

## **Risks Awareness and Readiness for Disaster Responses in Communities Located around Dadin Kowa Dam, Gombe State, Nigeria**

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### **Abstract**

Since its construction, Dadin Kowa Dam's utilization has been minimal until recently, when an attempt was made to maximize its utilization by serving as a source of electricity (40mw) and water for additional irrigation (2,000 ha). This study examines the level of people's awareness of risk, plans, and readiness for emergencies in events of Dam breakages; availability of effective communication systems and response mechanisms in case of emergencies, among others. Using a mixed-method research design, a sample of 350 adults (both males and females) residing upstream and downstream of the dam were administered questionnaires. Five (5) FGDs were conducted with water users and community leaders, and 3 officials of relevant MDAs were interviewed face-to-face. Availability and convenience were criteria used in selecting the 350 respondents, while a judgmental technique was employed in selecting the officials and community leaders. The result show that 90% of the respondents are benefiting from the dam. Officials said the Dam does not present any threat to communities around it, but people are aware of the risks associated with living around the Dam area. Presently, there is no plan for emergencies, no warning system in place; however, 55.1% of the respondents said they have plans for evacuation in case of emergencies. The best means of communication available include via community leaders, radio, and siren. The study recommends immediate installation of warning systems, creation of more awareness on the risks, training on emergency responses, and regular maintenance of the Dam.

**Keywords:** Awareness, Communities, Dadin Kowa Dam, Disaster Response, Risks

### **Introduction**

Dadin Kowa Dam, located in Gombe State, Nigeria, was completed in 1984, about 42 years ago however, its utilization has been minimal until recently. Currently, the Dam provides water for irrigating less than 120 ha of land only, in addition to being the main supplier of urban water for Gombe Metropolis. Recently, there was an attempt to maximize its utilization by serving as a source of electricity (40mw) and water for additional irrigation (2,000 ha). These new projects demand a change in the operations of the Dam, as more water is required at the reservoir for turning turbines and supporting the expansion of irrigation. This is not without risks and potential impacts, both positive and negative. Therefore, the concern with safety becomes necessary.

Although several studies may have been conducted on dam-related issues, some unpublished or appearing in non-open access outlets—there remains limited accessible, context-specific empirical evidence on the level of community awareness of risks associated with living around the dam area in this study context. In particular, there is inadequate documentation on residents' concerns and lived experiences, their level of preparedness for emergencies such as dam failure, and the availability and effectiveness of communication systems and response mechanisms. This gap in accessible and localized knowledge poses a significant challenge to effective disaster risk

management and humanitarian response, thereby increasing the vulnerability of affected populations and the potential for loss of lives and property.

The recent Derna Dam Collapse serves as a stark example of the devastating consequences that can arise from limited risk awareness and weak dam maintenance culture. In contexts where routine inspection, rehabilitation, and maintenance are inadequate, as has been reported in many parts of Nigeria, where some dams have not undergone significant maintenance for decades, the risks are particularly severe. Flooding events can compromise dam integrity, potentially leading to catastrophic collapse with far-reaching humanitarian impacts. For instance, reports by the Libya Red Crescent estimated over 11,300 fatalities within a short period, while the United Nations Office for the Coordination of Humanitarian Affairs reported approximately 4,000 deaths and 9,000 missing persons. These figures underscore the urgent need for improved risk awareness, preparedness, and institutional response mechanisms in dam-adjacent communities.

### **Statement of the Problem**

Dams are critical for water supply, irrigation, and energy generation, but inadequate safety management, risk awareness, and emergency preparedness can expose surrounding communities to serious hazards. Globally, evidence shows that limited public awareness, weak early warning systems, and poor emergency planning significantly increase the impact of dam-related disasters (Mehta et al., 2020; Daud et al., 2021). The Dadin Kowa Dam in Gombe State, constructed over four decades ago, has recently experienced changes in its operational dynamics due to increased water retention for hydropower and irrigation. These changes have heightened the vulnerability of nearby communities to flooding and other risks. However, there is limited accessible, community-level evidence on residents' awareness of these risks, their preparedness for emergencies, and the effectiveness of existing response mechanisms.

