually the first receptors of impacts and responders to natural and man-made disasters. This study investigated flood mitigation strategies at the community level. Thirteen communities identified by Oyo State government, been the most ravaged by 2011 flood were sampled. Community heads were identified through the Landlord/Landlady Associations (LLA) where the thirteen priority sites were situated. Six executives of the LLA (Chairman, Vice-chairman, General Secretary, Financial Secretary, Treasurer, and Public Relation Officers) were purposively selected for interview at each of the communities. Interview guide and observation were used for data collection. The strategies adopted included sensitisation of people about practices that trigger flood during community meeting, monitoring of water channels to curb solid waste disposal, clearing of water channels, construction of culvert and embankment, dredging of water channel, removing structure along water channels and improvising early warning systems. Some policy implications that can help improve flood risk mitigation are outlined.

Keywords: *community, flood, mitigation strategies, Ibadan, Nigeria*

INTRODUCTION
Globally, flood is acknowledged as an event with extreme destructive tendencies which can undermine the ability of a community to fulfil basic developmental agenda. Flood is a significant hazard in Ibadan. Ten remarkable incidences of flood occurred between 1902 and 2013. The first flood took place in 1902 at Oranyan swamp. Ogunpa overflowed its banks and rendered many homeless in 1924 and 1956. Four years after (1960), 400 houses were destroyed along Ogunpa River owing to inundation. In 1963, Ogunpa River overflowed its bank again and destroyed many homes. Properties worth several millions of Naira were damaged during the 1978 flood along Ogunpa River at Old Gbagi market. The most devastating flood in the history of Ibadan occurred in 1980; during which about three hundred people were killed and properties worth millions of Naira destroyed along Ogunpa Oyo, Omitowoju and Molete (Akintola 1994). Thirty-one years after, on the 26th of August 2011; 120 people were killed and 2,105 buildings were destroyed when Ibadan metropolis (11 Local Government Areas) was ravaged by flood (Oyo State Government, 2011). The flood collapsed hydraulic structures and isolated many communities for many days.

Affected communities include: Odo-Ona, Odo-Ona Elewe, Orogun, Agbowo, Apata, Ajibode, University of Ibadan, Ogbere-Babanla, Ogbere Moradeyo, Onipepeye and Eleyele Water Works (Agbola *et al*., 2012; Akintola, and Ikwuyatum. 2012; Wahab and Falola, 2018). The metropolitan Ibadan experienced another flood in 2012, while affected communities were Odo-Ona Elewe, Odo-ona Apata, Oke Ayo Apata, Oluyole Estate, Ring Road, Mokola and Apete. Also, the flood of September 2013 devastated the flowing communities: Asolo, Soka Ajegunle, Olorunsogo, Toll Gate, Felele, Basorun, Muslim, Soka, Fodasis, and Ring Road. Others were Baba Nla, Challenge, Molete, Olunloyo, Ighodalo, Academy, Omiyale, and Olomi. The remaining communities were Olunde, Ayegun, Aba-Alfa, Jaloke, Papa-Eleye, Aladi, Ire-Akari, Arapaja and Akala new extension areas.

Many communities in Nigeria are vulnerable to flood owing to rapid urbanisation (Mabogunje, 1968), poverty and poor drainage channels (Adelekan, 2012), development in floodplains (Ndabula *et al*., 2012), municipal solid waste disposal into drainage channels (Aderogba, 2012; and Ojolowo, 2016); excessive rainfall (Emeribeole, 2015), and building contravention (Wahab and Ojolowo, 2018). Communities are usually the first receptors of impacts and responders to natural and man-made disasters; yet majority of the causes, particularly in Ibadan, are anthropogenic and are invoked at the community level. This study identified efforts of the communities at reducing exposure to flood in Ibadan metropolis.

Community: a driving force of disaster risk reduction
Community is a coherent, social group of persons with interests or rights in a particular area of land which the members have or exercise communally in terms of an agreement, custom or law (ISDR, 2002). In disaster study, community is a group of people living at the same location and are

exposed to the same risks (ISDR, 2002). Boyles (1997) asserts that Aristotle defined community as a group of men having shared values. A community can be group of people living in one area, showcasing the same culture, appreciating the same value and observing the same norms. However, human communities is expected to have and share same of similar interest belief, resources, preferences, needs, risks, and a number of other conditions that may be present and or common, affecting the identity of the participants and their degree of cohesiveness. Community have knowledge about the hazards occurring in their environment and are able to anticipate and develop ways of reducing their impacts in many cases. The strategies might be crude but the richness of experience and indigenous knowledge is a resource to be recognised in reducing vulnerability to disaster globally (ADPC, 2003). Prior to modern civilisation, communities were collectively resolving issues when natural or manmade disasters struck. They developed techniques to resist total disruption of their activities in case of a disaster. They carefully select sites for their settlements to facilitate protection against invasions and ensure closeness to fertile land for agricultural activities.

