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Adaptation Initiatives to Flood Risks in the Downstream Section of River Niger Flood Plain in Mokwa Local Government Area of Niger State

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Abstract

Flood is a well-known phenomenon in the flood plain of River Niger. Despite its threats, communities continue to live there because of its economic benefits. Approaches to reduce it risks have not produced the desired results because of the conventional methods that overlooked and ignored communities' initiatives for lack of real evidence base to understand its importance. This paper identifies and appraises these initiatives to understand its importance. To achieve this, the research adopted qualitative method for data collection. Forty-five settlements were identified with 28,695persons. Nine settlements were selected using purposive sampling and 135 interviews and 9 FGDs were conducted. The participants were systematically selected. The findings indicated that communities have wealth of knowledge and experiences regarding flood threats and have developed adaptive initiatives to manage the situations. Recommendations highlighted the need for its integration with the scientific approaches.

Background to the Study

Flood is a well-known phenomenon in the flood plain of River Niger that has continues to pose serious multiple threats to the inhabitants (Flew, et al., 2004; Adeoye, et al., 2009; Aderogba, 2012; Onwuemele, 2012; Ikhuoria, et al., 2012; Kellens, et al., 2013; UNISDR, 2016). Despite the risk involved, the communities continue to occupy the flood plain area because of its economic benefits using their creative set of profound local knowledge, perceptions and adaptive initiatives (Oyebande, 1995; Abdullahi, 2004 and 2014). These communities have devised a creative set of strategies and complex adjustments that have allowed them to live in hazard-prone areas and they possess invaluable knowledge and perceptions that has helped them to prepare and adapt to crises caused by flood hazards (Cuny, 1991; Hiwasaki, et al., 2014). This knowledge system which is referred to as local knowledge is essential and its application in the face of hazards and other threats is referred to as an "adaptation measures" or "coping strategies" (Twigg, 2004).

However, existing approaches to flood risk reduction and management by stakeholders at local levels over the years have not produced the desired results. This is partly because of the conventional conceptualization by the stakeholders that has overlooked and ignored local adaptive initiatives in the management of flood plain areas. This neglect is partly due to the lack of real evidence base to understand the importance of adaptive initiatives of flood plain communities. This evidence base is virtually non-existent for most of Africa counties (UNDP, 2008; Iloka, 2016; Mafongoya & Ajayi, 2017). Given that flood plain areas are experiencing the impacts of global changes, it is important to take a step in identifying the initiatives and appraise its reality for potential role in flood risk management. The present study contributes to filling the knowledge gaps by designing a procedure that helps to identify these aspects and appraise the dynamics that strengthen the capacity of the affected communities to adapt more effectively to flood emergencies in the most flood-prone areas of River Niger in Niger State – Nigeria.

Literature Review

It is widely acknowledged that flood plains have always been attractive settlement areas, and, as a consequence, people and assets are at risk of flooding. The dynamics behind the spatial and temporal pattern of exposure and risk are dependent on the spatial extent of flood hazards threatening societies, in particular their magnitude and frequency, as well as on the socio-economic changes within society. Adaptation is the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC, 2007). It is adjustment, whether passive, reactive or anticipatory, that is proposed as a means for ameliorating the anticipated adverse consequences associated with climate change" (Smit, et al., 2000). It involves adjustments to enhance the viability of social and economic activities and to reduce their vulnerability to climate, including its current variability and extreme events as well as longer term climate change.

Flood plain communities have devised adaptive strategies that includes knowledge of hazards, vulnerabilities and capacities as an inherent part of community resilience and capacity and is a basis for local adaptive strategies (Iloka, 2016). Adaptive capacity is context-specific and varies from country to country, from community to community, among social groups and individuals, and over time. It varies not only in terms of its value but also according to its nature. The scales of adaptive capacity are not independent or separate: the capacity of a household to cope with flood risks depend to some degree on the enabling environment of the community, and the adaptive capacity of the community is reflective of the resources and processes of the region (Yohe & Tol, 2002). Adaptive capacity has been analysed in various ways, including via thresholds and coping ranges, defined by the conditions that a system can deal with, accommodate, adapt to, and recover from (De Loe & Kreutzwiser, 2000; Smit, et al., 2000; Jones, 2001). Most communities and sectors can cope with (or adapt to) normal flood conditions and moderate deviations from the norm, but exposures involving extreme events that may lie outside the coping range, or may exceed the adaptive capacity of the community. At the local level the ability to undertake adaptations can be influenced by such factors as managerial ability, access to financial, technological and information resources, infrastructure, the institutional environment within which adaptations occur, political influence, kinship networks, etc, (Blaikie & Brookfield, 1987; Kelly & Adger, 2000). Some determinants of adaptive capacity are mainly local (e.g. the presence of a strong kinship network which will absorb stress) while others reflect more general socio-economic and political systems (e.g. the availability of state subsidized crop insurance).

