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Informal Riverine Settlements and Flood Risk Management: A Study of Lokoja, Nigeria

Anunobi, A.I. (Correspond author)
Department Of Architecture, Federal University Of Technology, Minna
Email: arctonnie2000@yahoo.com

Abstract
This study focuses on flood risk management in a high risk zone, the confluence of rivers Niger and Benue at Lokoja, Nigeria. It highlights the extent of the disaster risk, vulnerability, prevention, preparedness and mitigation measures in place. The research method employed is partly qualitative and partly quantitative. Observation schedules, questionnaires and focused group discussion were the research instruments used. Findings show a near total lack of governmental intervention in the flood risk management. Rather the riverine communities put up rudimentary preparedness and prevention measures to confront the flood risk and reduce their vulnerability to its impact.
Key words: flood risk management, preparedness, prevention, riverine communities, vulnerability

1.0 Introduction

There has been a growing international recognition that flood risk management should not be adhoc but based on elaborate long term and flexible programme resulting from rigorous and robust study. This deduction is supported by numerous United Nations Conferences and resolutions on risk reduction (Yokohama 1994, Tampere 1998, Johannesburg 2002, UNISDR Geneva 2004a, b; UNISDR Hyogo 2005a,b, 2007 a,b) which have outlined strategies for various governments, organisations and stakeholders for confronting flood risk challenge.

1.1 Objectives of the study

The objectives of this study are
i. To explore the existential realities of informal riverine settlements.
ii. To explore the peculiar flood risk faced by riverine communities.
iii. To indentify the underlying risk factors through investigation of the components of flood risk in riverine communities.
iv To investigate the flood risk reduction strategies in place and their efficacy.
v. To proffer appropriate technology flood risk reduction approaches.

2.1 Informal Housing Settlements.

Informal housing settlements refer to settlements or shelters which are illegal, fall outside of development control or regulation and are not accounted for in the economy of the area. Such a settlement is either unknown to the authorities or is overlooked by the authorities. It is in a state of unregulation and the ownership, use and purpose of land does not concur to any prescribed set of land use or developmental regulation.
Vale(2005), characterised such settlements as contiguous settlement where the inhabitants have inadequate housing and basic services. Common categories of informal housing settlements include slum settlements, shanty towns, squatter settlements and pavement dwellers.
Large populations round the world face problems of homelessness and insecurity of tenure. Though informal housing settlements are found in developing and developed countries, there are particularly pernicious circumstances in developing countries that lead to a large portion of the population resorting to informal housing (Sassen, 2005). Among these circumstances are stringent development controls that lead to massive deficits in supply of urban land which often displaces low income households.
Due to the fact that these households lack the economic competitive power for the scarce urban land housing, they relocate to the periphery of the cities where they are still afforded the economic opportunity of the urban areas. In this way these peri-urban settlers form an informal housing settlement on the fringes of the urban area.
Many cities in the developing world are currently experiencing a rapid increase in informal housing driven by mass migration to cities in search of employment, fleeing from war or natural disaster. Neuwirth (2012) states that there are over 1 billion people living in informal settlements worldwide. This is one in six of the current world population. It is projected that if the current trend continues, 2 billion people (one in four of world population) will live in informal housing by 2030. This figure is yet projected to rise further to 3 billion (one in three of world population by 2050).

2.2 Riverine Housing Settlements

Riverine housing settlements are informal housing settlements that develop on both sides of riverbanks where the topography is relatively friendly. Among the several reasons for the emergence of riverine housing settlements,

two are very prominent. These are access to the economic opportunities of the river and the settlers strong affinity to their ancestral homelands.

Due to the subsistent nature of these settlements, most of the dwellings are natural buildings Smith, (2002) observes that these natural buildings depend on local technology, local ecology, local geology, the character of the building site and on the needs and personalities of the builders and users.Common building materials in use are mud for walls and thatch for the roof.

Riverine housing settlements are found everywhere in the world. The oldest recorded riverine settlement called the **Five Points** evolved in New York in 1825. History records Five Points riverine housing settlement to have sprung up round a lake named **Collect.** Lake Collect was surrounded by slaughter houses and tanneries all of which emptied their waste into the lake. This riverine settlement housed the poor, rural people leaving farms for opportunity and the urban homeless. (Vale, 2007).