After formation of state, government-based disaster risk reduction program, failed to serve the needs of the people and communities (Shaw *et al*. 2013). Local people revert to indigenous approaches of surviving harsh environmental conditions. Since 1989 that Maskrey introduced community-based approach to disaster management; many scholars have advocated for risk management approaches at the local level (Victoria, 2002; Shaw and Okazaki, 2003; Shaw, 2012, 2014). In the recent years, more research on development has been conducted in various fields that showed the approach to disaster risk reduction became more and more community-based (Quarantelli, 1989; Blaikie *et al*. 1994; Mileti, 2001), and much more effort has been put into incorporating disaster management aspects into the holistic development of communities (Twigg and Bhatt 1998; Shaw and Okazaki 2003).

Community-based disaster risk management (CBDRM); is defined by Yodmani (2001) as methods that lower exposure to and strengthens people's capacity to cope with disaster-related risks. It involves: reduction of vulnerabilities and increase capacities of vulnerable groups and communities to cope with, prevent, or minimise loss and damage to life, property, and the environment. The thrust of disaster risk reduction is to lower basic risk, advocate preventive actions, and reduce vulnerabilities by strengthening individuals, families and communities prior to a disaster. Conversely, disaster risk management transcends prevention, mitigation to relief, response, and recovery (Shaw, 2016). Owing to log-time experience of a peculiar disaster, community members have had adequate knowledge of pre-disaster signs and behaviour of nature; and have developed strategies that can reduce loss of life and property of those who are vulnerable to the disaster.

Community-based disaster risk reduction (CBDRR) focus on strategies that have been devised by local people to lower the risks associated with common disasters in their immediate environment. CBDRR focuses mainly on pre-disaster activities for risk reduction by the communities at the local level (Shaw, 2014). These are traditional approaches evolved through indigenous practices, and are designed and put in place prior to the occurrence of a disaster in order to lower its impacts on the environment. Community-based disaster reduction strategy is borne out of the ingenuity of the local peoples' wisdom (Cronin *et al*., 2004; Takeuchi *et al*., 2010; Mercer et al., 2010; Howitt *et al*., 2012); known as indigenous knowledge (IK). IK is acquired through long-time interactions with natural and manmade environment, and is transferred from generation to generation. The local techniques devised to mitigate disaster risks in different natural milieu are referred to as CBDRR. It is central to meeting local and global development objectives and to adapting to climate change. CBDRR is recognised globally in the key agreements of the Hyogo Framework for Action (ISDR, 2005); it is building safer, disaster-resilient and developed communities. CBDRR encourages community participation; it facilitates responsiveness on the part of local people; and strengthen the community prior to disaster (Table 1). Other traits include comprehensive approach to risk reduction, mainstream every member of the community to disaster risks reduction, and contribute significantly to economic prosperity.

Table 1 Characteristics of CBDRR

	Characteristics of CBDRR	Explanation
1	1. Participatory process and content	• Community is the key actor and primary beneficiary • Involves all the vulnerable groups
2	Responsive	• Considers the community's perception and prioritization of DRR • Community empowerment through ownership creation
3	Proactive	• Prepares the communities to face disasters beforehand
4	Comprehensive	• Structural mitigation (dam construction, early warning centres) • Non-structural mitigation (education and training, public awareness)
5	5. Integrated	• Involves all the stakeholders in DRR • Pre-, during and post-disaster measures are planned and implemented as necessary by the community
6	Multi-sectoral and multi-disciplinary	• Combines indigenous/local knowledge with sciences and new technologies • Builds capacity within while bringing resources externally
7	Empowering	• People's options and capacities increased • More access to and control of resources and basic services • Meaningful participation in decision-making
8	Developmental	• Contributes in poverty reduction • Correlated to developmental activities