a. Bearing the losses: this is the baseline response of 'doing nothing' but bearing any losses that may result. This occurs when those affected have no capacity to respond in any other way. For example, in extremely poor communities or when the costs of adaptation measures are very high compared to the risk or expected damages.
b. Share losses: this adaptation response means sharing the losses among the wider community. In traditional societies this happens when loss is shared with extended families, within the village, or the local community. In affluent societies losses are shared through public relief, rehabilitation, and reconstruction.
c. Modify the threat: when the risks are identified it is possible to exercise a degree of control over the environmental threat, for example by building dams and dikes in an attempt to control floods. Such measures are referred to as 'mitigation' of climate change and are considered to be in a different category of response from adaptation measures.
d. Change location: this refers to change of location of economic activity. For example, following loss of agricultural lands and erosion of homes, flood victims are forced to migrate to the nearest cities and change their economic activity in order to survive.

When people know an event may occur in the future because it has happened in the past, they often set up ways of adapting with it. Such adaptive strategies depend on the assumption that the event itself will follow a familiar pattern, and that people's earlier actions will be a reasonable guide for similar events. The assumptions on which people make their decisions therefore rest in the knowledge that, sooner or later, a particular risk will occur of which people have some experience of how to cope (Blaikie, et al., 1994). He also emphasized that all adaptive strategies for adverse events which are perceived to have precedent consist of actions before, during and after the event. In terms of natural hazards, for instance, the application of indigenous knowledge in the face of hazards and other threats is referred to as an adaptive mechanism or adaptation strategy (Twigg, 2004). In a range of disaster contexts, Twigg categorized the adaptation mechanism into four broad categories:

i. Economic/material; (economic diversification, such as having more than one source of income, even having large family can be seen as part of economic coping strategy because it gives household additional labour; saving and credit schemes are often an important component of economic adaptive strategies).
ii. Technological; (the way that housing is adapted to repeated floods. Common adaptations include building houses on stilts so that flood water can pass underneath, building them on plinths or platforms of mud or concrete so that they remain above flood levels, and building escape areas under or on top of roofs).
iii. Social/organizational; (the family is a fundamental social mechanism for reducing risk. Extended kin relations are networks for exchange, mutual assistance and social contact).
iv. Cultural (include risk perception and religious views, which are frequently connected) Public buildings that are used as shelter can be built above the expected flood level. This can be done by constructing the building on natural or artificial high grounds, by placing the building on columns and stilts or by providing access from outside via staircase to the upper floors. In areas where flood waters are shallow and slow moving, temporary barriers composed of sand bags may be used to protect individual buildings.

Similar to the concept as mentioned above, the concept of adaptive mechanism according to (Dewi, 2007) are:

i. Do-nothing on floods except learning how to live with them wisely; (flood impact are minimized by avoiding them. The future of this type of adaptive mechanism will highly depend on the concept of how and to what degree the environment is to be protected).
ii. Use of non-structural measures, including flood insurance (regulation for proofing of flood plains (zoning and coding); defence from flood; and flood insurance.
iii. Use of intensive and extensive structural technologies; (intensive: a flood levees along the river bank, terracing of land, changing biological cover and soil conservation in a catchment. Extensive: reshaping of the land surface, protection of soil from erosion, delay of run-off of rain and increase of infiltration by doing: soil conservation, especially by restoring the vegetation cover, the proper ways of cultivating land, and similar catchment-wide activities (mainly for agriculture, but it can be done as joint activities benefiting not only for agriculture but also forestry, urbanization and the other parallel useful purposes).
iv. Joint use of non-structural measures and structural technologies (in the real world,

the mixture of non-structural and structural technology is believed as the best alternative of adapting with flood).

