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Assessment of Changing Vulnerability from Kainji Dam in Yauri Emirate - Kebbi State, Nigeria

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Abstract: Kainji Dam is located in the north western part of Nigeria. The river flood plain downstream the dam has rich alluvial soils with great agricultural potentials and this has been the major pull factor for several local communities that settled in the area and engaged in farming as a means of livelihood. However, these downstream communities in Yauri Emirate are exposed to flooding and other forms of vulnerability related to their livelihood activities and living pattern. An assessment of changing vulnerability from kainji dam is therefore conducted in Yauri Emirate. The objectives of the study are to examine the different forms of vulnerability of the people to flood in the study area, characterize the factors that influence vulnerability in the study area and examine the changing nature of vulnerability in the area. The study employed direct field survey using oral interview, questionnaire and field measurements for data collection. Findings of the study revealed that flood hazard is the most common hazard applicable to the study area. 80% of the respondents believed building made from clay are most affected by flood disaster, this is because such buildings were built with poor construction material and requires varying major repairs after flood disasters. The study further shows that 55% of the respondents revealed they have been involved in the planning/activities aimed at reducing flood disaster measures but they found the strategy to be non-effective due to non-sustainability of the flood disaster risk management program within the community, clearing of blocked drainages was their only contribution to flood reduction. The impact of the previous flood experienced 60-65% of destruction to physical infrastructure, to be more common between 2008 to 2017, 65% of the respondents houses were severely destroyed during the year 2008 to 2017. From the data analysis, the respondents agreed on the fact that 2018 was the most affected year where people were rendered jobless, this distortion affected the community's occupation of farming & fishing therefore, having a negative effect on their income streams. This study revealed that Yauri Emirate has been exposed to a wide variety of hazards which need urgent attention. The establishment of the dam has impacted both negatively and positively on the inhabitants of the area. Negative effects seem to outweigh the advantages of the dam. This is because what is required to take full advantage of the dam to assist the local people is lacking.

Keywords: Assessment, Vulnerability, Dam and Yauri

1. Introduction

Large dams constitute a significant tool for the economic development of nations for years. Globally, there are 5000 large dams as at [1]; three quarters of these were in North America, Europe, and other Industrial regions. By the year 2000, the number of large dams had risen to more than 45,000, and these were spread among more than 140 countries [1]. On the average, two large dams were built per day for half a century [2]. The number of large dams exceeds 50,000 [3].

Nigeria as a nation has more than four decades of history of hydro-electric power development starting with the Kainji Dam on the lower part of River Niger. The primary purpose of these dams (Jebba, Kainji on River Niger and Shiroro on

River Kaduna) was to serve as engine of growth and development. This role has been performed credibly by supplying not only Nigeria but also those neighbouring countries for which River Niger is a common wealth, with the needed energy to power the growing economy.

The Kainji dam is the largest single project of the First National Development Plan of 1962 to 1968. The Dam was completed in 1968 with 8 turbines and total generating capacity of 760mw. The Kainji Lake has a storage capacity of about 11.5 billion cubic metres of water. It is 136km long and 30km wide at the widest part. Eighty Percent (80%) of the lake falls within the Yauri Emirate of Kebbi-State [4].

The construction of the dam was designed to meet multi-purpose national objectives aimed at improving the standard of living of the people. These objectives, among other things, is to serve as the main source of electric power supply in the country, to increase fishing and agricultural output around the reservoir area, to improve tourism potentials of the country, to improve navigation facilities of the Niger river from sea coast to Niamey, to establish a national water port at Yelwa-Yauri [4].

Naturally a gigantic project like the Kainji Dam is expected to provide excellent opportunities for the provision of basic amenities for the benefits of the immediate communities as indicated in the above objectives. The reverse is, however, the case. The Yauri Emirate, which provides more than 80% of the total land area, shows very clear evidences of deprivation and neglect in major areas of its peoples' livelihood; resettlement and housing, land utilization, agriculture, social infrastructure, health facilities, schools, etc which can be attributed to presence of the dam.

Apart from electric power generation, the development of agriculture has been one most single objective of the Kainji Lake project was designed for. It is planned to support increase productivity through upland irrigation and draw-down farming systems. However, the irregular filling and emptying of the reservoir have made the attainment of these targets mere dreams.

In addition, the menace of pests and weeds commonly associate with lakes as well as the devastating effects of poverty and ill health among the resettled communities have further worsen the situation. The defunct Niger Dams Authority and the Kainji Lake Research Institute which through their agricultural programmes are supposed to address these issues have made no little or impact. The river flood plain downstream of the dam has rich alluvial soils with great agricultural potentials which has been the major pull factor for several local communities that settled in the area and engaged in farming and fishing as a means of livelihood. As one aspect of an ecosystem is changed, the other parts must adapt or perish. A blockage in a river will inhibit fish migration, which is necessary for the survival of some species. This alteration in the fish life cycle will potentially lead to that species declination, even to the point of extinction. Also, the downstream ecosystem will be affected by the flow rates, water temperature, and lack of particulate matter. The species living in this area also depend on a defined range of habitat characteristics that if interrupted will have a significant effect on the flora and fauna in the area. People are also susceptible to ecosystem changes as well. When fish are affected, the people who depend on the species abundance will suffer if the aquatic populations decline to unsustainable levels. In certain cases, such as dam installations, people may also have to entirely abandon their way of life due to the inundation of their homes and land. However, the downstream communities are exposed to flooding and other forms of vulnerability related to their livelihood activities and living pattern.