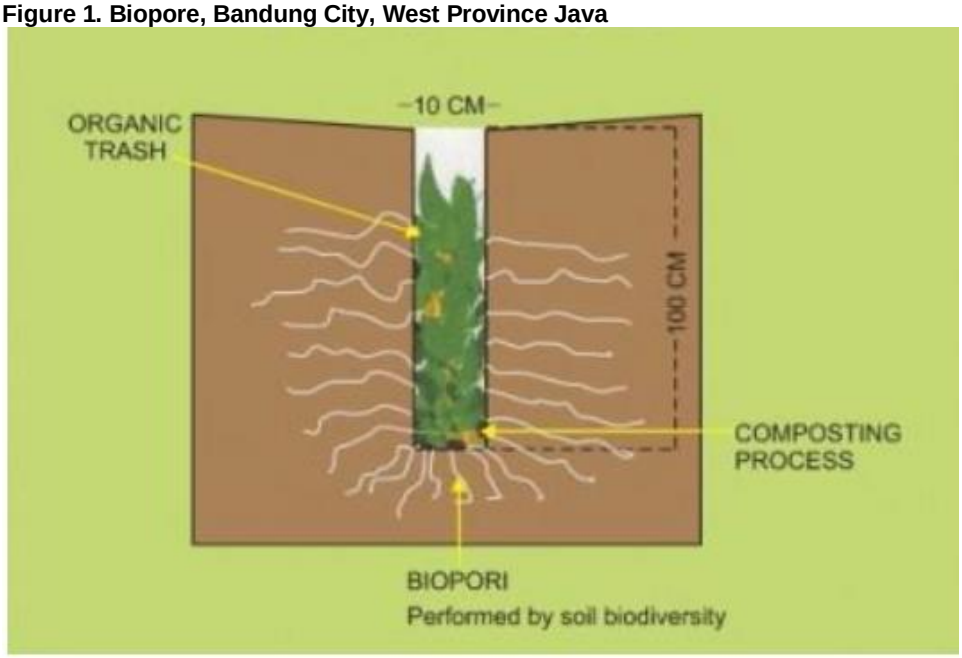
Source: Shaw *et al*., 2013

A brief review of community-based flood risk reduction practices

Community-based flood risk reduction practices are set to mitigate and curtail the impact of natural and manmade hazards on people, property and infrastructure, either through structural measures such as erection of bridges, protective dikes, embankments, and safety building design and non-structural measures like community risk assessment, community risk reduction planning, public awareness, food security programs, group saving, cooperatives, strengthening community disaster management organisations and advocacy on disasters and development issues, legislation, and land use zoning, among others (Shaw, 2016). In Nepal, riverbank have been raised and protected, wherein bio-engineering techniques are applied to cultivate suitable cash crops, including watermelon, vegetables, nuts, turmeric, taro, and ginger to reduce the impacts of flood (Gautam, 2009). Shaw *et al*. (2013) inferred that community-based risk reduction projects are taking place in 500 villages across Aceh as well as in disaster prone districts of Sri Lanka; these include hazards mapping, emergency first aid training and grassroots early warning system.

In 2008, UNEP asserts that the Luo community living around Lake Victoria, Africa, exhibits numerous climate monitoring indicators bequeathed to them by their ancestors as an early prediction of impeding disasters. These comprises behaviour of animals, birds, reptiles, amphibians, movement of insects, vegetation and trees, direction and strength of wind blowing, temperatures and celestial bodies. Rianawati and Sagala (2014) evaluated Biopore as a traditional approach to retaining storm water and eventually reduce the intensity of flooding in Bandung City, West Province Java. Biopore (Figure 1) is a 10cm by 100cm hole intentionally dug to contain storm water. This is to increase the absorptive capacity of soil and lowering surface water flow during rain event that could lead to inundation. Sari et al. (2013) discovered the use of "kentongan" as an early warning tool for flood. "Kentongan" is a traditional tool to warning the people in that village when the emergency response of everything occurred in the village (Figure 1). "Kentongan" will be emitted when flood reached the highway, so the people can prepare to rescue themselves.

Figure 1. Biopore, Bandung City, West Province Java



Source: Rianawati and Sagala, 2014

Figure 2. "Kentongan" The Traditional Tools of Emergency Response in Ponorogo, Indonesia