Informality of land tenure is a key characteristic of riverine housing settlements. Because of absence of governmental regulation, riverine housing settlements are characterized by substandard housing structures with unsuitable building materials. Construction quality is often inadequate to withstand heavy rains, flooding, high winds and other extreme weather events. Paper, plastic, earthen floors, and walls, wood held together by ropes, straw or torn metal pieces as roofs are common place. There is often a near absence of basic infrastructure.

2.3 The Concept of Flood

Flood is too much water in the wrong place, whether it is an inundated city or a single drain. Many definitions of flood have been proposed by many scholars. Ologunorisa (2004) reports that the European Union (EU) Flood Directory (2003) defined flood as a covering by water of land not normally covered by water. Oyegbile (2008) defined flood as an over flow of water that submerges land. This definition by Oyegbile appears to narrow flood as a land phenomenon only. This is not entirely correct as rivers and seas also experience flood.

Flooding is the unusual presence of water in a place to an intensity which has a disruptive effect on normal activities. Flooding arises mainly due to over flowing rivers and heavy rain over a short duration. In the sense of "flowing water" flooding many also be applied to the inflow of tide on land and may also result from the volume of water within a body of water, such as a river or lake, which flows or breaks levees, with the result that some of the water escapes its boundaries. It may also be due to accumulation of rainwater on saturated ground in an area. (Oyegbile, 2008).

An unusual inflow of sea water onto land is called ocean flood. Ocean flooding can be caused by storms such as hurricanes (storm surge), high tides (tide flooding), seismic events or large landslides (sometimes called tsunami). While the size of a lake or body of water will normally vary with seasonal changes in precipitation and snow melt from climate change, it is not significant a flood unless such escapes of water endanger land areas used by man like a village, city or other inhabited areas.

2.4 **Flood Risk Assessment**

A comprehensive flood risk assessment is indispensible to successful flood risk management. Flood risk assessment refers to detailed investigation of the flood hazardscape, the potential threats from the flood and the vulnerability paradigm of the research area (Alexander, 2000b:4).Such an assessment will determine the geographical area under flood threat, its population, economy, settlement patterns and prevailing legal framework and sensitivities. A flood risk assessment will therefore necessarily incorporate Hazard Assessment HA, Vulnerability and Capacities Assessment VCA and Damage Assessment DA (Alexander, 2000 b:4): These assessments will form the basis for developing a flood Risk Management blue print which will specify strategies, plans and actions for flood risk reduction or elimination.

Hazard Assessment (HA)

This determines the nature of the flooding based on meteorological and hydrological parameters and the river basin condition. The method can be either quantitative (no. of people affected, hydrological and meteorological data and economic losses) or qualitative (types of areas, damage caused, severity of floods) (Asian Disaster Preparedness Centre ADPC, 2005), Sources of data according to ADPC, (2005) include but not limited to government records, media reports, existing documentation for projects and participatory Disaster Risk Assessment PDRA.

Damage Assessment (DA)

This is an assessment and analyses of potential loss due to flooding (ADPC, 2005:50). Loss estimation integrated into risk assessment assists in selecting high risk areas based on areas of high loss sustainability. Also the Damage Assessment can also be used as part of the hazard assessment and vulnerability assessment. The Economic Commission for Labour America and the Caribbean ECLAC (2003) has done extensive work spanning over 30 years in this area and has come up with the ECLAC Model. The ECLAC model provides methods for estimating direct damages and indirect losses to the social sectors, services, physical infrastructure sector and the economic sectors.

Also captured in this mode are the overall effects of damages to the environment, the impact on women and children (most vulnerable segments of the population) macroeconomic effects and the impact or employment

and income. The ECLAC model provides guidelines for sources of information for each of the above parameters and the techniques to be employed in gathering the information.

Vulnerability and Capacities Assessment (VCA)

This highlights the people and infrastructure most vulnerable to flooding and the potential damages that may occur (ADPC:50). Vulnerability and Capacities Assessment VCA closely resembles Communities Risk Assessment (CRA) where the capacities of the risk population are assessed. The international Federation of the Red Cross and Red Crescent Societies (IFRC) (2004) and the ADPC (2005) have argued that a sustenance livelihood (SL) assessment must also be incorporated in this investigation to determine peoples' ability to withstand disaster. Here again, data collection may be quantitative.