Carter, et al., (1997) describe several approaches to assessing adaptation, although they concluded that establishing a general methodology for adaptation assessment is very difficult. Some approaches identified, are:

i. Risk assessment.
ii. The scenario-based approach.
iii. Normative policy framework.
iv. Employing models of specific hypothesized components of adaptive capacity.
v. Economic modelling.
vi. Scenario and technology assessment

While describing key conclusions and future directions, the IPCC, (2007), report describes a set of methodological, technical and information gaps. One of the gaps is a collection of empirical knowledge from past experience. It has been emphasized that experience gained in dealing with natural disasters, using both modern methods and empirical knowledge, contributes to understanding the adaptive capacity of vulnerable communities and its critical thresholds. This study has considered vulnerable flood plain communities' empirical knowledge.

Adaptation of the system is dependent on several factors such as demographic, social, cultural, economic, political, type of natural hazards, and geographical setting of the place (Gaillard, 2007). However, these factors may vary at different levels of analysis (Buckle, 2001). At the household level, access to agricultural land, diversity of income sources, and good housing quality create essential resources for households to cope with annual flood events in flood plains and climate change in the coastal provinces (Adger, 2003; Brouwer, et al., 2007).

Materials and Methods

This study was carried out along the flood plain corridor downstream section of River Niger in Mokwa Local Government area of Niger State. The area lies between 8° 50' N and 9° 15' N and 5°3'5" E and 6°3'6" E on topography of between 50-100 meters above sea level with a slope gradient of 0-1%. (Figures 1).

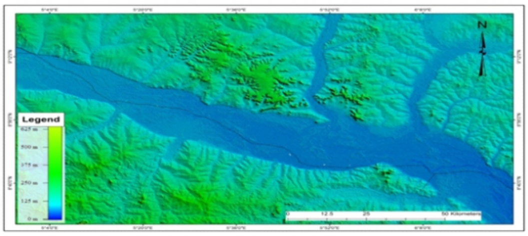

Figure 1: Digital elevation model of the downstream section of flood plain of River Niger in Niger state.

Source: Google Earth & Field Survey (2016)

This area is divided into three (3) geographic areas/zones based on the report of committee on resettlement scheme carried out in the year 2000 in the area by Niger State Government which also corresponded with three (3) political wards existing in the area. They include: Jaagi, Muregi and Gbara areas/zones) (Figure 2 & 3 and Table 1). However, there are forty-six (46) settlements scattered within the zones with a total population of eighteen thousand five hundred and forty (18,540) according to 2006 population census and twenty-eight thousand six hundred and ninety-five (28,695), projected to 2024 at the annual growth rate of 3%.

The study employed qualitative method for data collections. Nine (9) settlements were selected from the 46 settlements using purposive sampling. The criteria used was based on the vulnerability of each settlement to flood which was determined using (Flood Vulnerability Index (FVI)) formula developed by Connor & Hiroki (2005). The approach used component variables that were derived from the communities. These variables are grouped under four components, that includes: Climate, Environment, Socio-economic activities and Adaptation Strategies (Tables: 2, 3 & 4). Meanwhile, 135 interviews (15 per settlement) and 9 FGDs (one per settlement) participants were conducted. The respondents include the household heads while interviews and FGDs involves village heads, members of Community. The participants were selected systematically in consultation with Village Heads.

Figure 2: River Niger Flood Plain area in Mokwa local Government of Niger State.
Source: Google Earth & Field Survey (2024)

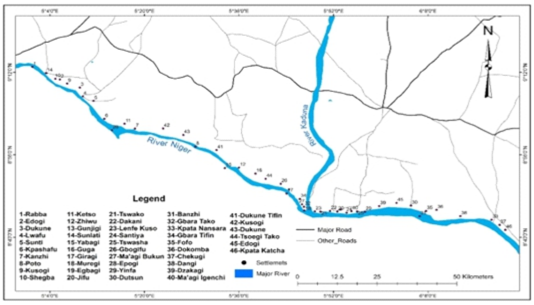

Figure 3: Distribution of Settlements within the downstream section of River Niger flood plain area in Mokwa Local Government area of Niger State.
Source: Google Earth (2024) & Field Survey

Table 1: Existing Settlements with their population in three geographic areas.