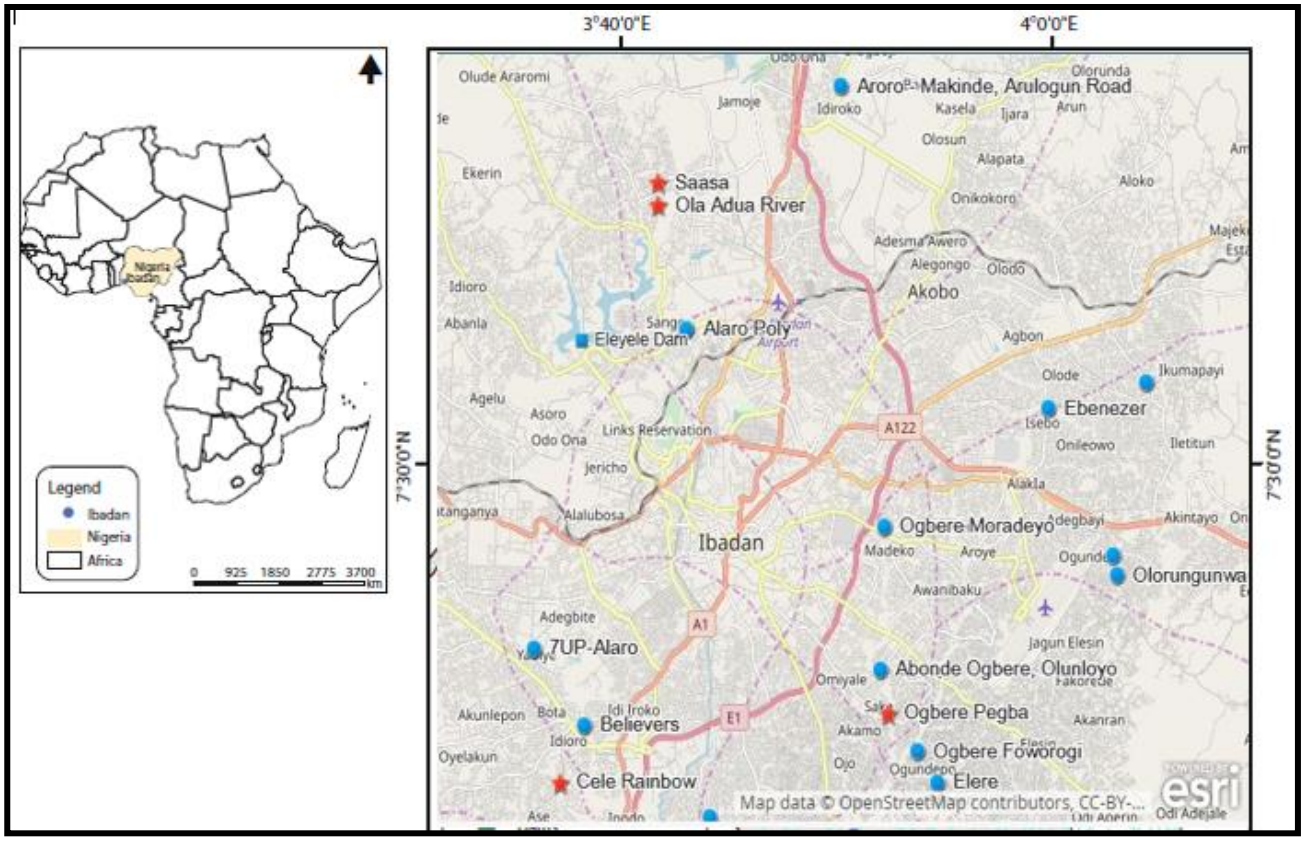
Source: Sari *et al*., 2013

THE STUDY AREA

Ibadan is popularly known as one of the oldest cities in West Africa Sub-region. It is the capital of Oyo State, Nigeria (Fig. 3), comprising eleven local government areas (LGAs). The ancient city is located 160 km from the Atlantic coast, found on seven main hills in the region with an average elevation of 200m (Mabogunje, 1962). Ibadan as a city consists of Ibadan urban core area and its immediate suburban or peri-urban districts. The Ibadan urban core is made up of the five LGAs these are Ibadan North, Ibadan North- East, Ibadan South-East, Ibadan South-West and Ibadan North-West. Often times called the Ibadan metropolitan area. The hinterlands of the metropolitan

city are predominantly peri-urban areas constituting six main LGAs (Ona-Ara, Ido, Oluyole, Akinyele, Egbeda and Lagelu LGAs) within periphery of Ibadan region.

Fig. 3: Thirteen priority sites in Ibadan



Source: Ibadan Urban Flood Management Project (IUFMP), 2018

METHODOLOGY

After the 2011 general flood in Ibadan, the Federal Government of Nigeria, on behalf of the Oyo State Government received a credit from the World Bank to provide hydraulic and associated infrastructure in 13 priority sites (Table 2 and Figure 3) to facilitate free flow of storm water in flood-ravaged communities. These sites are located at: Alaro Seven-up stream (7Up road, Ibadan South West LGA), Alaro Poly Alaro (Eleyele/Sango road, Ibadan North LGA), Ebenezery stream (Ebenezery/Isebo, Egbeda LGA), Elere stream (Idi-Ogun community, Oluyole LGA), Foworogi stream (Ifesowapo Idi-Osan community, Oluyole LGA); Maje river (Odo-Ona Elewe, Aba-adio/Aba-llepanu communities, Oluyole LGA); Ogbere Moradeyo stream (Ogbere Moradeyo community, Egbeda LGA), Olorungunwa (Egbeda LGA), Omirin Adekola (Egbeda LGA). Community heads were identified through the Landlord/Landlady Associations (LLA) where the thirteen priority sites were situated. Six executives of the LLA (Chairman, Vice-chairman [VC], General Secretary [GS], Financial Secretary [FS], Treasurer, and Public Relation Officers [PRO]) were purposively selected for interview at each of the areas. This gave a total of 78 respondents. Relevant data on the efforts at reducing the impact of flood at the sampled communities were collected. Data were descriptively analysed and presented.

Table 2: Thirteen priority flood sites in Ibadan

S/N	Communities	Water Body	Accessibility	Major Landuse	LGA
1	Alaro Seven-up	Alaro River	Seven-up road	residential/industrial	Ibadan S/West
2	Alaro Poly	Alaro River	Eleyele/Sango road	Residential/institutional/commercial	Ibadan North
3	Ebenezery/Isebo	Omi River	Iyana Agbala road	Residential/institutional	Egbeda
4	Elere Idi-Ogun community	Ogbere River	Idi-Ogun road	Residential	Oluyole
5	Foworogi Ifesowapo Idi-Osan	Ogbere River	Idi-Osan road	Residential	Oluyole
6	Maje Odo-Ona Elewe, Aba-adio/Aba-llepanu	Ogunpa River	Odo-Ona kekere road, off Alao Akala road	Residential/Industrial	Oluyole
7	Ogbere Moradeyo, Ore-meji	Ogbere River	Ore Meji along Lagos Ibadan Express way	Residential	Egbeda
8	Olorungunwa	Omi River	Iyana – Agbala through Omiri area	Residential	Egbeda
9	Omirin/Adekola	Omi River	Alakia - Iyana – Agbala	Residential	Egbeda
10	Believers Stream Oda Ona	Ona River	Odo ona Elewa Road	Industrial	Oluyole
11	Aroro – Makinde, Arulogun	Aroro Stream	Ojoo – Arulogun Road	Residential/Military	Akinyele
12	Oke-Ayo Tuntun Community	Orogbangba stream	Isokun road	Residential	Oluyole
13	Abonde Ogbere, Olunloyo	Ogbere River	Olorunsogo - Akanran Road	Residential	Ona-Ara