2.5 Flood Risk Management

A flood Risk Management Comprises flood risk assessment, analyses and the implementation of strategies and specific actions to control, reduce and transfer flood risks. This is aimed at producing a blue print for planning, programming and forecasting targeted at flood disaster prevention, mitigation, preparedness and vulnerability reduction. This Hyogo framework for Action HFA 2005a sets an international framework for participatory approach at all levels of society and government for disaster management rooted in sustainable development policies.

2.6 Flood Risk in Urban Riverine Settlements

Pelling (2003) stated that risk in cities is the outcome of a variety of processes that are best represented in the metaphor of a city as an evolving biological system. This declaration by Pelling aptly captures the urban riverine flood risk in most riparian urban settlements where the processes that shape urbanization not only creates but also increases the risk to a large range of hazards, flooding inclusive. Satherthwaite et al (2007) also averred that vulnerability of city populations to urban hazards is a factor of urbanization and its attendant consequences. This is because "nature" does not cause natural disasters, interactions between man and nature do.

Lewis and Mioch (2005) in alluding to the above observed that urban disasters are the result of a combination of inefficient urban management, inadequate planning, poorly regulated population density, inappropriate construction practices, ecological imbalance and infrastructure deficit.Pelling, (2003) and Satherthwaite et al (2007) in support have separately argued that good governance is necessary in reducing urban vulnerability.

Renn (2008) in his own study promoted the concept of risk governance. He defined risk governance as the process and mechanisms concerned with collection, analysis and communication of risk information, leading to management decision. He argues that it is particularly important where the nature of the risk requires collaboration of a range of different stake holders.

In summary, Nomdo and Coetzee's (2002) urban vulnerability framework, Lewis and Mioch's (2005) work on governance and risk reduction and Renn's (2008) promotion of risk governance all strengthen Pellings (2003) study on policies to reduce risk. These add to an abundance of published literature that shows poverty and resources deficit in the urban environment both conspiring to make the urban poor most vulnerable to hazards. These urban poor are often located on the periphery, suburbs and floodplains of urban areas, Benjamin, (2005); Hardoy et al, (2001); Lewis and Mioch (2005); Mustapha, (2005); Pelling, (1997, 1998, 1999, 2003), Rashid, (2000); Satherthwaite et al (2007); and Tipple, (2005).

RESEARCH METHOD

3.0 Type of Research

This study employed mixed approach, combining both quantitative and qualitative methodologies. Quantitative data was generated through questionnaire designed to elicit and evaluate the flood threat in the study area. Observation schedules were designed to obtain quantitative data on terrain classification, buffer zone analysis and physical numbers of affected houses. Field level instruments and physical counting were employed.

Quantitative data was sourced with observation schedules designed to seek information on the house types, damages extent of flooding and mitigation strategies. Local content analysis was used to elicit in-depth information on the social impact of the flooding on the community through focused group discussion.

Purposive sampling technique was also employed in selecting houses for in-depth study. Purposive sampling technique is a non probability sampling in which the housing units to be studied are selected based on the researchers own judgement about which units will be most useful for the research or most representative of the population.

3.1 Type of Research

This study captures the components of a flood risk assessment for Shinkatu Community, a sub-urban community on the outskirts of Lokoja, Kogi State in North Central Nigeria. It is a descriptive survey research drawing from both qualitative and quantitative data from both primary and secondary sources. These data were targeted at assessing housing and flood hazard at both macro (settlement) and micro (household) levels.

3.2 Research Methodology

A combination of both qualitative and quantitative methodologies are employed in this study. Quantitative data

were generated through survey research method by the help of questionnaires, observation schedules and focused group discussions. These instruments were focused on generating a data on house types, designs, flood vulnerability and resilience.Purposive sampling technique was used. This provided a non-probability sampling where the housing units studied are selected based on exposure and impact of flooding. This provided a framework where the study focused on the worst cases scenario in the study area.