In the 1930s, the United States constructed the Hoover Dam that would set a standard for others to follow. Since that time, larger dams have continued to be built throughout the world. Egypt created one of the largest manmade bodies of water with the construction of the Aswan High Dam. Brazil and Paraguay, in South America, followed by completing the Itaipú Dam, the most expansive barrier used to generate substantial amounts of energy for both countries. In Asia, China finished the largest dam on the planet in 2009, the Three Gorges Project, which tamed the Yangtze River (Chang Jiang) and required the greatest number of people in the history of dam building to be relocated.

Large dams do have benefits associated with them. From an environmental and social perspective, these massive structure result in numerous negative impacts. The World Commission on Dams (WCD) set out in 1998 to explore the values associated with dams. Their results were difficult for some to accept: large dams fail to live up to their proposed goals [2].

1.1. Research Questions

1. What are the forms of vulnerability to flood in Yauri Emirate?
2. What are the factors influencing reduced vulnerability to flood in the study Area?
3. How has vulnerability changed over time in the study Area?

1.2. Aim and Objectives

The aim of this study is to assess the changing vulnerability of people in Yauri Emirate to Kainji dam. This aim is achieved through specific objectives which are to:

1. Examine the different forms of vulnerability of the people to flood in the study area;
2. Characterize the factors that influence reduced vulnerability in the study area; and
3. Examine the changing nature of vulnerability in the area.

1.3. Scope of the Study

This study focuses on the assessment of the vulnerability levels as it relates to the people in the study area and also examines the coping strategies of Yauri Emirate (and its people) in relation to the impeding flood disasters of Kainji Dam.

2. Conceptual Framework

2.1. Concept of Flood

Flooding is the unusual presence of water on land to an intensity which has an effect on normal activities. This could arise from rivers/water courses overflowing their banks mainly due to heavy down pour. Other causes could arise from unusual inflow of sea water onto land prominently caused by storm surge, high tides, seismic events or large landslides (sometimes also called tsunami).. This type of flood is called oceanic flooding. Many definition of flood/flooding exist. [5] posits that flood is an overflow of water that submerges land. In the sense of "flowing water", the word may also be applied to the inflow of the tide. Flooding may result from the volume of water within a body of water, such as a river or lake, which overflows or breaks levees, with the result that some of the water escapes its usual boundaries, or may be due to accumulation of rain water on saturated ground in an area [5]. The European Union (EU) Floods Directive defines a flood as a covering by water of land not normally covered by water [6]. While the size of a lake or other body of water will vary with seasonal changes in precipitation and snow melt, it is not a significant flood unless such escapes of water endanger land areas used by man like a village, city or other inhabited area. A flood is a natural event that can have far reaching effects on people and the environment. Put simply, a flood is too much water in the 'wrong' place!

2.1.1. Causes of Flood Disaster

Upslope factors

The amount, location, and timing of water reaching drainage channel from natural precipitation and controlled or uncontrolled reservoir release determines the flow at downstream locations. Some precipitation evaporates, some slowly percolates through soil, some may be temporarily sequestered as snow or ice, and some may produce rapid runoff from surfaces including rock, pavement, roofs, and saturated or frozen ground. The most important upslope factor in determining flood magnitude is the land area of the watershed upstream of the area of interest. Other factors could be the intensity of rainfall as it relates to watersheds less than 30 square miles. Also, the main channel slope could be considered for larger watersheds [7].

Downslope factors

Water flowing downhill ultimately encounters downstream conditions slowing movement. The final limitation is often the ocean or a natural or artificial lake. Elevation changes such as tidal fluctuations are significant determinants of coastal and estuarine flooding.

2.1.2. Effects of Flood

Flood effect according to [8], could be Primary or secondary.

The primary effects of flooding include;

1. It lead to damage to buildings structures,
2. It also lead to damage to bridges,
3. Loss of Life and
4. Roadways.

The Secondary effects of flooding include:

1. Widespread of diseases and obstruction of the natural environment.
2. Economic hardship.

2.2. Vulnerability

A clear understanding of vulnerability is an important ingredient for a successful framework development in the context of assessing vulnerability in Yauri LGA. The word 'vulnerability' has multi-dimensional definitions [9, 10], and there is no single absolute explanation that is regarded as the best conceptualization of vulnerability [11]. Many scholars have given an array of definitions for vulnerability in different context, for instance, the definition of vulnerability to natural and human-induced hazards in relation to climate change [12] and with regard to floods [13, 14].

A society or city is said to be vulnerable when its characteristics and circumstances make it susceptible to the damaging effects of a risk [15]. Therefore, vulnerability may depict circumstances triggered by various phenomena in the form of physical, social, economic, cultural and environmental factors which make a society, system or asset susceptible to natural and human-made hazards.

