The Akosombo Dam Spillage 2023: A Critique of Disaster Preparedness and Management

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Dedicated to all the victims of the error of judgment in the 45-day spillage of the Akosombo Dam and the organisations and individuals who responded spontaneously when the state was slow to respond.

Background

On 12 September 2023, the Volta River Authority (VRA) issued a somewhat boilerplate press release titled "Controlled Spillage of Water from the Akosombo Dam and Kpong Dam." The VRA alerted the public about a disturbing rise in the inflow pattern and water level of the Akosombo Dam. In line with its Emergency Preparedness Plan (EPP) and Standard Operating Procedures (SOPs), the VRA notified critical stakeholders of the possibility of a controlled spill in the coming days if the situation persisted. The VRA urged residents along the River Volta and downstream of the Akosombo and Kpong Dams to stay vigilant, take precautionary measures, and collaborate with stakeholders to respond to any potential emergency promptly.

On 15 September 2023, the VRA initiated a controlled spillage of the Akosombo Dam due to a persistent upstream water rise and heavy rainfall to protect the dam's integrity and prevent potential disasters. The VRA ended the controlled spilling of the Akosombo Dam on 30 October 2023, as the water inflow into the Akosombo Dam decreased significantly between 27-28 October, resulting in a diminished spillage.

The inundation of large parts of the Lower Volta Area (LVA) downstream sparked considerable debates on disaster preparedness and management. While the VRA and the National Disaster Management Organisation (NADMO) engaged in a media blitz to explain the necessity for the spillage, they should have acknowledged coordination issues and ineffectiveness in their responses and taken responsibility for the crisis. For a while, the VRA and the Ghana Meteorological Agency (GMet) engaged in a blame game, the VRA accusing the GMet of misleading predictions on 15 October 2023. The GMet refuted the claim on 18 October, asserting its consistent forecasting of above-normal rains. This lack of acceptance of blame for failing to manage the human-caused disaster effectively aligns with the national political culture, where blame avoidance is prevalent. The blame exchange also exemplifies the broader trend of deflecting responsibility.

Empirical evidence suggests that careful water management could have prevented downstream flooding and safeguarded the dam's structural integrity during extreme precipitation. The events between 1963 and 2023 emphasise the importance of accurate weather forecasting, early warning systems, and improved dam infrastructure to cope with extreme weather conditions. They underscore the need to improve the dam's infrastructure and enhance its resilience to extreme rainfall events, such as installing advanced monitoring systems, improved flood forecasting capabilities, regular maintenance, and community involvement to ensure stability.

This paper evaluates disaster preparedness and management, focusing on the timing of the September 15 spillage and its aftermath. A synopsis of the Akosombo Dam precedes an overview of the spillage's impact, setting the stage for a critical analysis of disaster preparedness and management. Geographically, the discussion centres on the downstream districts affected by the spillage. It concludes with broad recommendations for key stakeholders to enhance adaptive strategies for future preparedness.

Overview of the Akosombo Dam, Lake Volta and Water Spillages

Location and panoramic views of the Akosombo Dam & hydroelectric plant







Source: Google *Source: Webuild* *Source: xklusives*

The Ghana government constructed the Akosombo Dam on the River Volta between 1961 and 1965 at £130 million, with 25 per cent funding from the World Bank's International Bank for Reconstruction and Development, the UK, and the United States, which remains a pivotal achievement in Ghana's economic development. Impregilo (now Webuild) successfully executed the riverbed dredging and channel dewatering, even overcoming a three-month delay caused by the 1963 flooding of the River Volta. The project's total cost upon completion was $196 million. The memorialisation of the twenty-eight Impregilo workers who lost their lives during the dam's construction in Akosombo tAkosombo township and St. Barbara Catholic Church underscores the sacrifices made. Anticipating the Dam's impact, the VRA directed a resettlement program, relocating 700 villages, including two per cent of riparian fishers and subsistence farmers,[1] into 52 resettlement villages two years before the dam's completion.