JA'AG AREA/ZONE					MUREGI AREA/ZONE				GBARA AREA/ZONE		
S/N	EXISTING SETTLEMENT	POPULATION AS AT 2006	PROJECTED POPULATION, 2024	S/N	EXISTING SETTLEMENT	POPULATION AS AT 2006	PROJECTED POPULATION, 2024	S/N	EXISTING SETTLEMENT	POPULATION AS AT 2006	PROJECTED POPULATION, 2024
1	Rabba Kede	811	1,254	18	Muregi	718	1,111	32	Gbara Tako	381	590
2	Edogi	228	353	19	Egbagi	493	762	33	Kpata Nansara	491	760
3	Dukune	305	471	20	Jiffu	498	771	34	Gbara Tifin	492	761
4	Lwafu	784	1,213	21	Tswako	164	254	35	Fofo	418	647
5	Sunti	298	454	22	Dakani	358	554	36	Dokomba	408	631
6	Kpashafu	503	778	23	Lenfa Kuso	494	764	37	Chekugi	422	653
7	Kanzhi	303	469	24	Santiya	279	432	38	Dangi	888	924
8	Poto	372	575	25	Tswasha	180	279	39	Dzakagi	290	449
9	Kusogi	463	716	26	Gbogifu	330	511	40	Ma'agi Igenchi	595	921
10	Shegba	196	303	27	Ma'agi Bukun	373	577	41	Dukune Tiffin	305	472
11	Ketso	573	887	28	Epogi	361	559	42	Kusogi II	463	716
12	Zhiwu	265	410	29	Yinfa	367	568	43	Dukune	563	871
13	Gunjigi	86	133	30	Dutsun	407	630	44	Tsoegi Tako	429	664
14	Sunlati	451	698	31	Banzhi	233	361	45	Epogi	312	483
11	Yabagi	431	667					46	Kpata Katcha	505	781
16	Guga	277	429								
17	Giragi	277	429								
TOTAL											
			EXISTING SETTLEMENT				**46**				
			POPULATION AS AT 2006 CENSUS				**18,540**				
			PROJECTED POPULATION, 2024 at 3 % growth rate				**28,695**				

Source: 2006 Population Census and projection to 2024

Table 2: Components variables for flood vulnerability index (FVI)

Components	Indicators	ABB.
Climate	Amount of rainfall	M_1
	Average slope	M_2
Environment	Area coverage	M_3
	Population in flood area	M_4
Socio-economic activities	Damage of properties per year	M_5
	Literacy rate	M_6
Adaptation Strategies	Invest amount of building structures	M_7

Source: Connor & Hiroki, (2005)

The weights of the indicators were presented with the following equation:

$FVI = C + E + S - M$

$$FVI = C + E + S - M \text{ --------------------------1}$$

Where $F = Flood$

$V = Vulnerability$

$I = Index$

and

$C + E + S - M$

$C = Climate\ component$

$E = Environmental\ component$

$S = Socio - economic\ component$

$M = Adaptation\ Measure$

- $FVI = C + E + S - M$
- $C + E + S - M - FVI$
- $C + E + S + MFVI$
- $C + E + S = MFVI$
- $C + E + S / M = MFVI/M$

$$\boldsymbol{FVI = C + E + S / M}$$

$$FVI = \frac{(3 * m1) + (3 * m2 + m3) + (m4 - m5 + m6)}{m7}$$

The results are presented on (Table 3) below.

Table 3: Flood Vulnerability Index for the Settlements (FVI)