Vulnerability levels are measured using combination of quantitative and qualitative methods. Mixed methods, according to [16], combine both quantitative and qualitative approaches to benefit from their strengths which will result in the emergence of multiple forms of vulnerability measurement. These include a deductive approach that uses indicators and inductive or participatory approach that involves vulnerable population identifying their own perspective of vulnerability and resilience [17].

Meanwhile, a community-based and participatory approach which combines quantitative and qualitative methods has been acknowledged as the best alternative for flood risk assessment [18].

2.3. Literature Review

Dams have been constructed for millennia, influencing the lives of humans and the ecosystems they inhabit. Remnants of one such man - made structure dating back 5,000 years are still standing in northeast Africa [19].

Around 2950 - 2750 B. C., the first dam known to exist was built by the ancient Egyptians, measuring 11.3 meters [m] (37 feet [ft]) tall, with a crest length of 106 m (348 ft) and foundation length of 80.7 m (265 ft) [20]. The dam was composed of 100,000 tons of rubble, gravel, and stone, with an outer shell of limestone. The immense weight was enough to contain water in a reservoir estimated to have been 570,000 cubic meters [m3] (20 million cubic feet [ft3] or 460 acre-et) in capacity [20].

2.3.1. Dam Failures

The environment is an intricate system, all its parts interconnected to work together. Though lack of water has

had severe outcomes, too much water is also taking its toll in other parts of the world. The reason for the failure could be linked to design, material, site, attack, or a combination. Dams have physically displaced 40-80 million people worldwide, and most of these people have never regained their former livelihoods (WCD, 2000). Inhabitants along rivers will not only be affected by water quality issues, but their way of life will be altered indefinitely.

The Carbora Bassa Dam in Mozambique, built by the Portuguese, has been a target of sabotage over many years of civil wars within the country, which has weakened the structure [21]. In 2000, Mozambique experienced the most devastating flood on record when the spillway of the Carbora Bassa broke open causing a torrent of water to flood the villages downstream [21]. Mozambicans had to deal with their homes being flooded during the rainy season.

In the early 1900s, Arizona suffered a few costly flooding incidents, which caused $2 million in damages per year [22, 23]. In 1918, Arthur Powell Davis, the U.S. Reclamation Director, proposed taming the Colorado River with the largest structure of its time [22. 23]. The Hoover dam was the last project in the $2.5 million five year needle valve replacement program [24]. Now more water can flow through the outlets, but water usage play a significant role in the condition of the Colorado downstream. "In drought years, the riverbed is literally dry miles short of the delta [and at times] there is barely a trickle of water as the river enters" Mexico [25]. In this case, the United States/Mexico treaty of 1944, "which guarantees Mexico 1,500,000 acre-feet annually" is violated causing strain between the countries [26]. The issue has been alleviate due to "abundant rainfall in recent years along much of the Mexico-US border region" amending the water-sharing arrangements for the time being [27].

The annual floods of the Nile River, resulting from late summer rains, carried more than 100 million tons of soil to the lower Nile Valley and cleansed the soil to prevent salt accumulation [28]. This led to the construction of the Aswan dam in Egypt between 1960 to 1971. This augmented water shortages and persistent drought conditions in Egypt. But as years went by, high siltation levels have led to water shortages and increased demand for water by the some of the countries located at the upstream of the Nile River, notably Ethiopia.

With Ethiopia's plans to irrigate about 3 million hectares of farmland, Egyptian could face shortages of water, electricity, and increased siltation [29]. Uganda also began construction in 2007 in Bujagali, on the Ugandan section of the Nile north of Lake Victoria [30]. Egypt can only cooperate due to the infeasibility of going to war. Internally, Egyptians have been affected by the construction of the dam which required ten thousand people to relocate, altered natural habitats, submerged ancient temples and monuments that were not able to be moved to higher locations [22].

The Brazilians and Paraguayans Dammed the Parana River in the 1960s as a result of the intermittent drought conditions experienced by these countries. Although the project was beneficial to the populace, also necessitated a half million people being resettled, as well as affecting the local ecosystems to a great extent [22]. "By 1974, it was reported that almost 85% of the forest on the Paraguayan side of the Paraná River had disappeared" [22]. In the reservoir upstream of the dam, other changes have occurred.

2.3.2. Forms of Vulnerability

Vulnerability could arise in four different forms. viz, Physical vulnerability, economic, social and attitudinal forms of vulnerability.

2.3.3. Changing Nature of Vulnerability to Flood

The first step of vulnerability and capacity assessment is to record the actual impact of the hazard on elements in different categories. Different hazards will affect these categories in different ways. For example, a flood may have a very large impact on houses (physical) and livelihoods (economic), but perhaps a much smaller impact on the forest and fish (natural resources).