The Akosombo Dam impounds Lake Volta, the second-largest man-made lake in the world,[2] with a surface area of approximately 8,502 square kilometres and stretching across about six of the country's sixteen regions—Greater Accra, Volta, Eastern, Oti, Bono East and Savannah regions. The dam rises 440 feet (134 m) above ground level, has a crest of 2,201 feet (671 m) wide and a volume of 10,451,000 cubic yards (7,991,000 cubic m). The Lake Volta also covers 3.6 per cent of Ghana's total land area and has a capacity of 124,000,000 acre-feet (153,000,000,000 cubic m). It comes second after Lake Kariba (1958) on the border of Zambia and Zimbabwe in southern Africa—with a volume of approximately 180 cubic kilometres and an area of about 5,580 square kilometres.

As a cornerstone of Ghana's economic development plans, the Akosombo Dam supports commercial fishing, navigation, and transportation and is a vital source of renewable hydropower generation. Initially generating (912 megawatts, the dam's power output was retrofitted in 1993 and upgraded to 1,020 megawatts in 2006, contributing to the country's electricity surplus for sale to neighbouring nations. Additionally, the dam supplies power to the Volta Aluminium Company (VALCO) smelter in Tema.

The dam's water management hinges on the highest and lowest water levels. While historical records highlight intermittent spillages from 1966 to 2010, the 2010 spillage, although impactful, was arguably less severe than the recent events in 2023. The VRA consistently monitors water levels, staying above the maximum operating level of 278 feet while considering the minimum permissible level at 240 feet. Instances of low rainfall, as in 2007, typically resolved themselves with increased precipitation. However, in 2023, the VRA faced a unique challenge, managing an excess inflow of over 400,000 cubic feet per second against an outflow of about 183,000 cubic feet per second. This necessitated emergency measures to prevent the water level from surpassing the critical 278-foot mark and safeguard the dam's integrity.

Analysing National Disaster Preparedness and Response

Synopses of the VRA and NADMO

The VRA was established in 1961 under the Volta River Development Act, Act 46 of the Republic of Ghana, with the primary mandate to generate, transmit, and distribute electricity. However, in 2005, an amendment narrowed its focus to electricity generation, paving the way for independent power producers (IPPs) to enter the Ghanaian energy market. Concurrently, the transmission function was separated into the Ghana Grid Company (GRIDCo), while the Northern Electricity Department (NED), established in 1987, transformed into the Northern Electricity Distribution Company (NEDCo), a wholly owned standalone subsidiary of the VRA.

Conversely, the NADMO, established by Act 927 (2016), operates under a broader mandate. Tasked with managing disasters, developing community response capacities, and raising public awareness, NADMO is committed to disaster prevention, risk reduction, and effective response efforts. The Organisation is also responsible for post-emergency rehabilitation and reconstruction. To support its mandate, the National Disaster Management Fund was created to finance disaster prevention, risk reduction, climate change initiatives, and emergency relief efforts. Despite its vital role, NADMO faces challenges in fulfilling its mandate due to limited human, technical, and financial resources.

Disaster Preparedness: A Comprehensive Approach

Disaster preparedness is a comprehensive approach aimed at mitigating the impact of disasters on individuals and communities. It involves proactive measures undertaken by governments, organisations, communities, or individuals to enhance resilience and reduce vulnerability to various disasters, whether natural or human-induced. The objective is to minimise the loss of life and livelihoods through proper planning, organising, and implementing measures to enhance resilience and reduce vulnerability to several types of disasters, including natural disasters such as hurricanes, earthquakes, floods, and wildfires, as well as human-made disasters like terrorist attacks and industrial accidents. Disaster preparedness While the components of a disaster preparedness framework or cycle may vary among institutions, generally, it includes risk assessment, emergency planning, public education and awareness, infrastructure and resource preparedness, community engagement and collaboration, coordination and emergency response and recovery, continuity planning, and monitoring and evaluation.