Although dam authorities maintain that the structure is technically safe, communities continue to experience challenges such as flooding, loss of farmlands, and livelihood disruptions. This disconnect raises concerns about risk communication, preparedness planning, and the overall effectiveness of dam safety governance. Therefore, the problem addressed by this study is the lack of systematic evidence on risk awareness, preparedness, and disaster response readiness among communities surrounding Dadin Kowa Dam. This gap constrains the ability of policymakers and relevant agencies to design effective early warning systems and community-based disaster risk reduction strategies.

The socio-economic aspect of Dadin Kowa Dam safety studies revolves around ascertaining the level of people's awareness of risks associated with living around the Dam area; concerns and experiences the people have; plans and readiness for emergencies in events of Dam breakages, reserving water at the reservoir and discharge etc., availability of effective communication systems and response mechanisms in case of emergencies among others.

## Literature Review

Communities near dams face significant risks from dam failures, but effective disaster preparedness and risk awareness programs—especially those that are community-based and include clear communication and regular drills—substantially improve resilience and response.

### World Bank Policy on Dam Safety

The 2013 Policy on Dams outlined in OP 4.37 categorizes dams into two classifications: small (less than 10 meters) and big (10 meters and above). The policy mandates that the dam owner is fully responsible for the dam's safety. The World Bank's policy specifies distinct requirements for big dams, like Dadin Kowa Dam, including: an independent panel of experts must review the dam's design, construction, and initial operations; there must be detailed plans for construction supervision and quality assurance, an instrumentation plan, an operation and maintenance plan, and an emergency preparedness plan; and regular safety inspections of the dam must be conducted after completion and during its operation. Specifically, for existing dams and dams under construction, the policy requires independent specialists to:

- (a) inspect and evaluate the safety status of the existing dam or DUC, its appurtenances, and its performance history; (b) review and evaluate the owner's operation and maintenance procedures; and (c) provide a written report of findings and recommendations for any remedial work or safety-related measures necessary to upgrade the existing dam or DUC to an acceptable standard of safety.” (Operational Manual).

### Risk Awareness

Muda et al. (2021) and Daud et al. (2021) concurred that communities living downstream of dams are often aware of the potential risks, with studies showing that 66.7% to 100% of surveyed residents recognize the danger of dam failure (Daud *et al.*, 2021). However, this awareness does not always translate into knowledge of emergency procedures; many lack familiarity with Emergency Action Plans (EAPs) and specific response steps (Daud *et al.*, 2021; Mehta *et al.*, 2020). Demographic factors such as previous disaster experience, gender, and marital status can influence risk perception and preparedness levels (Muda *et al.*, 2021; Daud *et al.*, 2021).

### Preparedness and Effective Strategies

Preparedness is generally low to moderate (at where? Because this is supposed to be a general literature review), but can be significantly improved through integrated, community-based disaster risk reduction (DRR) programs (Muda *et al.*, 2021; Muda *et al.*, 2020; Muda *et al.*, 2021). Key elements that enhance preparedness include: Regular community drills and awareness campaigns (Muda *et al.*, 2021; Muda *et al.*, 2020; Muda *et al.*, 2021)- Clear, localized risk communication, including maps and evacuation routes (Saputra *et al.*, 2024; Sianturi *et al.*, 2021; Mehta *et al.*, 2020)- Involvement of local leaders and authorities in planning and education (Muda *et al.*, 2021; Muda *et al.*, 2020)- Development and regular updating of EAPs, with community input and training (Saputra *et al.*, 2024; Daud *et al.*, 2021; Sianturi *et al.*, 2021; Juliastuti *et al.*, 2019). Simulation models and visual communication tools (e.g., leaflets, videos) further help communities understand risks and appropriate responses (Saputra *et al.*, 2024; Juliastuti *et al.*, 2019). Community engagement and participatory planning are crucial for building trust and ensuring that preparedness measures are relevant and actionable (Johnston *et al.*, 2022; Muda *et*

*al.*, 2021; Muda *et al.*, 2020) (so many things are mixed up here. Please use short and simple sentences to enhance comprehension).

## Methodology

This study adopted a mixed-methods research design, combining both quantitative and qualitative approaches to provide a comprehensive understanding of risk awareness, preparedness, and disaster response among communities surrounding Dadin Kowa Dam. The quantitative component involved the use of structured questionnaires, while the qualitative aspect comprised Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs).