3.3 Field Work

In flood risk assessments, the study investigates the flood hazardscape of the settlement and the physical measures undertaken by the building owners. To capture this appropriately it was important that the field work for this study be done at the peak of the flood season. Consequently the field work for this study was undertaken from October 28 to October 30, 2013. This was at the peak of the rainy season in the study area and it is the rains that are responsible for the riverine flooding.

The field work was done by a team of researchers made up of this author, two senior research assistants and two junior research assistants. The senior research assistants were chosen based on their expertise and experience on similar researches before while the junior research assistants were chosen based on their local knowledge of the geography, culture and language of the study areas.

The field work was kick-started by arrival of the team and obtaining a "permit" from the community head. This permit gave the researchers unfettered access to all the nooks and crannies of the community. The people having seen that the researchers had the confidence of the community head in turn took the researchers into confidence and offered as much information to them as was available to them.

4.0 THE STUDY AREA

4.1 Lokoja: Its Geography and Political Context

Located on Latitude 7^{o} 49' North and Longitude 6^{o} 45' East, Lokoja is a historical city in North Central Nigeria. It served for several pre colonial years as capital of British Northern Nigeria Protectorate and remained a convenient administrative town for the British Colonial government even after the amalgamation of Northern and Southern Nigeria in 1914.

Apart from being a riparian town, Lokoja is also a confluence town with a population of about 90,000 inhabitants (National Population Commission, 2006). It is a trade centre as both the Niger and Benue Rivers that join together in Lokoja are for much of their separate courses navigable. A port of River Niger is also situated in Lokoja.

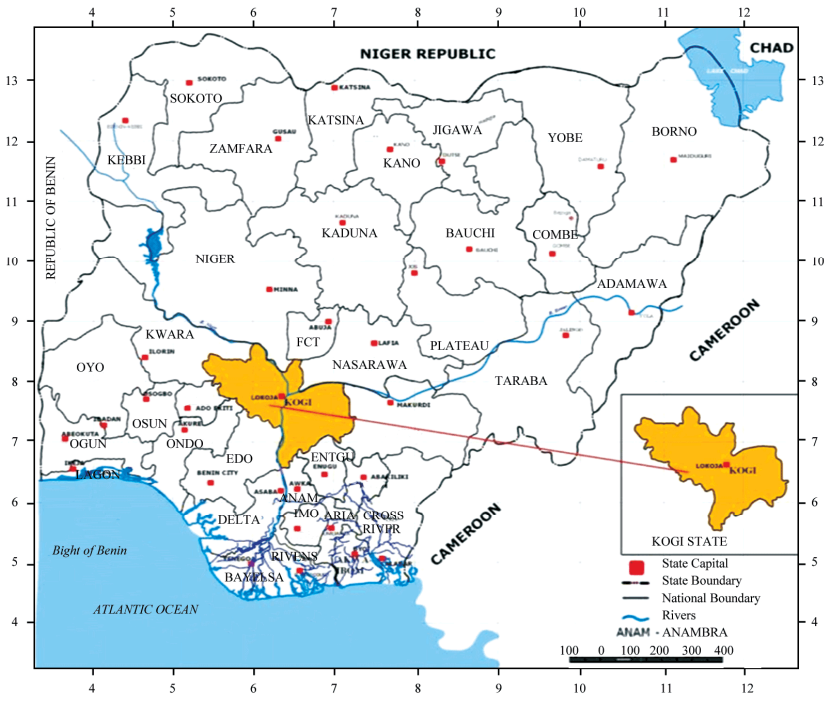

Figure 1 Map of Nigeria showing the location of Kogi State
Note: Source: Kogi State Ministry of Land and Environment, 2008

4.2 Lokoja in the context of the Niger Benue Basin.

The Niger River originates from the Guinea Highlands in South-Eastern Guinea, flows a distance of 4,180km through Mali, Niger and Nigeria before discharging into the Atlantic Ocean in the Niger Delta Area of Nigeria. It

is the principal river of West Africa and the third longest in Africa, after the Nile and the Congo Rivers. The Benue River on the other hand originates from the Adamawa Plateau of Northern Cameroun and flows for 1,400 kilometers westwards through the Lagdo reservoir in Cameroun and into Nigeria before meeting the Niger at Lokoja. At the point of confluence, the two join to form one river.