The VRA Simulation Exercise

The VRA conducted a flood simulation exercise (SIMEX), *"DA WO HO SO"* 2023 (more appropriately *"NOR NDZOR"* in Ewe), in collaboration with NADMO in May 2023. The exercise aimed to test the VRA's EPP and involved various agencies such as the Ghana Police Service, Ghana National Ambulance Service, Ghana National Fire Service, Ghana National Signals Bureau, Ghana Armed Forces (GAF), including the Ghana Army and Ghana Navy.[3] The simulation achieved a degree of seamless collaboration and coordination, but the crisis revealed gaps in achieving its objectives. Complementary exercises were held in the other six districts. The SIMEX occurred in three (33 per cent) of the nine districts—Asuogyaman, North Tongu and Ada East districts of the Eastern, Volta and Greater Accra regions, respectively.

Stakeholder responses during the crisis indicated shortcomings in the SIMEX. Even if the VRA adequately informed all communities in the lower Volta basin about the spillage, community evacuations lacked consideration for vulnerable populations, including the infirm, sick, elderly, pregnant women, and nursing mothers. Community members and volunteers were crucial in assisting and accommodating victims, indicating a gap in the institutional relocation efforts.

Institutional responses could have been timelier and more comprehensive, especially from participating agencies. Agencies like the Ghana Health Service, Ghana Education Service, and the Ghana Water Company Limited, which are critical in humanitarian assistance, needed to be adequately involved in the simulation and better prepared during the crisis. The absence of well-prepared evacuation centres equipped with essential amenities—food, shelter, water, sanitation and hygiene (WASH),[4] health interventions, and makeshift classrooms—raised concerns about the adequacy of the emergency response planning.

The aftermath of the crisis highlights the importance of refining disaster preparedness strategies and ensuring that simulations effectively translate into real-time responses, encompassing the needs of all community members, especially the most vulnerable.

Strategic Decision-Making on Dam Spillage: A Critical Examination

The imperative to safeguard the structural integrity of the Akosombo Dam, a linchpin of Ghana's national interest and national security, prompted the VRA to consider the controlled spilling of excess water. This strategic decision, a response to the pressing need to prevent a catastrophic inundation, underscores the critical importance of timing and disaster preparedness in managing such a delicate situation: the quandary of "to spill, when to spill, or not to spill."

Critical Timelines and Decision-Making Process

The VRA's decision-making process hinged on a sequence of events, starting with the realisation of excessive water build-up in the dam's reservoir due to the unusually heavy rains in October-November 2022. The known timeframe for water accumulation and the dam's known discharge capabilities provided vital data points for decision-making. Press releases in October 2022 indicated rising water levels, and by 25 October, the VRA foresaw a spillage unless the inflow rate subsided.

Examining the subsequent events reveals a strategic approach by the VRA:

- Simulation Exercise (SIMEX): Conducted in three high-risk districts and complementary exercises in six others, the SIMEX aimed to test emergency preparedness.
- Community Notification: Communities in all nine districts were notified of a possible spillage using established channels and a dedicated disaster platform.
- Press Releases: National press releases on 12 and 15 September announced the commencement of spill operations.
- Controlled Spillage: Starting at a low rate of 20,000 cfs and gradually increasing, reaching 90,000 cfs on 9 October and further to 180,000 cfs on 10 October due to rising reservoir levels.

Judgment of Spillage Timing and Disaster Preparedness

The critical question centres on the judgment of when to initiate the spillage. While historical data and monitoring tools provided insights, the VRA faced challenges predicting the weather's fluid nature. The decision-making process involved anticipating potential spillage in October 2022, which did not materialise due to a drop in the inflow rate. Conversely, the decision to spill in September 2023 was swift as rising inflow rates and a reservoir elevation of 272.5 ft indicated an imminent threat.

The fluidity of parameters for spillage decision-making became apparent, particularly with the unexpected deluge in 2023. If, in 2023, the VRA was confronted with the challenge of dislodging the dam's excess water of 217,000 cfs, it could only have avoided the dilemma of flooding up and downstream by an earlier and gradual spillage to avoid the precipitate spillage occasioned by the delay

in the decision to spill too little too late on 15 September at some 183,000 cfs, until 10 October 2023. During this period, four or six spill gates out of the twelve were opened to increase the release as water-inflow to the reservoir kept growing close to the acceptable maximum capacity of the dam.