A brick building may appear to be a solid asset or capacity, but if it is badly built or situated in a vulnerable place, it could increase the risk to those taking shelter inside – especially during floods or earth-quakes. The general impacts (such as displacement from homes, mortality, physical injuries, disruption of economic activities, destruction of urban infrastructure, and submergence of buildings) that relate to social systems directly have been extensively considered in literatures [31]. However, there are reports that flooding causes severe additional impacts including the loss of social values, spread of vector-borne diseases, as well as air and water pollution [32-33] report that flood hazard increases city-wide poverty as a result of the farmlands which are destroyed and essential services which are often interrupted.

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Ibidun O Adelekan investigated these impacts using four poor urban communities in Lagos as case studies and identified three significant scales: individual, household, and community. [32] At the individual scale, the reluctance of friends and family to visit one another while in flooded houses affects social relationships. This has broad adverse implications on community lifestyle and further compounds depression among flood victims. Food insecurity is equally an important issue at this scale as food items stored in

individual homes are often lost during flooding. In addition, there can be numerous health impacts including chronic skin infections from exposure to contaminated environmental systems and increased effects on those with an already poor health history. Household and community scales of impacts are mainly indicated by the secondary effects of flooding.

Household impacts include deterioration of building quality, intrusion of contaminated water into apartments, lack of good drinking water, and loss or damage to household properties including sanitation facilities. The community impacts include an unclean environment, disruption of movement, and damage to public utilities. Urgent needs arise where community schools were flooded and schooling for children has been interrupted. This is an important issue within the context of human development. In many other developing countries where it is also applicable, community leaders and the local authorities have often instigated measures to ensure that children's schooling is not interrupted despite the magnitude of flooding. In Bangladesh for example, a strategy known as "floating schools" in which classrooms are constructed on boats is being put in place during flooding [39]. This enables provision of uninterrupted education for children who have been impacted and whose education has been disrupted by flood catastrophes.

3. Research Methodology

3.1. Reconnaissance Survey

Firstly, a reconnaissance survey was carried out, aimed at identifying the best sampling method for this study. The primary information was obtained through the use of questionnaires, designed to source information relevant to the study.

3.2. Types of Data

In other to achieve the objective of the study both primary and secondary data which containing both spatial and non-spatial (attribute) were used. The data used includes; Data on the nature of vulnerability such as proximity to flood prone area, destruction from flood such as farmland, settlement, health facilities, and drainage systems. Data on socio-economic and demographic characteristics, housing quality, physical and/or structural conditions of the housing, as well as respondents' environmental conditions, the flood risk awareness, experience, preparedness, coping capacity and mitigation measures.

3.3. Source of Data

The research tool employed for the collection of data for the purpose of this research includes primary and secondary data source. The primary source of data: This has been observed to be the first-hand data. It provides data that are directly related to his interest. In this light the following method were employed.

a. Questionnaire Method: Structured questionnaires was designed and administered to residents within the study area and the responses were recorded. This instrument were used to extract information on the residents.
b. Secondary Data Sources: These are ready materials from different relevant studies. These include textbooks, thesis, seminar paper, reports, published and unpublished materials, maps from different areas.

3.4. Sample Size and Sampling Technique

Purposive sampling technique was used to draw information from the inhabitant of Yauri LGA of Kebbi State. The total population of Yauri LGA based on 1991 census is 150,378 people.

Assuming linear population growth in Yauri LGA, the population in 2018 is estimated using the mathematical method relating to geometric growth that is biological populations in expansion, for which growth rate is assumed constant, the equation below:

$$P_f = (P_0 (1 + r)^n$$

Where, P_f = future population as at 2018, P_0 = present population as at 1991 is 150,378, r = rate of population growth of kebbi state (3.1%), n = ($t_{final} - t_{initial}$) in years, t = time variable in years.

$$2018 = (150{,}378\ (1 + 0.031)^{2018 - 1991}$$

$$= 150{,}378\ (1 + 0.031)^{27}$$

$$= 150{,}378\ (1.031)^{27}$$

$$= 150{,}378 \times 2.280$$

$$= 342{,}862$$

Therefore, the population of the study area is estimated to be about 342,862 People as at 2018.

Table 1. *Sample Size for the Study.*

Wards	1991 Census	2018 Projection	Sample
Chulu/Koma	16,825	38,361	35
Gungu Sarki	16,713	38,106	35
Zamare	15,010	34,223	38
Yelwa South	14,500	33,060	40
Yelwa North	14,524	33,115	40
Yelwa West	15,025	34,257	38
Yelwa Central	15,045	34,303	38
Yelwa East	14,327	32,666	40
dJijima	14,448	32,941	40
Tondi	13,961	31,831	42
Total	150,378	342.87	386

A total of 386 copies of questionnaires were administered to household heads in Yauri LGA to obtain information that is relevant to the study. This copies of questionnaires were arrived at using the Krejcie and Morgan's sample size determination table 1 above for research activities as the sample size level is about 500 [40].

3.5. Methods of Data Analysis

The methods of data analysis used for the purpose of this study are presented based on the objective of the study.