Names and list of Communities living around the Upstream Left Side of the Dam are: Rugu Gari (Yobe State), Daurawa, Fikayel, Ardo Gajere (Borno State), Mallamawa, Kubugasi, Shinga, Gurda, Tutsa, Faqo, Gwani East, Kabawa, Dukul. At the Upstream Right side of the Dam, the communities are: Gongila, Ashaka, Ashaka Gari, Juggol, Juggol Borkono, Manawaci, Mannari, Dubel, Fesshingo, Gulenji, Jarko, Kuka Bakwai, Kupto, Almakashi, Wuro Kulum, Shanin Fulani, Shani tera, Allugel, Tinda, Hamsi, Malleri, Damgaram, Dogon layi, Issa Tonga, Jurara, Garin rafi/Dawaki, Garin Waziri, Zoto, Garin Tela, Jauro Usaini, Difa, Kalagari, Wro Embe, Garin modibbo, Hamma Jama'are etc.

The study area includes several communities living along both sides of the dam. Upstream communities are located across parts of Gombe, Yobe, and Borno States, while downstream communities are mainly within Gombe State.

## Results of the Findings

**Table 1: Socioeconomic Characteristics of the Respondents and Communities**

| Age Range                 | Number of Respondents | Percent |
|---------------------------|-----------------------|---------|
| 18 – 24                   | 27                    | 7.7     |
| 25 – 29                   | 36                    | 10.3    |
| 30 – 39                   | 108                   | 30.9    |
| 40 – 49                   | 77                    | 22      |
| 50 – 59                   | 53                    | 15.1    |
| 60 – 69                   | 49                    | 14      |
| <b>Sex</b>                |                       |         |
| Male                      | 245                   | 70      |
| Female                    | 105                   | 30      |
| <b>Level of Education</b> |                       |         |
| Quranic Education         | 193                   | 55.1    |
| non-formal                | 12                    | 3.4     |
| Drop out                  | 4                     | 1.1     |
| Primary                   | 42                    | 12.0    |
| Secondary                 | 61                    | 17.4    |
| Tertiary                  | 38                    | 10.9    |
| <b>Occupation</b>         |                       |         |
| Fishing                   | 14                    | 4.0     |
| Farming                   | 259                   | 74.0    |
| Rearing                   | 8                     | 2.3     |

|                                      |    |                       |
|--------------------------------------|----|-----------------------|
| Trading                              | 12 | 3.4                   |
| Civil service                        | 24 | 6.9                   |
| Tailoring                            | 5  | 1.4                   |
| Artisan                              | 13 | 3.7                   |
| Unemployed                           | 15 | 4.3                   |
| <b>Secondary Occupation</b>          |    |                       |
| Fishing                              | 27 | 7.7                   |
| Farming                              | 91 | 26.0                  |
| Rearing                              | 68 | 19.4                  |
| Trading                              | 34 | 9.7                   |
| Civil service                        | 7  | 2.0                   |
| Artisan                              | 33 | 9.4                   |
| No Secondary Occupation & Unemployed | 81 | 23.5                  |
| <b>Occupation</b>                    |    | <b>Average Income</b> |
| Primary Occupation                   |    | ₦ 155,882.00          |
| Secondary Occupation                 |    | ₦ 103,920.00          |
| Total                                |    | ₦ 259,802.00          |

The age distribution of the respondents shows that the majority (50.9%) are youth within the age range of 30 – 49 years. The percentages of young men and women within the ages of 18 and 29 was 18 and those who are 50 and above 29%. Similarly, the structure of the population in the four LGAs is such that youths are the dominant population; the sample also is a true reflection of the structure.

Even though the proportion of the population in the communities is fifty-fifty with that of men, decisions are normally taken by men. Coupled with the fact that there are restrictions on interaction with women in the study locations, the sample selected reflects that a significant majority are males. However, the sample still contained the opinions of women.

The dominant educational qualification of the respondents is Qur'anic education. Those with formal education are 40%. Thus, the population can be said to be literate since they can read and write in either English or Arabic. Given the fact that almost the entire population of the communities living within the Dam area is Muslim, Qur'anic education is usually given priority. Almost all the respondents are Muslims. This reflects the religious composition of people residing along the Dam.