This scenario compelled protecting "the dam from overtopping" but caused the devastating flooding in low-lying areas along the river on 11 October 2023. Given the substantial deviations from rainfall forecasts, the VRA's risk aversion should have been more pronounced. While acknowledging the complexity, the question arises: Could a more proactive approach, factoring in climate change-driven variations, have mitigated the volume of the spillage and ensuing disaster?

Post-Spillage Assessment and Future Considerations

The aftermath prompts critical questions about the scale and impact of the spillage. Concerns raised by the Centre for Climate Change and Food Security (CCCFS) on 17 October 2023 highlight the need for accurate impact estimates and proactive measures to address climate change-driven variations in water levels. The GMet, African Centre for Meteorological Application for Development (ACMAD) and the Climate Prediction Centre (CPC) should complement the methods of proactively forecasting suitable spill date forecasts. This will help narrow the range of ambiguities and significant deviations in the rainfall over the dam's catchment areas.

In the final analysis, a business-as-usual attitude might have clouded the Authority's judgment in balancing the decision on when to spill or not to spill. The wealth of fifty-eight years of institutional memory and experience should prompt reflection on whether the VRA could have better managed the spillage to minimise risks and protect the population and the dam. As Ghana moves from the spillage, collaborations with global programmes, such as the World Bank's West Africa Coastal Areas Programme (WACA),[5] could enhance climate resilience. Additionally, improvements in forecasting methods, with inputs from meteorological agencies, will be crucial to reducing uncertainties in spillage decisions. The lessons learned must inform future disaster preparedness and spillage management strategies to ensure a more effective response to such complex challenges.

Risk Assessment, Emergency Planning, and the Impact of the Flood

The devastating consequences of the spillage-induced floods were felt most acutely in Mepe, the epicentre of the flooding, and Battor, Sogakope, Mafi, Adidome, and Ada. Significant losses and displacement of nearly 40,000 individuals occurred by 24 October, particularly in Mepe and surrounding areas of North Tongu district and South and Central Tongu and Asuogyaman districts. Consequently, the socio-economic toll of the floods was extensive, ranging from disrupted livelihoods to the destruction of property, businesses, and infrastructure. Although lives were spared, physical harm, injuries and psychological trauma were reported, along with the collapse or submergence of houses.

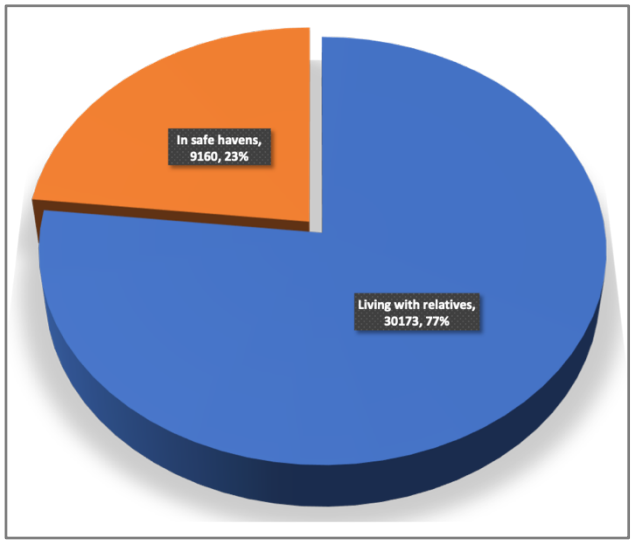
By 19 October 2023, North, South, and Central Tongu districts had been declared public health emergency zones. By 25 October, cases of snakebites predominated at some of the makeshift health centres because NADMO had not undertaken any pest control measures against snakes, animals, plants or fungi. There was also a potential increase in the cases of malaria, general body pains, and other waterborne illnesses like diarrhoea, dysentery, cholera, and typhoid fever, aside from skin infections, hypertension and neurological symptoms. This was because pit latrines, sewer holes, mortuaries and general food and water were contaminated from the inundation.