1. Objective (i) was to examine the different forms of vulnerability of the people to flood in the study area. A combination of quantitative and qualitative methods for measuring vulnerability is crucial, particularly when identifying and measuring risks and vulnerabilities before and after disasters have occurred [41]. Many researchers have tested this approach for better understanding the levels of vulnerability of population groups or communities and the specific climatic threat they encounter [42, 43]. This mixed method approach is considered the social aspects of the individuals, households or community and involves the participation of population groups expressing their perceptions to the risks within a specific region [44]. More importantly, this mixed method, according to [16], combine both quantitative and qualitative approaches to benefit from their strengths which will result in the emergence of multiple forms of vulnerability measurement. Data obtained are presented and analysed using descriptive statistical tools such as tables, simple percentages, cumulative percentages and charts.
2. Objective (ii) characterized the factors that influence vulnerability in the study area. A quantitative method using primary data drawn from questionnaire administration was also used. This quantitative method entails a series of numerical data which are measurable by instruments for statistical analysis [45].
3. Objective (iii) examined the changing nature of vulnerability in the area. Descriptive statistics was used to examine the relationship between physical vulnerability and other forms of vulnerability overtime in the study. Data obtained are presented and analysed using descriptive statistical tools such as tables, simple percentages, cumulative percentages & charts. Data from the completed questionnaires were collected, coded, analysed and interpreted using Statistical Predictive Performance Systems (SPPS) and direct calculations.

Over time, these physical vulnerabilities may dominate at the onset which may later become social, economic, psychological, and cultural. Settlement may also experience change in vulnerability due to presence or absence of some resilient infrastructure.

4. Presentation of Result and Data Analysis

4.1. Demographic and Socio-Economic Profiles of Respondents

The researcher administered 386 copies of questionnaires to household heads using door-to-door survey in the studied communities between July and August 2018, with a response rate of 62.4%. The remaining 37.6% of the sampled population was not available at home when the researchers returned twice to collect the questionnaires, or the target household head declined to answer the survey. The analysis was based on the returned copies of questionnaire from 244 respondents.

4.2. Demographic Characteristics of Respondents

Table 2. *Gender of respondents.*

Gender	Frequency	Percentage (%)
Male	198	81.9
Female	46	18.1
Total	244	100

Source: Field Survey 2018

According to the research, table 2 indicates that of the 76 respondents from the residents of the study area, 81.9% of respondents were males and 18.1% were females. This shows that there are more men residing in Yauri Emirate as head of families and in terms of disasters they would suffer averagely due to unemployment and poverty.

Table 3. *Age.*

Age	Frequency	Percentages
18-20	8	3
21-30	48	20
31-40	61	25
40-50	86	35
51-60	27	11
61-above	14	6
Total	244	100

Source: Field Survey 2018

From table 3 showing age distribution, 3% are within ages 18-20, 20% are within 21-30, 25% are within 31-40, 35% within 41-50, 11% of the respondents sampled were between the age group of 51 and 60 years. Also, 6% are 60 years and above.

Table 4. *Occupation of Respondents.*

Occupation	Frequency	Percentages
Civil servant	51	21
Farmer	75	31
Student	6	2
Artisans	19	8
Trader	31	13
Fishermen	62	25
Total	244	100

Source: Field Survey 2018

Table 4 shows that 21% are Civil Servants, 31% of the respondents are Farmers, 2% Students, 8% Artisans, 13% Traders and 25% are Fishermen. Also, this shows that the literacy level of the sampled population can be greatly influenced by the nature of occupation and status of their livelihoods. Majority of the respondents were engaged in informal economy, ranging from farming, fishing and trading. Many scholars have argued that communities with low human capital households (such as low income and poor education) face higher exposure to flood risk and lower level of flood preparedness [46-48].

Table 5. *Educational Qualification of Respondents.*

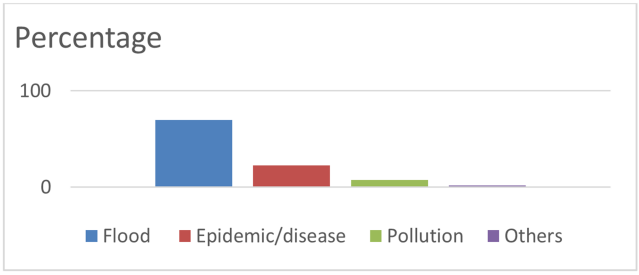
Qualification	Frequency	Percentage (%)
Non-Formal Education	75	7.8
Primary	57	32.6
Secondary	39	20.2
ND/NCE	60	32.1
HND/Degree	15	7.3
Total	244	100

Source: Field Survey 2018.

Of the 244 respondents in table 5, 7.8% have no formal education background. 32.6% and 20.2% of the respondents have primary and secondary education respectively, 32.1% National Diploma (ND) and National Certificate of Education (NCE), While 7.3% have HND/ Degrees. This study shows that parents do not encourage their children or wards to go to school, or proceed to tertiary institutions. Hence low literacy level in the study area.

4.3. Forms of Vulnerability

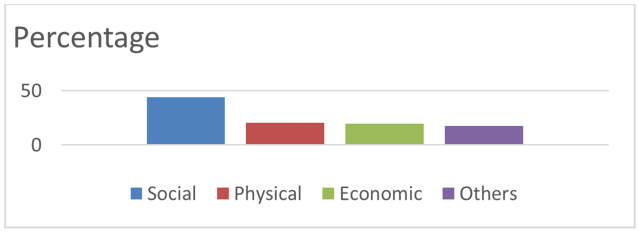
Vulnerability has different dimensions such as physical and social. Figures 1 to 5 present the results.