SELECTED SETTLEMENT	ANNUAL RAINFALL FOR ZONES (MM) (M1)	SLOPE COVERAGE PER SETTLEMENT (M2)	AREA COVERAGE PER SETTLEMENT (KM2) (M3)	PROJECTED POPULATION PER SETTLEMENT (M4)	DAMAGE TO PROPERTIES PER YEAR (₦) (M5)	LEVEL OF LITERACY (%) (M6)	AMOUNT INVEST ON BUILDING PROPERTIES (M7)	FVI (%)
JAAGI ZONE/AREA								
Rabba Kede	1486.7	0.61	301	1,254	53	31	117	
Edogi	1486.7	0.73	601	353	42	47	101	53.4
Dukune	1486.7	0.69	705	471	39	39	288	19.5
Lwafu	1486.7	0.75	913	1,213	25	72	320	20.5
Sunti	**1486.7**	**0.71**	**710**	**454**	**48**	**41**	**91**	**63.1**
Kpashafu	1486.7	0.63	501	778	33	38	104	54.9
Kanzhi	1486.7	0.70	522	469	29	49	99	14.4
Poto	1486.7	0.68	611	575	44	71	113	49.9
Kusogi	**1486.7**	**0.58**	**531.01.**	**716**	**59**	**66**	**180**	**31.5**
Shegba	1486.7	0.74	813	303	37	52	110	50.6
Ketso	1486.7	0.63	320.50	887	61	33	115	46.3
Zhiwu	1486.7	0.55	435	410	55	38	133	39.5
Gunjigi	1486.7	0.77	394	133	59	68	97	51.4
Sunlati	**1486.7**	**0.62**	**672**	**698**	**49**	**53**	**118**	**11.2**
Yabagi	1486.7	0.59	589	667	30	48	114	49.9
Guga	1486.7	0.66	639	429	17	59	413	13.4
Giragi	1486.7	0.57	478	429	23	46	119	45.0
MUREGI ZONE/AREA								
Muregi	**1486.7**	**0.78**	**810**	**1,111**	**22**	**51**	**171**	**37.0**
Egbagi	1486.7	0.69	711	762	38	59	149	34.9
Jifu	**1486.7**	**0.75**	**586**	**771**	**19**	**44**	**169**	**34.4**
Tswako	1486.7	0.58	712	254	40	55	133	39.8
Dakani	1486.7	0.63	689	554	77	46	121	46.5
Lenfa Kuso	1486.7	0.54	792	764	61	52	105	56.7
Santiya	1486.7	0.68	816.44	432	33	56	165	36.5
Tswasha	1486.7	0.74	700	279	39	64	139	39.1
Gbogifu	**1486.7**	**0.61**	**891**	**511**	**70**	**73**	**88**	**63.8**
Ma'agi Bukun	1486.7	0.58	882	577	43	58	99	59.5
Gbara Tako	1486.7	0.68	686.30	559	24	64	131	42.8
Yinfa	1486.7	0.65	802	568	57	40	148	39.0
Dutsun	1486.7	079	902	630	27	77	143	41.9
Banzhi	1486.7	0.73	795	361	48	48	159	35.1
GBARA ZONE/AREA								
Epogi	**1486.7**	**0.57**	**813**	**483**	**51**	**50**	**128**	**12.4**
Kpata Nansara	1486.7	0.72	855	760	48	49	109	48.8
Gbara Tifin	1486.7	0.56	918	761	60	66	95	60.5
Fofo	**1486.7**	**0.65**	**621**	**647**	**34**	**57**	**79**	**71.6**
Dokomba	1486.7	0.61	771	631	25	32	139	41.5
Chekugi	1486.7	0.74	695	653	34	43	188	30.7
Dangi	1486.7	0.60	707	1,374	65	52	146	44.0
Dzakagi	1486.7	0.77	694	449	32	62	157	36.0
Ma'agi Igenchi	1486.7	0.52	599.21	921	45	47	92	64.4
Dukune Tiffin	1486.7	0.67	639	472	39	61	104	47.3
Kusogi II	1486.7	0.61	744	716	60	59	99	59.3
Dukune	1486.7	0.72	806	871	21	39	182	33.5
Tsoegi Tako	1486.7	0.75	789	664	36	48	172	34.2
Edogi	1486.7	0.51	779	483	40	59	161	35.6
Kpata Katcha	**1486.7**	**0.68**	**851.22**	**781**	**37**	**60**	**183**	**31.8**

Source: Connor & Hiroki (2005)