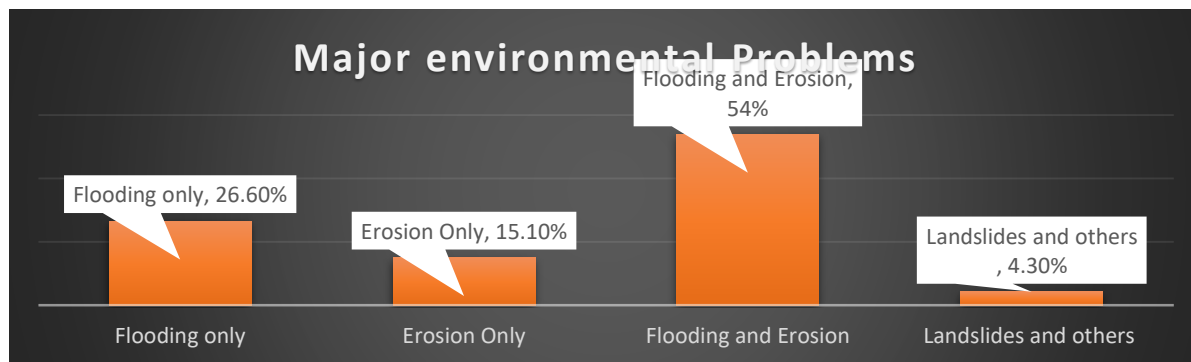
More than 2/3<sup>rd</sup> of the people living in the area of Dadin Kowa Dam are farmers who largely practice rain fed and irrigation farming. An overwhelming majority of the irrigation farmers are utilizing water from the Dam. Unemployment rate among the respondents is very low. About 76% of the respondents have more than one occupation.

Average annual household income is 259,802 Naira. The respondents at the upstream of the Dam, during consultations, argued that their income has drastically reduced due to the loss of irrigation land. This happened because the water level has risen to the extent that a greater portion of land was flooded with water.

**Table 2: Positive Benefits of the Dam**

| Category                                            | Yes (%)    | No (%)    | Total (%) |
|-----------------------------------------------------|------------|-----------|-----------|
| I benefit from the fish caught from the Dam         | 259 (74)   | 91 (26)   | 350(100)  |
| I benefit from the water during irrigation          | 291 (83.1) | 59 (16.9) | 350(100)  |
| The Dam serves as a source of water for our animals | 277 (79.1) | 73 (20.9) | 350(100)  |

A large proportion of respondents, 259 (74%), reported that they benefit from fish caught from the dam, while 91 (26%) indicated otherwise. This suggests that the dam contributes substantially to local livelihoods through fishing activities, providing both a source of food and income for a majority of community members. Even more pronounced is the benefit of the dam for irrigation purposes, where 291 respondents (83.1%) affirmed that they benefit from the water used for irrigation, compared to 59 respondents (16.9%) who do not. This high level of agreement underscores the dam's critical role in enhancing agricultural productivity, supporting dry-season farming, and improving food security within the community. Similarly, 277 respondents (79.1%) acknowledged that the dam serves as a source of water for livestock, while 73 respondents (20.9%) did not perceive this benefit. This highlights the importance of the dam in sustaining animal husbandry, which is a key component of rural livelihoods in the study area. Overall, the table demonstrates that the dam provides substantial positive benefits across fishing, irrigation, and livestock watering. The consistently high percentages of affirmative responses suggest that the dam is a vital community asset, contributing to economic activities, livelihood diversification, and overall resilience of households in the area.

**Figure 1: Major Environmental Problems Affecting Communities**

Flooding and erosion are the commonest environmental problem in the dam area is flooding and erosion. It is observed that erosion is everywhere within the communities and even along the access roads. Landslide is not much of a problem compared to other forms of environmental problems.

### **Dam Safety, Assessments, and Maintenance**

#### **How Safe is Dadinkowa Dam?**

‘Dadinkowa Dam is very much safe by all standards,’ says an official of UBRBDA under whose care the Dam is. This has been reiterated by other officials interviewed that the dam is safe.