Source: Field Survey 2018

Figure 1. *Type of hazard experienced.*

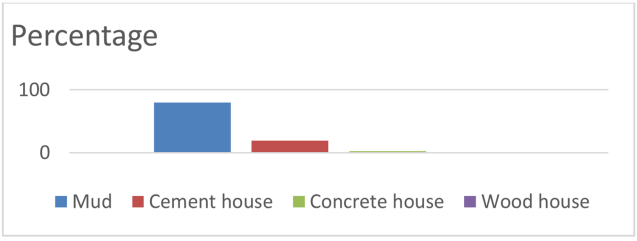
According to the respondents, in all the ten wards, floods have a higher probability of occurring, while pollution and other forms of hazards like accident and crime have a lower probability of occurring. Epidemic/disease has a medium probability of occurring in the area.



Source: Field Survey 2018

Figure 2. *Vulnerability element that increases disaster risk of the hazard.*

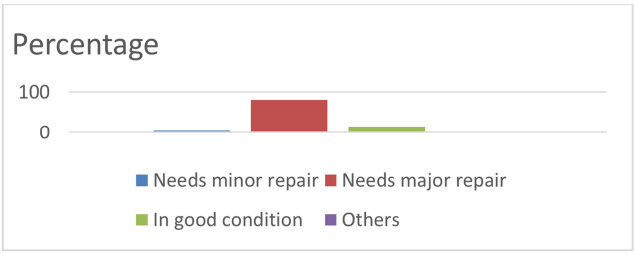
From the social aspects 44% of the respondents from the wards said that lack or shortage of information, theft, crime, robbery and drug abuse were reported to be the highest social hazards. From the physical vulnerability assessment, 20% said that lack of drainage, lack of tarred road and poor building structure, waste pollution crisis in the community is a problem since there is shortage or no access to electricity which make them more vulnerable to flood disaster. With regards to the economy 19% of the settlement in the area attest to rate of unemployment. 17% of the respondents in the wards said that degradation, accident are noted to be from the other forms of vulnerability element.



Source: Field Survey 2018

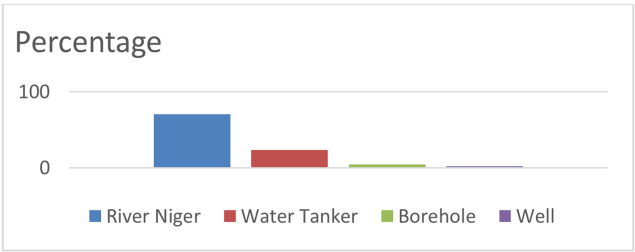
Figure 3. *Type of building mostly affected by the disaster.*

80% of the respondents in Yauri Emirate live in Mud houses while 1% of the respondents live in wood house. From the data analysis, it is clear that 19% of the respondents live in cement/concrete houses which are regarded as one of the best construction materials. According to the analysis, most people living in Yauri Emirate are vulnerable to floods because most of the houses are built with weak construction materials clay soil. This means that there was need to conduct awareness campaigns in the community of Yauri Emirate to reduce the impact of flood disasters. This is also one of the reasons there is an increase number of accidents during rainy season.



Source: Field Survey 2018

Figure 4. *The structured condition of building after the flood disaster.*



Source: Field Survey 2018

Figure 5. *Type of drinking water available and useable during disaster.*

The structural conditions of the houses are deplorable with varying degrees of disrepairs as more than half of the sampled settlements. 81% of the respondents in the settlements were in high density and low-income area which

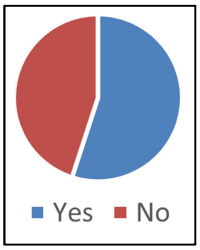
needed varying major renovation of their buildings to be structurally fit. 15% of the houses were in good condition and only 4% of the buildings needed minor repairs. Housing structure serves as a predictor variable to assess housing quality in the study area and a determinant of occupants' level of exposure and vulnerability to flood hazards.

Similarly, assessment of the availability of drinking water & still in use during and after flood disaster, 71% of the respondents get their drinking water through River Niger and 23% through water tankers provided by the government were shown to be the most available services in the communities. While the least said available drinking water were borehole and well water.

4.4. Factors Influencing Reduced Vulnerability to Flood

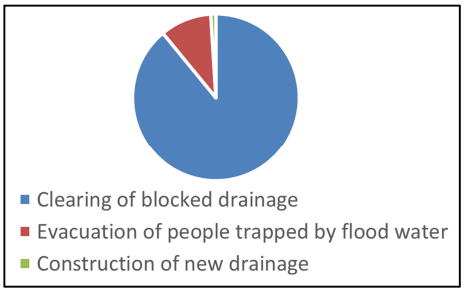
Some issues are connected to flood which either mitigate or aggravate hazards. These are presented in Figures 6 to 9.