Table 4: Selected Settlements

Geographical/ Administrative Zones	No. of Settlement Per Zone	Projected Population Per Zone	Selected Settlement Per Zone	Population Per Selected Settlement	FVI	Location of Selected Settlements	
						Latitude (N)	Longitude (E)
Jaagi	17	10,239	Sunlati	698	11.2	090º 07′ 517″	0050º 10′ 572″
			Sunti	454	63.1	090º 04′ 337″	0050º 13′ 040″
			Kusogi	716	31.5	090º 06′ 314″	0050º 16′ 513″
Muregi	14	8,133	Muregi	1,111	37.0	080º 52′ 122″	0050º 48′ 861″
			Gbogifu	511	63.8	080º 47′ 382″	0050º 45′ 980″
			Jifu	771	34.4	080º 47′ 168″	0050º 45′ 999″
Gbara	15	10,323	Fofo	647	71.6	080º 44′ 225″	0060º 11′ 040″
			Epogi	483	12.4	080º 44′ 519″	0060º 14′ 917″
			Kpata/ Katcha	781	31.8	080º 44′ 136″	0060º 18′ 873″
Total	**46**	**28,695**	**09**	**6,172**			

Source: Field Survey 2021

Results and Discussions

The identified community initiatives are the local knowledge and the signs that are used to identify risk within the environment. Local knowledge composed of local early warning systems which are grouped into five knowledge categories: (i) phenomenological knowledge (human physical sensation such as hearing, seeing and feeling), (ii) ecological knowledge (flora, fauna and non-human related behaviours), (iii) riverine knowledge (behaviour and observations of running water bodies), (iv) meteorological knowledge (meteorological phenomena such as winds, rainfall and air temperature), and (v) celestial knowledge (behaviours of celestial bodies). The community generally depend on their behaviours through experiences to identify early signs of flood as summarized by the participants during interviews and Focus Group Discussions (FGDs) as presented on (Table 5).

Table 5: Local Knowledge on early Warning Signs on Flooding

Categories of Local Knowledge	Example Signs
Phenomenological	• Elderly community members feeling pain in certain body parts. • Villagers unable to sleep due to increased temperatures
Ecological	**Fauna**
	➢ Behaviours of certain animals. • Increased number of ants in the villages. • Animals (e.g., hippos' crocodiles) migrating from the rivers to the fields and villages. • Birds producing a specific sounds (e.g., trumpet bird)
	Flora
	• Tamarind tree producing an increased number of flowers. • Increased production of fruits of the mango tree. • Plenty of bamboo growing next to river banks
Phenomenological	• Rainfall intensity. • Strong winds. • Rainfall duration. • Hot temperatures
Celestial	• Halo around the moon. • Occurrence of orion star. • Full moon
Riverine	• Sounds of waters in the rivers increasing. • Colours of waters getting dirty and muddy. • Rate of water level increase

Source: Interviews & FGDs, 2024

Behaviours of Certain Animals

Certain animals' actions/behaviours are used to foretell flooding by research participants stem from their close relationship with their surrounding environment, and they are embedded in their livelihoods and everyday existence. For instance, farmers have reported the observation of different animal species in the fields; whereas fisher men have identified an increased number of specific fish species as a sign of upcoming floods. some of the reported animal species includes:

i. Frog calls uninterrupted f imply heavy showers and probable flooding.
ii. If there are no fish or few fish in the early raining season, there will be floods, etc (FGD, October,2024).

These folk beliefs are shared primarily during community gatherings, such as religious ceremonies, funerals, and during meetings of community groups indicating a more formal dissemination practice. In some instances, the local chiefs and disaster committees organized special community meetings in order to share the signs and provide advice for household heads in the areas.

Knowledge on Movement of River

They have an idea of how soon a flood wave will come and how severe it can become by observing the aspect of the rising waters and the current in the flow and, accordingly, prepare to endure the floods from their houses or to leave their residence for safer places if required. Changes in the river constitution were considered important indicators of eminent flooding. Bursting of river banks due to heavy rain in the area or runoff was reported as one of the main causes of flooding in the study area. As one respondent in the FGD put it;

> *"When the amount of water flowing in the river increases alarmingly, we know there is a possibility that it will flood and therefore, appropriate action will be taken" (FGD, October, 2024).*

Change in the colour of the river water was another sign of approaching floods mentioned by the respondents. As described by one of the respondents;

> *"When the river turns a dirty brown with a lot of debris, we know the floods are Fast approaching and will be here in less than 24 hours. These are the deadly flash floods that come without warning sweeping everything on their path including people, animals, crops, trees, furniture etc"*.