Ibadan Urban Flood Management Project (IUFMP), 2018

FINDINGS AND DISCUSSIONS

Socio-economic traits of community leaders

Observations from the 13 communities sampled showed that land/house owners have always been constituting associations to oversee the welfare of their members in Nigeria, particularly in southwest. Some members are either elected or selected as executives, they oversee the affairs of the association; among which are chairman, secretary, and treasurer. Based on general consensus, the members contribute token to service security and also provide some basic public infrastructures; such as road, communal toilet, and public primary school. One of the significant role of the executive is settlement of dispute among or between members. This act alone facilitates cohesiveness among members and improve social relations. Therefore, concern for members who were struck by disasters cannot be an exception. Analysis of the socio-economic characteristics of the respondents revealed that majority were elderly as 71.8% were 56-65 years of age and 28.2% were 76-85 years (Table 3). Out of those who were 56-65 years of age, 38.5% were chairmen, 84.6% were VC and PRO respectively, FS and Treasurers were 76.9% respectively, while GS was 69.2%. For those who were 76-85 years old, 61.5% were Chairmen, PRO and VC were 15.4% respectively, FS and Treasure were 23.1% respectively, and GS was 30.8%. This indicates that the elderly among residents of flood-prone areas in Ibadan were providing invaluable services at the community level. They informally promote peaceful co-existence of the people from different backgrounds; and enhance governance at the local level. The results affirmed that age is one of the determinants of headship (Wilson, 2009); that make people submissive to order and hearken to advice in Yoruba Land.

The gender analysis showed that 24.4% and 75.6% of the respondents were females and males respectively. This indicates that females were also part of the decision making body at the community level. All the sampled communities were male-headed. The PROs were also men. While 38.5% of the Vice-chairmen were females, 53.8% were Treasurers, 30.8% were FSs, and 23.1% were GS. Out of the thirteen communities, five (Aroro – Makinde, Arulogun, Oke-Ayo Tuntun, Maje Odo-Ona Elewe, Omirin/Adekola,) made females the VC, while seven (Oke-Ayo Tuntun, Maje Odo-Ona Elewe, Omirin/Adekola, Ebenezery/Isebo, Olorungunwa, Elere Idi-Ogun community, and Abonde Ogbere, Olunloyo) made them their treasurers.

None of the community leader was been paid for rendering services to the community; however, transport and meal allowances were provided from communities' coffers any time they represented the community outside their domain. Thus, the executives have requisite skills to generate personal income without recourse to the community finances. The majority of the executives 52.6% were artisans, 32.1% were traders, while civil servants and retiree were 7.7% respectively. It indicates that all the community leaders engaged in income-generated activities; as 47.4% earned between ₦31, 000 and ₦40, 000 monthly, those who earned between ₦21, 000 to ₦30, 000 were 46.2%, 3.8% earned less than ₦20, 000, while 2.6% earned more than 100,000 per month.

Table 3: Socio-economic characteristics of the respondents

Age (years)	**Frequency**	**Percentages**
56-65	56	71.8
76-85	22	28.2
Total	**78**	**100.0**
Age-Position Crosstabulaton	**56-65**	**76-85**
Chairman	5 (38.5%)	8 (61.5%)
Vice-Chairman	11 (84.6%)	2 (15.4%)
General Secretary	9 (69.2%)	4 (30.8%)
Financial Secretary	10 (76.9%)	3 (23.1%)
Treasurer	10 (76.9%)	3 (23.1%)
Public Relation Officer	11 (84.6%)	2 (15.4%)
Total	**56 (71.8%)**	**22 (28.2%)**
Gender	**Frequency**	**Percentages**
Female	19	24.4
Male	59	75.6
Total	**78**	**100.0**
Gender –Position Crosstabulaton	**Male**	**Female**
Chairman	13 (100.0%)	0 (0.0%)
Vice-Chairman	8 (61.5%)	5 (38.5%)
General Secretary	10 (76.9%)	3 (23.1%)
Financial Secretary	9 (69.2%)	4 (30.8%)
Treasurer	6 (46.2%)	7 (53.8%)
Public Relation Officer	13 (100.0%)	0 (0.0%)
Total	**59 (75.6%)**	**19 (24.4%)**
Income Range per month (₦)	**Frequency**	**Percentages**
< ₦20, 000	3	3.8
₦21, 000 – ₦30, 000	36	46.2
₦31, 000 – ₦40,000	37	47.4
>₦100,000	2	2.6
Total	78	100.0
Occupation	**Frequency**	**Percentages**
Artisan	41	52.5
Trader	25	32.1
Civil Servant	6	7.7
Retiree	6	7.7
Total	**78**	**100.0**
Length of Residence (years)	**Frequency**	**Percentages**
30-39	19	24.4
40-49	5	6.4
50-59	5	6.4
60-69	24	30.8
70 and above	25	32.1
Total	**78**	**100.0**