A 55% of the respondent said that they have been involved in the planning/activities aimed at reducing flood disaster measures. Although they found the strategy to be non-effective because there is no sustainability of the flood disaster risk management programs within the community. 45% of the respondent said that they have not been involved in the planning/activities aimed at reducing flood disaster measures.



Source: Field Survey 2018

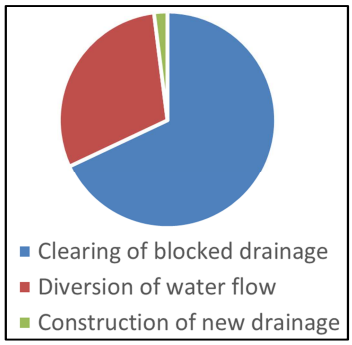
Figure 6. *Participation in activities that reduce flood.*



Source: Field Survey 2018

Figure 7. *Contribution to flood reduction processes.*

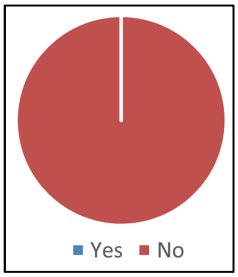
Most of the respondent said that their contribution to induced flood disasters is clearing of blocked drainage within their houses 89%, while 10% said that their contribution was evacuation of trapped people during flood disasters. From the 244 respondents; only 1% said their contribution was construction of new drainage. This research will therefore recommend suggestion for disaster management programmes to be implemented in the emirate. Indications from the analysis also shows that people are not aware of the dangerous situation they are settling during disasters.



Source: Field Survey 2018

Figure 8. *Community effort toward reducing flood vulnerability.*

The result of this study at 10 wards of the study area 68% of the community said that clearing of blocked drainage was one of their effort aimed at reducing flood vulnerability in their various wards but did not find it efficient, 30% of the respondent said diversion of water flow and 2% involved in the construction of new drainage. Clearing of blocked drainage is part of effort aimed at reducing problems during floods disasters. Therefore, if blocked drainage can be cleared reliably, this could help reduce the floods incidents.



Source: Field Survey 2018

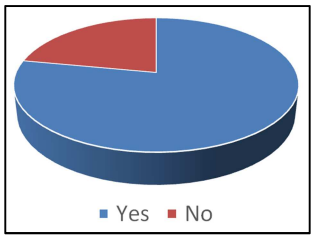
Figure 9. *Women participation in activities aimed at reducing vulnerability to flood.*

All of the respondents interviewed said that indigenous females were not incorporated in any activities aimed at reducing vulnerability to flood disaster. It is important for this research to respect local knowledge and religious belief of the communities.

4.5. Changing Nature of Vulnerability to Flood in Yauri Community

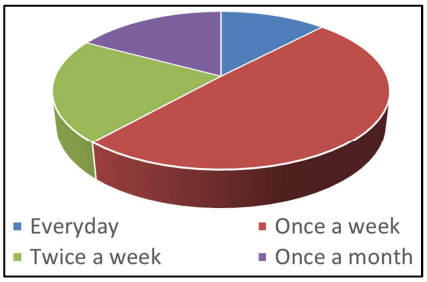
Vulnerability changes overtime, this study examine such changes in Yauri Emirate. Figures 10 to 12 present this result.

Figure 10 shows whether flood affect the secured relationship with families/friend during flooding. From the result, it can be said that most of the respondents have agreed that flood disaster really affect their secured relationship with their families/friends. However, it becomes apparent because majority of the effect are water related problems alone or combined with other factors like the risk of using canoes.



Source: Field Survey 2018

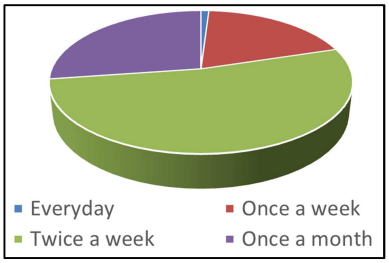
Figure 10. *Effect of flood on relationship with families/friend.*



Source: Field Survey 2018

Figure 11. *Oftenest of visitation to relatives before flood.*

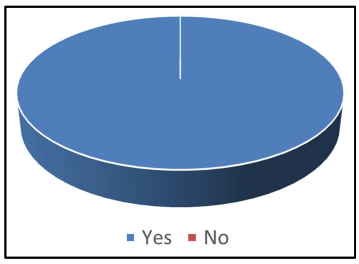
12% of the respondent's visit their families/friends every day before flood disaster. On the other hand, (49%) of the feedback received from respondents shows that they only pay visit once a week. In addition, (21%) of the respondents shows they visit twice a week. While (17%) of the respondents only visit once in a month.