Knowledge of Weather Pattern

Long experience of living in flood-prone areas has equipped villagers with the knowledge and intelligence to read the nature of weather and anticipate rain and floods by observing natural phenomena. Seeing grey and black clouds in the sky means rain in the next couple of hours, dark clouds on the horizon and lack of visibility of the distant hills warns them about the possibility of rain in the upstream and consequent floods in a matter of three to four hours in the area. This involves predicting probability of future flood events by watching for changes in the rain pattern. Heavy rain in these areas accompanied by strong winds blowing from the river towards the hills was considered by half (50.5%) of the respondents to be signal of the approach of flood. Heavy rains in the area was believed by nearly (38.1%) to be clear signs of impeding flash floods usually experienced as a result of the ensuing runoff. If heavy rain was accompanied by lightning and thunder on the river, it was a signal that it will definitely flood. High temperatures during the wet season were also mentioned as another sign of heavy rainfall. An inquiring into the Sources of community information on flood forecasting revealed that 54.6% of respondents through the surveyed had knowledge of flood occurrence with 45.4% that does not have because of experience. Further inquiry for the source of information revealed that majority of respondents got the knowledge through personal observations.

Communities' Perceptions to flood Severity

Participants demonstrated a high level of understanding of flood dynamics, by detailing the ways in which water reach and spread throughout the villages. From their responses

(FGDs), they usually have a measured and marked most visible houses or objects which they constantly monitor at the onset of rain each year that informs them of decision to take at a particular stage of water entering their settlements. A measurement of an object up to ankle (human body) is equivalent to less than 1 feet and less than 20cm in metric system. This constitutes a 'practical' approach as their local experiences and perception toward flood risk (Table 6).

Table 6: Community-based Reference for Flood Severity and its Approximate Equivalence in feet and Metric System

Community-based reference level in correlation to a person's body parts	Its equivalence in feet	Equivalence in metric system
Ankle	< 1 foot	< 20cm
Knee	1-2 feet	40 – 60cm
Waist	< 3 feet	70 – 90cm
Chest	> 3<4 feet	80 – 100cm
Above chest	> 4 < 5feet	110 – 130cm

Source: Field Survey and FGDs, 2024

From the FGDs and interviews it was revealed that severity of flood is usually measured (in days or weeks) according to the marked and measured references and the duration of flooding and the time that flood waters may remain. Based on their experiences, the participants characterized the threat posed by flooding with progressive depth and duration and the disruption to their normal activities and life as presented in (Figure 4). As noted in the diagram, the transition from one situation to the next may present some fuzziness in time and water depth. The transition will depend among others on the way in which flooding is taking place, the moment at which it stops and moreover the effectiveness of the adaptive strategies at hand. Some households, for instance, may find they can '*manage*' a 60 cm flood level (above *Knee* depth) for four days as long as it stops raining on the second day and the flood starts receding.

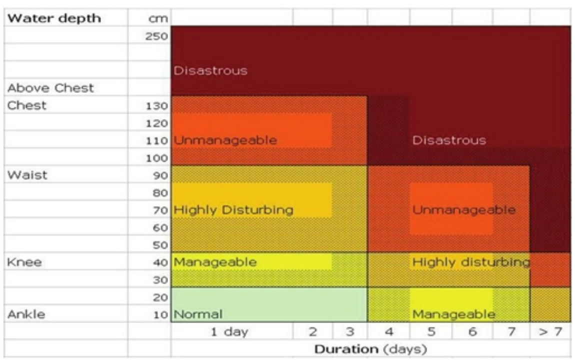

Figure 4: Summary of the Communities' perceptions to flood severity
Source: Field Survey and FGDs, 2024

Communities' Adaptive Initiatives

As revealed during the FGDs and interview activities carried out as part of this study revealed that in these communities' numerous adaptive strategies existed to deal with the disruption created by flooding (Table 7). The main aim of these strategies is to avoid or decrease the disruption and damage of the most important aspects of people's everyday life such as their own safety, the safety of their residence and valuables for livelihood activities.