Author's fieldwork, 2018

2011 Flood: experience and perceived causes

The number of years that the sampled leaders have spent living in the flood-prone communities have enriched their knowledge of risks associated with flood. Experience is a function of time and level of involvement in a particular issue, thereby, grant individual the confidence to contribute to subject of discourse. Majority, 32.1% which include leaders from Olorungunwa, Believers Stream at Oda Ona, Abonde Ogbere, Olunloyo, Oke Ayo Tuntun Community, and Aroro – Makinde Arulogun have been living in the flood-prone communities for more than 70 years; 30.8% for between 60-69 years, and 6.4% for between 40-49 years and 50-59 years respectively. These four categories of leaders witnessed all incidences of flooding in Ibadan, including that of Ogunpa in 1980. Those who witnessed only the 2011 and 2012 flood disasters in Ibadan among the executives were 24.4%, they had lived between 30 and 39 years. According to 75.7% of the community leaders, the causes and intensity of flooding of 1980 were different from that of 2011. Blockage of only Ogunpa River channel caused the 1980 flooding. However, in addition to blockage of channels of seven rivers (Table 2), changes in spatial and demographic traits of Ibadan (Wahab, 2011) made the aftermath of 2011 flooding disastrous than that of 1980.

The 2011 flooding was triggered by combination of natural and manmade agents (Agbola *et al*, 2012). According to the community leaders, one of the significant natural agents of 2011 flood was prolonged and heavy rainfall that lasted for many hours. However, none of the respondents recollected the amount of rainfall that caused the inundation. The International Institute of Tropical Agriculture (IITA) revealed that 187.5 mm of rain water was received in Ibadan on the 26th of August, 2011, when the entire city was ravaged; however, 258 mm rainfall caused 1963 flood along Ogunpa River only; 274 mm rainfall flooded three areas: Ogunpa Oyo, Omitowoju and Molete in 1980. Despite the fact that the rainfall of 26 August 2011 was not the highest in the recorded history of the city, the spatial coverage, monetary value of damages to property, and death that resulted from the event were by far the highest (Agbola et al, 2012). Another natural cause indicated by 15.4% of the respondents was siltation of water channels due to natural weathering and hydrologic processes. Regular contraction and relaxation of rocks due to exposure to sun radiation and rainwater, lead to natural production of pebbles that are moveable by storm water. These pebbles gradually accumulated along the drainage channels, particularly at points where solid waste were deposited or where there were other hurdles; and thereby reduced the capacity of hydraulic infrastructure to contain storm water, which eventually overflow into hitherto dry areas.

Furthermore, others perceived causes indicated by the community leaders in their respective areas were human induced; these include: poor knowledge of causes of flood (14.1%), location of residential buildings in floodplains (20.5%), indiscriminate refuse dump in drainage channels (39.7%), and increased paved surface (10.3%). As shown in Figure 4, indiscriminate dumping of solid waste in drainage channels was observed as one of the causes of flooding in all the communities except Omirin/Adekola and Olorungunwa. Also, community leaders at Olorungunwa, Omirin/Adekola, Alaro Seven-up, Elere Idi-Ogun, Ebenezery/Isebo, Alaro Poly and Ogbere Moradeyo did not consider increased paved surface as a factor of flooding. Location of residential buildings in flood plain was a significant factor across all the sampled communities, except Omirin/Adekola, Alaro Seven-up, and Maje Odo-Ona Elewe. Siltation of water channels and poor knowledge of causes of flood were perceived as factors of flooding in eight communities out of thirteen. The causes of flood perceived by community leaders across the sampled communities were subjected to Chi-square model to determine whether there was a significant difference (Table 4). The Pearson Chi-Square revealed no significant difference in the perception of the agents of flooding across the communities (X^2 = 66.237, P ≥ 0.05). Thus we can conclude that factors identified in this study were principal agents of flooding in Ibadan.