Source: Field Survey 2018

Figure 12. *Oftenest of visit after flood.*

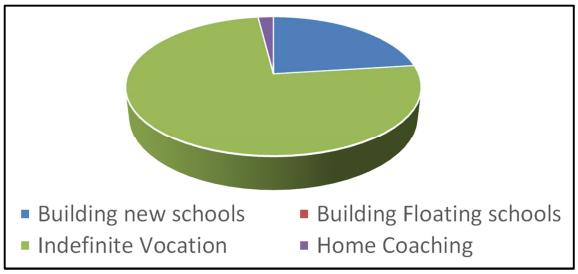
Furthermore, the result of the community visit after flood disaster shows that only (1%) of the respondent's visit every day, while (19%) visit once a week. 52% of the respondents said they visit twice a week and (27%) of the respondents said once in a month.



Source: Field Survey 2018

Figure 13. *Efforts to ensure schooling is not interrupted during flood.*

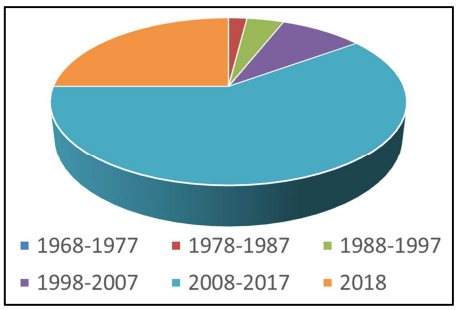
Figure 13 also shows that community leaders/local authorities initiate measures to ensure that children's and their school activities are not interrupted despite the magnitude of the flood which is (100%).



Source: Field Survey 2018

Figure 14. *Measures taken to ensure uninterrupted education.*

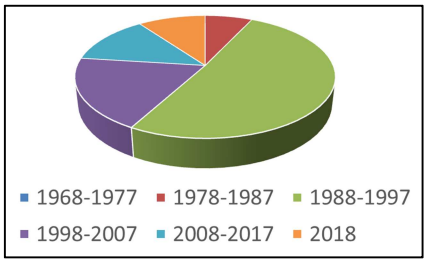
The information in Figure 14 shows that the result of the measures taken was to give indefinite vocation which were supported by (75%) of the respondents, while (23%) of the respondents said building new school should be considered as the second measure. Home coaching carried only (2%) from the feedback received by the respondents with no response from building temporary floating schools.



Source: Field Survey 2018

Figure 15. *Destruction of physical infrastructure btw 1968 and 2018.*

Regarding the impact of the previous floods experience, on the issue of which years was destruction of physical infrastructure more common to the community as a result of flood disaster from the year 1968 to 2018 the result shows that between 60% and 65% of the sampled population claimed they experienced destruction of physical infrastructure to be more common between the year 2008 and 2017.

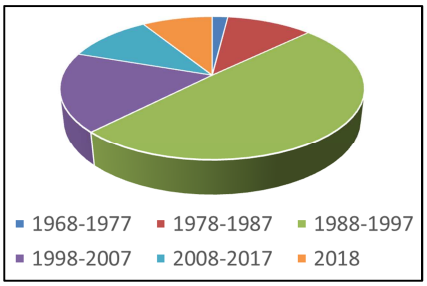


Source: Field Survey 2018

Figure 16. *Diseases spread btw 1968 and 2018.*

Also, according to the finding of the research on figure 16,

51% of the respondents said that disease were common after flood occurrence between the year 1988 to 1997, while 19% and 13% said that it was between 1998 to 2017 respectively. Only 10% of the respondent agreed on year 2018, this might be connected with the occasional problem of water borne diseases because of dependence of the rural populace on the river for domestic use.



Source: Field Survey 2018

Figure 17. *Abandonment of government provided accommodation btw 1968 and 2018.*

The findings also revealed that 50% of the respondents from the settlements lack of housing provision by the government to be more frequent between 1988 to 1997, therefore poor provision of housing accommodation during resettlement and are incompatible with their socio-cultural patterns with inadequate sizes and functionality "unlike the former houses built of mud and thatched- roof, the resettled houses were built with concrete blocks and roofed with asbestos. Discussions with respondents revealed that the rooms are very hot during hot weather and very cold during the cold weather. As such, resettled household, especially the Kambaris deserted their homes to former houses.

5. Conclusion

This study provides an evaluation of a human settlement's vulnerability to flooding risk in Yauri, an indigenous community situated at the southern part of Kebbi State, Nigeria. This was achieved through an assessment of changing vulnerability from Kainji dam of the study area. The study utilizes a case study approach in the flood-prone local community using households' questionnaire survey to elicit vital information that relates to the residents' awareness, the level of preparedness, preparatory measures adopted and the rating of their vulnerability to risks attributed to flooding. The questions asked also included respondents' physical, environmental, socio-economic and institutional variables.

This study has established that Yauri Emirate has been exposed to a wide variety of hazards which need special attention in terms of employing preventive and mitigation measures. It has also been established that the dam has impacted most negatively on the people, environment and the economy. This is because farmlands are taken over by the overflow of the dam. The inhabitants had to be resettled in the first place, thereby subjecting them to a lot of inconveniences and loss of properties. Environmental components have also been tempered with in a great way which overtime have change to social and the economy. The aim for which the dam was constructed has not been fully achieved. This aim should be vigorously pursued so as to compensate for the lost environment and threatened human lives. The research also established some point that the community must take certain measures that will help make them less vulnerable to disasters, before and after they occur.

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