While some of these strategies were found to be temporary and practice just for survival during the event or in the aftermath, some others have become permanently integrated in their daily life. Some of the adaptive strategies have the aim to reduce the impact of a possible flood (e.g. raising a house). Some others are more related to adapting with the negative impacts of a flood. These are strategies to deal with the reduction of resources. Decreasing the food intake, pawning or selling valuables, borrowing money at high interest rates increase the poverty and marginality of the people in these communities. Related to that was the subdivision of adaptive strategies that are executed before, during or after the occurrence of a flood. Adaptive strategies are also chosen depending on the way how a flood is evolving. The timing at which households have to start implementing adaptive strategies is an indicator for their overall vulnerability. For instance, households that do not have the resources for elevating their house need to adapt coping strategies already at very low water levels (*ankle* level).

Table 7: Adaptive Strategies Employed by the Community at different Stages of Flood

Before Flooding		
Technological/Structural	**Economic**	**Social**
Long term: 1. Build a secure place under the roof to put their valuable properties more than one floor. 2. Reinforce pillars. 3. Construct house using the concrete material (wall and floor). 4. Ask in advance for temporary refuge at relatives or friends in case of flooding.	**Long term:** 1. Buy stocks to avoid scarcity and increasing prices. 2. Store basic non-perishable food items (rice, sugar, salt, canned goods). 3. Collect/store wood for fire and cooking. **4.** Look for additional sources of income.	**Long term:** 1. Cleaning the house and surroundings together. 2. Discuss with other households about the action plan to adapt with flood.
Short term: 1. Put sand bags in front of the house to barrier the water	**Short term:** 1. Prepare the cooking Equipment. 2. Prepare baby's stuffs(clothes, blankets, etc.), light and battery	**Short term:** 1. Check the water depth at the designated areas. 2. Move properties to relatives or neighbours house
DURING FLOODING		
1. Evacuate personal goods to the higher place. 2. Evacuate the children, women, and elderly. **3.** Tie a rope in dangerous places to help people during evacuation.	1. look for jobs in flood-free areas to meet family needs. 2. Bring enough food to evacuation place	1. Prevent kids from going out/playing amidst flood waters.
AFTER FLOODING		
1. Reconstruct damage houses by family members to avoid cost of labour.	1. Look for alternative job. 2. Swap labour for food (in farms). 3. Borrow money from relatives, friends' 4. Ask for livelihood to community members.	1. Source relief materials. 2. From government 3. Solicit support from relatives, friends, or Government. 4. Participate in community recovering activities.

Source*:* FGDs, and Interviews, 2024

Conclusion

The research reported herein has uncovered the importance of local Knowledge, perceptions and adaptation initiatives for flood risk management in the flood prone areas of River Niger in Niger State, by identifying its role in the context of flood risk management. Results demonstrates that local flood knowledge does exist in the study area and the strategies in such knowledge are a trusted source of information and importance to this community, which indicates some ability of the locals to be resilient. The findings revealed a greater level of awareness of flood hazards in the areas. This research provides evidence from the ground that can foster thinking among the other flood risk management actors with regard to how they could possibly include local knowledge in their interventions. The dimensions of local knowledge, perceptions and adaptation initiatives that are identified through this research offer insights to stakeholders into what constitutes the aspects.

Recommendations for Implementation

i. Flood plain communities have their levels of understanding of flooding, with this knowledge presenting a valuable resource for other Flood Risk Management stakeholders (Bracken, et al., 2016). The diversity of the identified local knowledge in this research highlights that local practices should not be overlooked in approaches that are taken by governments, but should be built upon and used to complement the dominant practices. As argued by Scolobig, et al., (2015), people-cantered approaches, in which local communities are encouraged to contribute their knowledge, facilitate the delivery of sustainable Flood Risk Management.

ii. While the importance of local knowledge is partly acknowledged in the National Disaster Risk Management Policy, especially in relation to risk assessment and early warning DDMA, (2015), there are no guidelines on how its role could be enhanced. These types of general recommendations for the use of local knowledge in policy do not result in concrete and tangible outcomes on the ground (Romero, et al., 2018). Based on a critical assessment of the reality of the local knowledge presented, this research proposes several venues that would enhance the role of local knowledge in Flood Risk Management of flood plain communities.

iii. This research shows that integration is informally happening on the ground, in an unstructured manner, and led by local people. What is needed is a further understanding of how this negotiation and knowledge production takes place in local communities, and what the enabling and hindering factors in this process are.

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