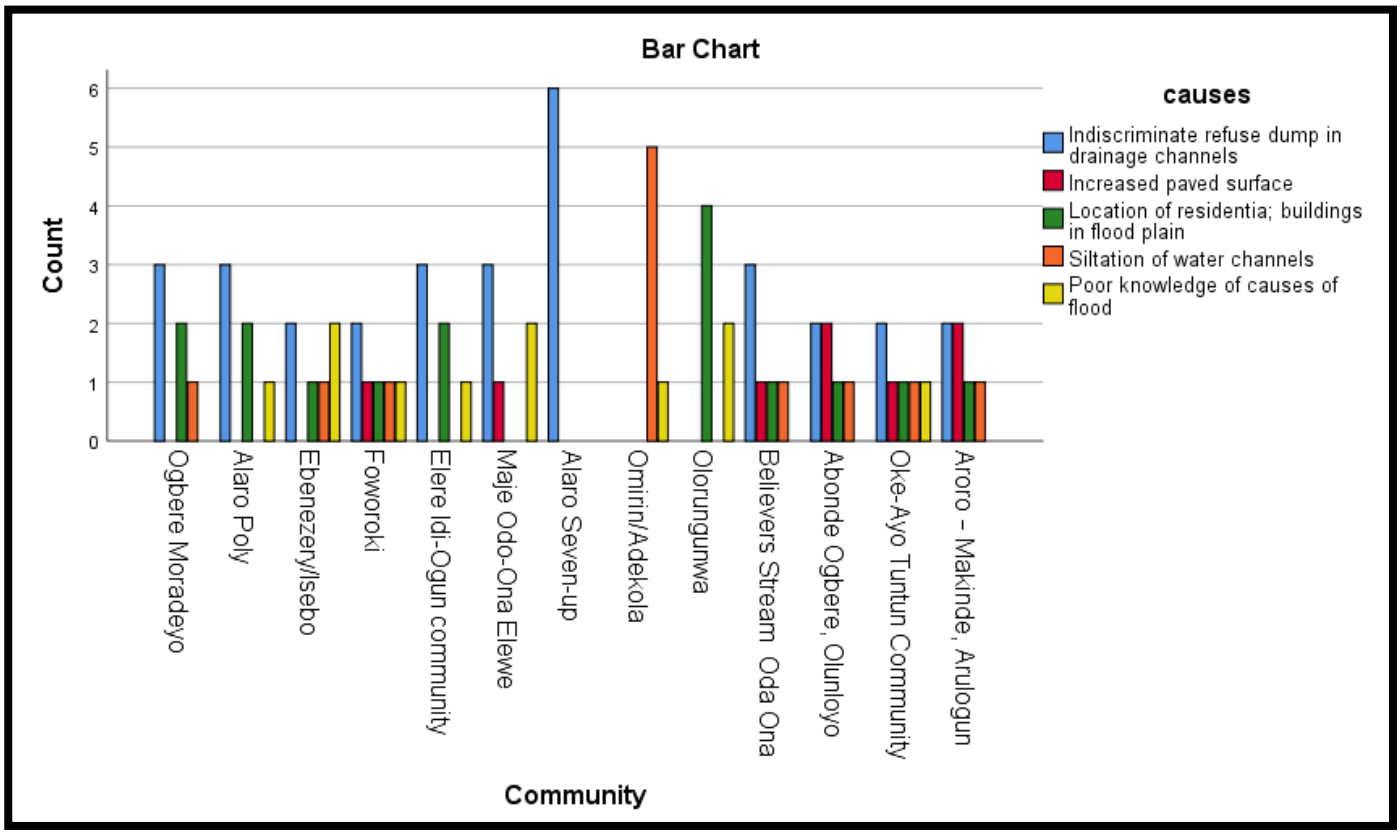


Fig. 4: Perceived causes of 2011 flooding in Ibadan
Source: Author's fieldwork, 2018

Table 4: Chi-Square results of difference in causes of flood in Ibadan

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	66.237[a]	48	.042
Likelihood Ratio	70.527	48	.019
Linear-by-Linear Association	.000	1	1.000
N of Valid Cases	78		
a. 65 cells (100.0%) have expected count less than 5. The minimum expected count is .62.			

Source: Author's analysis, 2019

Flood Mitigation Strategies

The inundation of Ibadan by rainfall in three consecutive years- 2011, 2012, and 2013- and associated havocs have attracted responses from some stakeholders. The Oyo State Task Force on Flood Prevention and Management (OSTFFPM) was inaugurated by the State government on 9 September. 2011 to investigate the causes and possible solutions to risks associated with Ibadan flood. The OSTFFPM submitted its reports on 22 November, 2011 and revealed that a total of 2,105 buildings were washed away. Also, 25 bridges and culverts damaged by flood would require a total sum of ₦4.31 billion for reconstruction in all the affected areas across all the 11 local government areas. The World Bank also responded by providing credit for the reconstruction of damaged roads, bridges and culverts in 13 priority areas of the city (Figure 1). The hypothesis was that the communities who bore most of the brunt make efforts to reduce the risks associated with flood in their respective areas.

The study revealed that all community leaders regularly sensitise their members during community meeting. Three communities (23.1%) where sensitisation takes place every 15 days during LLA meeting were Maje Odo-Ona Elewe, Ebenezery/Isebo, and Oke Ayo Tuntun. Those who educate their members on mitigating flood risks during meeting monthly were 76.9%. All the communities monitor the portion of water channels in their areas to curb indiscriminate disposal of solid waste.

While 23.1% of the communities (Elere Idi-Ogun, Oke Ayo Tuntun, and Ominrin/Adekola) attached fine of ₦10, 000 to a defaulter, the fine is paid into communities' coffers; 38.5% (Ogbere Moradeyo, Alaro Poly, Maje Odo-Ona Elewe, Aroro – Makinde, Arulogun, and Ebenezery/Isebo) handover culprits to the police for necessary legal action. The remaining (38.4%) communities forced defaulters to remove solid waste from the water channels (Table 5).