5.0 FINDINGS, ANALYSIS AND DISCUSSIONS

5.1 The Confluence Flood Plain

Lokoja is the point of confluence between Rivers Niger and Benue. Communities along single river floodplains normally experience riparian flooding. The case of Lokoja is exacerbated by the confluence of two major rivers to produce not a single riparian floodplain but adouble generated by two large water bodies. This confluence floodplain floods yearly beginning in September, peaking in November and receding from May. (World Bank, 2012).

This confluence flood plain is one of the distinguishing features of North Central Nigeria and it, is a significant contributor to Northern Nigeria's rise and fall relief. The extensive flood plain is also vividly captured in the large Africa massive physiographic divisions. (World Bank, 2012)

However, this vast confluence floodplain has its advantage. Its seasonal flooding makes the plain extremely productive for both fishing and agriculture. Also numerous rivulets arising from this confluence point provide livelihoods for numerous communities around the area.

For the cosmopolitan part of Lokoja town, this extensive confluence flood plain offers the following benefits:-

* Excellent land for agriculture
* Water supply for domestic uses (the city's water works obtains water from here).
* Water for watering live stock (for migrant herdsmen)
* Water for fishing (Lokoja is the foremost inland fish centre in Nigeria.
* Access to water for transportation
* Excellent beach view for housing and recreation (an extensive housing estate and a world class beach hotel 'The Confluence Hotel" are already in place.

5.2 Flood Risk in Riverine Settlements

Riverine settlements are specifically prone to flooding due to the following reasons.

* Their terrain elevation in relation sea level is normally low
* Their terrains are normally relatively flat, making them easily over-run by rampaging water that breaks its banks.
* The level of urban planning is normally poor.
* Design, materials and technology of their buildings are normally rudimentary and extremely vulnerable to even minor flood.

5.2 Terrain Classification of the Flooded Houses and Extent of flooding.

The flood macro hazardscape was determined using a 1:50, 000 topographic map obtained from the Nigeria Inland Waterways Authority (NIWA), Lokoja. This was overlaid with a 0.5cm grid. The number of dwelling units and other land use purposes in each cell of the grid was determined.A 50% rule was applied for dwellings that overlap on two cells. An overlapping dwelling is therefore allocated to a cell that has more than 50% of the dwelling spread. Furthermore, where a grid cell has less than 50% of the dwelling spread, the cell is discounted and discountenanced in the counting. To back up these, the dwellings were further geographically located with a GPS for GIS mapping purposes.

The Gradient was calculated with the formula:-

$$\text{Gradient} = \frac{\text{Height (in metres) of elevation}}{\text{Distance (in metres) of spread}}$$

Table 5.1 presents the findings

S/No	Total No. Of Dwellings	No. Flooded	% of flooded Dwellings	% of flooding of Dwelling
0 – 5m	35	ALL	100	100
5.1 – 10	43	ALL	100	90
10-1 – 15m	47	40	85	62
15m.1 – 20m	42	27	64	55
20.1 – 25m	38	21	55	51

Source: Authors Field Work 2013

5.3 Buffer Analysis of the flooded Houses and Extent flooding.

The flood hazardscape in the study areas is quite extensive covering hundreds of metres on both sides due to the convergence of two rivers. Since the dwellings were located in poorly drained floodplain with high water table, the dominant form of flooding observed was through seepage of ground water and water from the rivers

overflowing their banks. This water from overflow of bank was particularly problematic as it swept off dwellings due to its volume and high velocity.

Five buffer zones were delineated by this study viz 0m-50m, 51m – 100m 101m – 150m, 151m – 200m and 201m – 250m. These buffer distances were measured from the banks of the river.Physical count of the dwellings in each buffer zone was undertaken and mapped out.

It was observed that all the dwellings in the flood plain were affected by flooding in one form or the other.While dwellings nearer the river bank experienced flooding from bank over flow and upwelling, the dwellings nearer the road that were obviously below street level and sometimes facing run-off from storm water experienced flooding from storm water.