No, no, there is no incidence of a threat to the safety of the dam, since its commissioning in 1987, and all the indices that we are using in measuring the dam safety, we have not noticed any deviation from the normal standard. (Official, Fed. Min. of Water Resources)

An official of the River Basin further asserts:

There are some hydrologists that did study on the Dam Simulations, the Dam Break analysis they did. I think they did the trial; it wasn't a full study, but they indicated that the dam could go as far as 250, which is almost more than the flood level, which is 249. So, in case you record that kind of event and actually this dam is more or less a storage reservoir because it has a high volume of storage compare to the spill way discharges so it is more or less a storage reservoir so if in case you do the impoundment and within that time you still receive some inflow which cannot be contained within the may be by way of getting by malfunctioning which is by way not opening in time, the emergency spill way will be a bail out. (Dam Management Official)

With regards to assessment and maintenance, which is solely the responsibility of the Federal Ministry of Water Resources, officials described it thus:

Generally, in Dam Safety, there are some regulations that, once we abide by them, I don't think we will have any problem. Because from any scenario you can see in any dam break, it cannot just occur overnight..... the authority and the technician...It is the authority because, as you know, in Nigeria most of the dams are owned by the government. We have private but very small Dams. But the large dams or the big dams are owned by the government, so it is the responsibility of the government, and we are the government. We hear the engineers, the geologists, the hydro mechanical engineers are the technical people generally. We have the responsibilities of monitoring and maintaining the dams..... For safety reasons, we do maintenance regularly, almost every day we are there...{How?} Because we take the water level every day, we check the inflow of the dam, and we check the outflow of the dam. So every day, you know the actual volume of water that is coming in, the actual volume that it contains, and the actual volume that is going out. So, we do it daily, and we have our weekly maintenance, and we check our galleries weekly. We have monthly maintenance, we check our piezometers, we check our galleries monthly too, and then we have our annual maintenance. So, we do, we evaluate all daily records. We look at the maximum flow, we look at the minimum in flow, we look at the maximum in flow, then we write our annual report. (KII, Official, UBRBDA).

### **Risks Associated with Dam Failure**

In line with their positions that the dam is safe, an official maintained that:

No we have not recorded any risk because the dam is safe it was not impounded or rather operational because it was constructed with the hope of the gate been close that is what is called impoundment but when they finished the gates were not close they were left open so we didn't have a full impoundment the water will come and go as a free discharge apart from the initial impoundment to the minimum level which is 239 so subsequently, the water will build up as the rain comes to the highest level depending on the season of the and then as the rain come to subside, the water passes through because as its coming it passing through the gate (this sentence is too long, please break into short and simple sentences). So, there was no regulation until last year because the first impoundment was done, and it was impounded up to 247, which is the normal level, and then it went down gradually until the operation of the gate was closed. So, we have not noticed any problem with over impoundment because it is when we are being threatened by any excessive inflow that cannot be manage then we talk of being a threat, but I don't think we have ever noticed that. Because the highest level we ever recorded was that of last year, which was 247.98, which is still within the flood level, which is 249, so since the dam has been constructed, that level of 249 has not been attained. Even last year, when it was closed, it didn't even reach 248; it was 247.98 But there is a difference of 0.25; Just close to 248. The flood level, which we don't expect to come often, is 249, so if we go by that 249 and can't manage it, then we can be talking of a threat to overtopping, so we have not yet noticed that since the dam was impounded. So, in terms of threat to safety, we have not noticed that' (KII, Official, UBRBDA)

**Table 3: Effects of the Dam**

| Category                                         | Yes (%)    | No (%)     | Total (%) |
|--------------------------------------------------|------------|------------|-----------|
| The dam has affected farmlands/crop production   | 312 (89.1) | 38 (10.9)  | 350(100)  |
| The dam has affected homes                       | 127 (36.3) | 223 (63.7) | 350(100)  |
| The dam has affected grazing lands               | 211 (60.3) | 139 (39.7) | 350(100)  |
| The dam has affected the quantity of fish        | 193 (55.1) | 157 (44.9) | 350(100)  |
| the Dam Negatively affects health                | 217 (62)   | 133 (38)   | 350(100)  |
| The Dam negatively affects lives (loss of lives) | 229 (65.4) | 121 (34.6) | 350(100)  |
| The Dam negatively affects transportation        | 201 (57.2) | 149 (42.8) | 350(100)  |

Apart from the positive impacts highlighted earlier in this report, there are other negative effects of the dam. Prominent among the negative ones are problems related to flooding on farmlands, which result in a decrease in crop production; loss of lives; reducing grazing lands; and difficulty in accessing neighboring communities. The volume of water in the Dam has made fishing difficult in the areas and has negatively affected the quantity of the fish. The Dam has less impact on homes, as only 36% of the respondents reported being affected by the Dam/River. Other serious risks/hazards brought by the river is Hippopotamus. The dam is serving as home for over 125 hippos in the Upstream part of the dam alone. This has led to a serious decrease in food production in the area. In fact, people with farms close to the reservoir have to sleep mostly on the farms to protect their crops from the hippos. This does not mean the communities downstream are safe from the Hippos; No! They also complained that, regardless of how much the crops yielded, hippos can

ruin that happiness. And since they have no rights, they can only keep calling on the government to come to their rescue. Although the dam itself has not posed any threat to people directly, there are some indirect effects as captured by an official, thus:

There are some instances, there are some instances that are very, very rare, sometimes we have cases of this canoe capsizing there were loss of lives, we have flood, flooding, you know whatever you do this some things are natural, so there may some flooding in the upstream and downstream if there is too much water you have to reduce it and it affect the downstream. And if you don't open it, it will affect the upstream. These things are natural things, but we monitor them every day, and we give them time like the downstream, we always tell them that there is too much water, we tell the Kiri Dam.



**Figure 2: Period of Experiencing the Negative Effects**

Communities experienced almost all the negative effects enumerated above, mainly in the rainy season. Only 21% of the respondents are experiencing the negative effects throughout the season. The negative effects of the Dam are insignificant during the dry season. This is so for all the negative effects, except for those on farmlands and crop productivity. People of the Upstream have lamented the negative effects of the dam on irrigation lands and loss of crops during the last dry season due to the volume of water at the Dam reservoir. The water reserved for the turbines has a multiplier effect on the area of land people were cultivating for over 34 years. So, during the dry season, communities on the upstream side are experiencing the negative effects.

**Table 4: Major Sources of Local News/Information**

| Major Source of Information | Frequency  | Percent      |
|-----------------------------|------------|--------------|
| Local TV channels           | 2          | .6           |
| National TV channels        | 2          | .6           |
| Local Radio station         | 184        | 52.6         |
| National Radio station      | 5          | 1.4          |
| Town Cryer                  | 138        | 39.4         |
| National Press              | 1          | .3           |
| Internet                    | 4          | 1.1          |
| Others                      | 14         | 4            |
| <b>Total</b>                | <b>350</b> | <b>100.0</b> |

Basically, the local radio station and Town Cryer are the major sources of local news/information. Therefore, for effective and efficient communication, the two means should be utilized. However, the town Cryer is not acting independently, but with the instruction of the traditional rulers. When

they receive any correspondence for onward passage to the commoners, they use the town Cryer to deliver the message.

**Table 5: Awareness of Risks Associated with Dam Breakage/Collapse/Draw Back**

| Awareness    | Number of People | Percent      |
|--------------|------------------|--------------|
| Aware        | 267              | 76.3         |
| Not aware    | 83               | 23.7         |
| <b>Total</b> | <b>350.0</b>     | <b>100.0</b> |

A significant majority (76.3%) of the people interviewed are aware of risks associated with Dam Breakage/Collapse/Draw Back. But still, 23.7% are not aware, perhaps because they have never witnessed or heard of the risks or effects. Knowing the risks is important, for it helps in preparing the people mentally for eventualities and could perhaps encourage them to take precautionary measures before risks.

### **Plans for Saving/Evacuating People in an Event of Dam Failure**

There are no plans for saving and evacuating people in case of a dam failure. This is attributed to the fact that the Dam has, for the past 34 years, been operating as a normal river, without being closed. It was not until 2019 that the dam was closed; there was no risk of flooding. Secondly, even with the closure now, there was no risk based on the opinion of the officials managing the Dam. From the design, the dam has a life span of at least 100 years. However, as a possibility, should the Dam fail, an official explained that:

So, if by accident, all the gates failed. Maybe you want to operate it if the water is still building up, and all the gate failed, then we should be able to give that notice by the time they repair and you want to open it completely so that already by that time the dam was already very high and you want to open all the gate then that kind of communication can be done. When something like that is coming, you will already inform the people that are living within the side of the river to move because we are expecting a very serious flood that we cannot handle. So, it is not there, but in case it comes, the people should be fully informed to be able to evacuate and move. (KII, Official, Dadin Kowa Area Office)

**Table 6: Having a Plan in Case of Dam Breakage/Collapse/Backdrop**

| Stand on having a Plan | No. of Respondents | Percent      |
|------------------------|--------------------|--------------|
| Have a plan            | 193                | 55.1         |
| Don't have a plan      | 157                | 44.9         |
| <b>Total</b>           | <b>350.0</b>       | <b>100.0</b> |

Only a little above half the people of the Dam Area have a plan in case of Dam Breakage/Collapse/Drawback. This indicates a serious problem, because a lack of a plan will leave people stranded during an emergency.