Table 5: Communal flood mitigation strategies in Ibadan

S/N	Communities	Sensitisation of people	Monitoring of water channels against solid waste disposal	Clearing of water channels	Construction of bridge	Construction of culverts	Dredging of water channels	Erecting Embankment	Removing structure along water channels	Early warning
1	Ogbere Moradeyo	√	√	√	-	-	-	-	√	-
2	Alaro Poly	√	√	-	-	-	-	-	√	-
3	Ebenezery/Isebo	√	√	√	-	-	-	-	√	-
4	Foworogi	√	√	√	-	-	-	-	√	-
5	Elere/Idi-Ogun community	√	√	√	-	-	-	√	√	-
6	Maje Odo-Ona Elewe	√	√	√	-	-	-	-	√	-
7	Alaro Seven-up	√	√	-	-	√	√	-	√	-
8	Omirin/Adekola	√	√	√	-	√	-	-	√	√
9	Olorungunwa	√	√	√	-	√	-	-	√	-
10	Believers Stream Oda Ona	√	√	√	-	√	-	-	√	-
11	Abonde Ogbere, Olunloyo	√	√	-	-	√	-	-	√	-
12	Oke-Ayo Tuntun Community	√	√	√	-	√	-	-	√	-
13	Aroro/Makinde, Arulogun	√	√	√	-	√	-	-	√	-

Source: Author's fieldwork, 2018

Majority 76.9% of the communities attested to clearing of water channels to allow free flow of storm water as a strategy of reducing risks associated with flood in their communities. The 23.1% of the communities (Alaro Poly, Alaro Seven-up, and Abonde Ogbere, Olunloyo) who did not adopt clearing of water channel as a strategy attributed it to size of the channels. According to the respondents, none of the community could construct bridge owing to the cost involved. Fortunately for them, the World Bank has offered credit to Oyo State government for the construction of roads and bridges damaged during the 2011 flood. Communities who constructed culverts were 53.8%; they claimed to have done so, to enhance free flow of traffic and storm water. The community leader at Alaro Seven-up said the point where the culvert was erected along the drainage in their community was where storm water used to accumulate and spread to other areas. An existing culverts were reconstructed At Oke-Ayo Tuntun, Olorungunwa, Aroro/Makinde, and Arulogun to improve flow of storm water and disallow spill.

Alaro Seven-up was the only community that dredged portion of Alaro River where the channel was narrow- 43m west of Zartech Company. The remaining communities did not have the wherewithal to dredge; according to the community leader, they (Alaro community) raised the fund from companies around. The Elere/Idi-Ogun community who erected embankment (7.7%) did so at a point where storm water used to flow into the community and caused havoc. The embankment was made of laterite reinforced with used tyres and about 3m high. All the communities indicated that they disallowed the erection of structures along the water channels. Majority 92.3% of the communities have not been able to develop an early warning system for flood disaster. Inability to create an early warning systems is one of the factors that exposed residents to the risks of 2011 flood in Ibadan. According to the community leaders at Oke-Ayo Tuntun and Ebenezery/Isebo; lack of early warning systems was responsible for dearth of communication to vulnerable residents during the 2011 flood. Those living downstream would have escaped been hit by flood water if there were methods of passing information to one another. Only Omirin/Adekola community improvised an early warning systems. It was made possible by a communication expert living in the community. Christian and Islamic clerics and community leaders had exchanged mobile numbers to enable communication during any emergency. Besides, public address systems belonging to churches and mosques were agreed to be used for disseminating information during emergency situations. According to the community leader, the clerics have unhindered access to the religious houses at any point in time and could be of help during distress calls.

There were challenges associated with the strategies adopted to mitigate flood impact at the local level. According to 92.3% of the respondents, only landlords and landladies who lived around always attend the community meeting where sensitization took place; majority who were tenants do not usually attend. Thus, there is the problem of reaching out to large number of people living in the community. For monitoring water channels to curb indiscriminate solid waste disposal, 53.8% indicated that residents have devised means of disposing off refuse at night to avoid been apprehended during the day; while apprehending those who disposed refuse into public drain had led to violent struggle and unrest (46.2%) in the community. Unhindered flow of solid waste of all descriptions and debris from communities upstream was the major challenge to clearing of water channels in sampled communities (84.6%). The main setback to construction of bridge, culvert, and embankment and dredging of water channels was finance (92.3%). It was also discovered that lack of knowledge (92.3%) was responsible for dearth of early warning systems by the sampled communities.

Flood-prone communities have shown concerns for victims of flood among them by introducing conventional flood control strategies at micro level. The elders living in flood-prone communities

have displayed their ingenuity at solving environmental challenges, even when the wherewithal is a challenge. They have displayed the capability of mitigating flood risks if resources are available.

Conclusion: Policy implications

To effectively sensitise community members, community leaders should step-up campaign beyond community meetings; design handbills for flood education and enlightenment to include when flood-related programme is aired. Ologunorisa and Adejumo (2005) opined that flood risk reduction required the combined efforts of government and local communities, and environmental education through mass media, particularly radio, will disseminate information to every member of the community at the same time; because it appeared to be the most widely accessible and utilised media in local communities. To avoid illegal arrest and imposition of fine, that usually lead to conflict among community members; community leaders should seek the services of Nigeria Security and Civil Defence Corps in monitoring, arresting, and prosecuting recalcitrant community members who are fond of: dumping refuse into water channels and building within floodplains. Community leaders should contact the Department of Works at local government and State levels each time there is need for construction of culverts and bridges respectively. It is also recommended that the early warning systems improvised by Omirin/Adekola community be adopted by flood-prone communities in Ibadan. Although the system is capital intensive, it is anchored on an existing systems and does not impose additional burden on the residents.

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