Damage from runoff water from the road entering dwelling through doors, windows and cracks on walls was more frequent due to frequent rains while damage from over flow of bank was seasonal but more destructive. In summary all dwellings within the studied buffer zones had scars of flood damage in varying degrees depending on location, construction, quality of building materials and level of flood resilience measures put in place.

5.4 **House Types of the flooded Houses**.

Most of the dwellings in the studied area were informal self help built dwelling units. Poor planning, poor construction and unsuitable building materials characterized most of the buildings.

Most of the buildings were made of mud walls, thatched roofs and wooden doors and windows. These materials could hardly withstand flooding. The foundations were shallow and unsustainable.

As a result many houses slanted from the force of the flood water, mud walls were soaked, or washed away with the mesh of reinforcing sticks and poles (adobe construction) exposed. Others completely collapsed from the impact of flood.

Figure 1.1: Showing collapsed shelter by the riverside
Source: Author's fieldwork 2013

Figure 1.2: Type of housing unit within the settlement
Source: Author's fieldwork 2013

Figure 1.3: Proximity of housing unit to river channel
Source: Author's fieldwork 2013

5.5 **Impacts of flood on the flood Hazardscape**.

Various destructive consequences of flood were observed on the flood hazardscape. While some were easily quantifiable, others were not, but all could be classified under the following headings.

* Human: This includes injury, illness and death directly or indirectly associated with the floods. The most vulnerable sections of the community (women and children) were the most affected.

* Social: In this category of impact is the disruption in the normal daily routine and loss of communal life as a consequence of the flood.
* Infrastructural: This incorporates damages to roads, dwellings and communal infrastructure like electric supply, schools, markets and hospitals, Damages in this category were quite extensive.
* Agricultural: As an agrarian community, agriculture was the number one occupation of the community. With farmlands washed away, livestock swallowed by the floods and fingerlings washed ashore, the livelihood of the community was badly affected by the floods.
* Environmental: Consequent upon the floods were erosion, landslides and other earth movements in the community.

5.6 Flood Risk Management in Riverine Settlements

Due to their location, riverine settlements lie on a riverine flood hazardscape and are therefore vulnerable to river flooding. Accordingly management of flood risk in these settlements must necessarily focus on two fronts viz: containing the river and protecting the dwellings.Containing the river will naturally involve structural measures to be undertaken by Government. The cost implications of these structural measures are clearly beyond the capability of the community. They include:

* Building embankments, dykes, levees and floodwalls.
* Channel improvements: Widening, deepening, dredging and removing obstructions.
* Bye-pass channels: Spillways, Sluice gates and breaching.

On the other hand, protecting the dwellings is within the capability of the community. Various measures have been employed by the people over the ages to protect their property with varying degrees of success. They include:-

- Flooding proofing: Flood proofing techniques observed include waterproof sheets, shields, sandbags, sealants.
- Relocation.
- Elevation of building with high foundation.
- Communal flood alert system.

6.1 Conclusion

As already noted, unplanned, poorly regulated and informal settlements located on river flood plains are susceptible to river flooding. Poor housing construction, materials and building standards, coupled with poor site locations either close to the rivers or wetlands, increase the susceptibility of dwellings to flood risk. Terrain classification and buffer locations of these settlements are compounding factors.

Building dykes, constructing houses with stronger foundations and water resistant building materials have been found very helpful. The settlers have historically protected their dwellings with a number of measures. Government's intervention is still very infinitesimal.

6.2 Recommendations.

The management of flood risk in riverine informal settlements is clearly beyond the capability of the settlers. These settlements spring up due to a number of reasons which include economic, urbanization and ancestral ties. Even though these settlement are informal, Government still has a duty to secure the lives and property of citizens, not least against floods.Furthermore Government has to collaborate with the settlers in finding lasting solutions to their flood challenges. This is because each settlement is unique in geography, geomorphology and the attendant risks. A blanket solution may not work everywhere.

Government management of humanitarian crises arising from flood disasters is poor. Archaic practices of evacuation, housing in temporary camps and dumping of relief materials are still implemented. But the general trend the world over is a realization that the flood challenge will not go away, hence the emphasis on flood containment.

Good and pro-active governmental actions in the area of floodplain management will be a very important step. This will entail a policy paradigm shift from haphazard measures to more permanent measures to tame flood devastations.

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