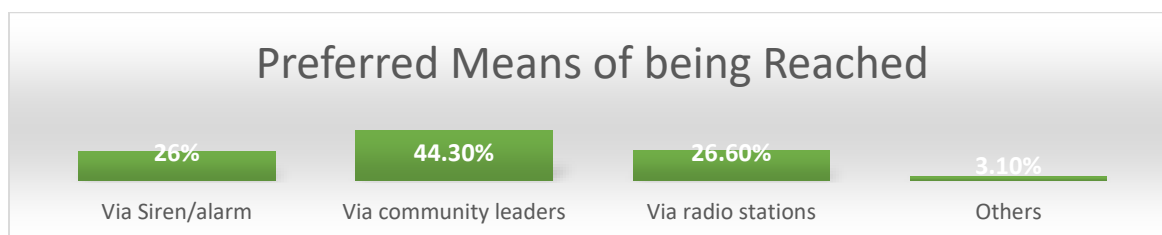
**Table 7: Estimated Time Required to Prepare and Evacuate in case of an Emergency**

| Time Range       | Percent of Respondents |
|------------------|------------------------|
| 1 – 10 minutes   | 43.4                   |
| 11 – 20 minutes  | 11.4                   |
| 21 – 30 minutes  | 16.3                   |
| 31m – 40 minutes | 3.4                    |
| Above 40 minutes | 25.4                   |
| <b>Total</b>     | <b>100.0</b>           |

Almost all the respondents said they are ready to evacuate in case of a dam breakage/collapse, except 7.1%. The majority requires time between 1-10 minutes, and 25.4% needed more than 40 minutes. Though sometimes signs of a problem could be detected and communicated, there are instances when there won't be sufficient time. A communication mechanism is needed to take the average time required to get the people prepared for an emergency, especially those at the downstream side of the Dam.

An official posits:

A dam cannot just break overnight, it cannot, it is not possible. In any engineering structure, there must be a sign either from the bank, there may be piping, there may be leakages, there may be a sign, so if we see any sign, we let the people know, we inform the authority concerned, then we inform the communities, especially the traditional rulers... they will have enough time! is not like a car accident that will just happen like that; there must be a sign, so once we notice that, we give notice, yeah. (KII, Official, UBRBDA)

**Figure 3: Preferred means to be reached or communicated to in the event of an emergency notice from the Dam Managers**

The most preferred means of communication on the status of the Dam or River is through the Community leaders, who normally inform their subjects via the town Cryer. The second most preferred means are through Local Radio stations and or the use of an alarm/Siren. However, the siren can only be heard by communities that are very close to the Dam. Traditionally, when the river is flowing unexpectedly, people used to shout out, alert others to vacate risk areas, and or to cross over to the safer side of the river. This line of communication was affirmed by officials, thus:

With the communities ok we have ar..., you know these associations we have 'WUA' the water user's association, the fishermen, we are always together with them, and the traditional rulers. The traditional ruler as well, so if there is any problem, we can liaise with the representatives, the community representatives, and we can tell them. ' (KII, Official, Dam Officials)

## Availability of a Plan to Provide Alternative Means of Livelihood for People in Case of Dam Failure

Although officials in charge of the Dadin Kowa do not anticipate failure from the dam, those living in the upstream (reservoir) of the Dam have lost their means of livelihood. They rely on farmlands when the water is drawn back. With the current reality, reversing this trend is almost impossible.

This raises the question of ‘is there any alternative for people to earn a living?’ An official posits:

Well, when the dam was really conceived, they took care of all those people. Most of them were settled, those villages, as you can see, Gwani East, Gwani West, Ashaka gari, Kupto Malleri, etc. They were in one place; some of them prefer to remain there, and some of them stay on this side. So, most of them are resettled at various villages, and the upper Benue for years have been providing amenities for them because we don’t expect them this is stagnant water, we don’t expect them to use the stagnant water for their drinking water. The rest of them. So, we provided amenities boreholes for them, and actually, most of them prefer money, because those due for resettlement were supposed to have been building standard new houses for them, but they didn’t want them; they preferred money, so money was given to them. Though there are, of course, some of them that are not alive, most of the children may not know that their parents were fully compensated. And most of them as you say they have other up land area that they are planting but those area why they took advantage is that as I told you during the raining season water will build up on its own to almost normal level, but because the gates were not operating as the rain is going the water will pass through the spill there is a sharp drop and because of that sharp drop between October and December we discover that from 247 or 246 whatever level we attain, it will go as low as 240. so you know there is a lot of inward moving they take advantage of that well zone to plant there crop naturally without any irrigating and then they will harvest before the place become dry. That is why they are called draw back activities, and then when we discover that, we say *toh*, let us put a control on them. So, we decided to group them into various villages and then listed them as our drawback activities and our staff assigned, so they will know that these areas do not belong to them, we are just collecting a little token. We allow them to do the farming within the reservoir area with the understanding that any time the impoundment is done, those lands will be off to use. And that is exactly what happened last year. (there is difference between written English and spoken English. It is the responsibility of the authors to structure the response of the KII into the right formal language of expression for academic writing like this)

With regards to the alternative means of livelihood, the Official further maintained:

Even as we did impoundment, knowing the fact that these people were already benefiting there, we tried to give them pumps, irrigation pumps, so that instead of just staying like that, they should be able to extract by using those pumps to irrigate those higher areas that are no longer inside the reservoir. So, within that vicinity of the dam, they can take the privilege of the dam water all year round, even during the dry season, they can still use these pumps and then irrigate. I know pumping through open surface water

is cheaper than the wash borehole. Because that one is costlier because energy needed to draw water is more costly than the one from the surface water. So, we encourage them as much as possible, and we even group them. They have cooperatives that are registered cooperatives in various communities. We have the Kupto farmers, we have the Malleri farmers, we have the Gwani farmers. We give them pumps every year for their farming activities to encourage them, and then we are also trying, with the coming of Trimming taking over irrigation, we are transferring most of the pumps that we have here. We are trying to establish an irrigation scheme at the main Raffi, like a pilot scheme ..... is more or less a scheme that we want to experiment with, grouping them as a kind of big farm up to 40/50 hectares. So, we were using a kind of pump, and eventually we want them to manage these pumps themselves. So if there is, because there are solar pumps which come as maintenance-free, but of course, they should be able to generate revenue that will be able to pay for and manage this project on their own. So, we are just trying to do that; we have not yet completed the project, but we are in the process. And we hope that if that succeed then as many of them as are willing, we can group them and be able to provide them with facilities so that they can come together and do dry season farming to better their lives.

## **Conclusion**

For now, Dadin Kowa Dam is safe according to the officials, whose responsibility is to ensure the safety and smooth operations of the Dam. However, residents upstream of the Dam have experienced some negative effects indirectly from the Dam. Indirectly, because the Dam itself has not failed, over-discharged, etc., but the presence of the Dam and water in the reservoir has some negative effects on the livelihood of the people at the upstream. It has also affected fishing and has provided accommodation for Hippos that usually destroy crops in the region. The authority has provided, though not sufficiently, support for some farmers to get alternative means of livelihood, especially during the dry season, by supplying them with hand-pumps and is developing a new irrigation area of about 40hectres. The conviction that the dam is safe, as it has been flowing like a normal river for over 3 decades except for last year (2019), has led the authority and the community to agree to disagree on the standard procedure of communicating risks. Although there are traditional means of reaching out or passing information across, people prefer receiving information through the traditional rulers, radio, and siren/alarm in case of an emergency related to the dam failure.

## **Recommendations**

- i. Federal Ministry of Water Resources and the Upper Benue River Basin Development Authority (UBRBDA) immediately install a multi-tiered early warning system. This should include electronic sirens for communities close to the dam, integrated with alerts to local radio stations to reach a wider audience
- ii. A structured training program should be developed for traditional rulers and town criers on disaster response protocols, ensuring they can receive, interpret, and disseminate clear evacuation instructions from dam authorities quickly and accurately.

- iii. There is an urgent need for official Emergency Action Plans (EAPs). These plans must be co-developed with community input to be practical and must include clear evacuation routes and assembly points.
- iv. Launch a targeted risk communication campaign focused on co-existing with the new water levels and wildlife. This must be paired with the accelerated implementation of alternative livelihood programs (such as the proposed irrigation scheme and provision of irrigation pumps) to mitigate the loss of drawdown farming and build long-term community resilience.

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