Table 1: Disaggregated demographics of flood victims in affected districts and communities

Srl	District	Communities Affected	# of Safe Havens	# in Safe Havens	# with Relatives	Total Affected Persons	# of Affected Persons				
							Adults		Children		PWDs
							Male	Female	Male	Female	
1.	North Tongu	69	15	4216	8417	12633	3151	3285	2982	3134	81
2.	Central Tongu	34	4	2773	6941	9714	2545	2780	1795	2546	48
3.	South Tongu	28	0	0	3364	3364	989	1024	650	701	0
4.	Shai Osudoku	14	4	1256	325	1581	296	336	421	528	0
5.	Asuogyaman	6	5	325	1015	1340	320	494	240	286	0
6.	Ada East	14	3	590	5067	5657	1518	1534	1394	1211	0
7.	Anloga	20	0	0	4762	4762	1009	1148	1128	1477	0
8.	Lower Manya	7	-	0	282	282	62	63	83	74	0
9.	Ada West	-	-	-	-	-	-	-	-	-	-
10.	**Total**	**192**	**31**	**9,160**	**30,173**	**39,333**	**8,867**	**10,664**	**8,693**	**9,957**	**129**

Source: Emergency Operation Centre (Battor), 24 October 2023

Figure 1:Disaggregated numbers of victims in safe havens or sheltering with families and friends



Source: Extracted from Emergency Operation Centre (Battor), 24 October 2023

Table 1 and Fig 1 show a record of eight of the nine hardest-hit districts in the Volta, Eastern and Greater Accra regions and thirty-two communities downstream of the Akosombo Dam.

Fishing communities and local commercial fish farms, including fish cages and floating barrels, suffered significant losses, impacting the livelihoods of those dependent on fishing. Downstream of the Sogakope Bridge, aqua businesses, river resorts, hotels, and water sports faced curtailment due to the inundation of landing platforms and entertainment areas, leading to cancelled social events and decreased hotel bookings. Properly evaluating the economic and social costs of the inundation is, therefore, imperative.

To ensure effective preparedness and response to potential hazards, it is crucial to have sufficient evidence that a comprehensive risk assessment accompanies the SIMEX. This assessment should involve a thorough understanding of the risks communities face, with stakeholders determining the likelihood and potential impact of these risks. Furthermore, it is essential to identify vulnerable populations and

critical infrastructure that may be at risk. It would have helped develop a scheme for building a more commensurate community and infrastructure resilience to withstand such a magnitude of flooding.

In addition to the above, the humanitarian crisis was compounded by the lack of two essential services: electricity and water. The Electricity Corporation of Ghana (ECG) had to cut the electricity supply because substations, e.g., the GRIDCo sub-station in Fievie, Sogakope, were submerged to avoid mass electrocution. On their part, the Ghana Water Company Limited (GWCL) had to cut water for two reasons: the submergence of substations and water tanks and to prevent contamination.

Communities grappling with flooding



Source: Graphic



Source: VRA



Source: CNR



Source: Graphic



Source: Tasking Manager



Source: GBC







Source: Ghana News

It is permissible to guesstimate that some affected community members lost their identification cards, such as their Ghana cards, NHIS cards, and voter registration cards. Losing some or all these cards could cause further hardships later. For instance, the sick and other outpatients, like pregnant women who were penniless, were denied health services until the district health chief (Dodowa) declared that all patients were to be offered treatment free of charge. Even so, one media house (TV3 News, 21 October 2023) reported the case of a nursing mother who was denied a bed because she had no money to settle a bill of GH₵600 (about US$51). Adding that she would have no home to go to even if she were discharged, she was confined to sleeping on the floor with her days' old baby. Given the politics around voter registration, it is not impossible that down the line, community members who lost their identification cards could face challenges with voter registration and voting. This scenario requires deliberate action by the Electoral Commission and other stakeholders to ensure that such persons are not disenfranchised.

Another dimension of the impact of the spillage was the disruption of education for several weeks, as some school facilities on higher ground, notably the Mepe Saint Kizito Senior High Technical School (SHTS), had to be used for housing the displaced persons. The Mepe school and other facilities needed doors, windows, and floor screeding. The plight of children is discussed later in the paper.

It is logical to point out that VRA and NADMO should have obtained this information from the risk analysis as part of the SIMEX *"DA WO HO SO"* in May 2023 to be disaster-prepared. This would have implied further that by 15 September 2023, the two government agencies, in collaboration with others, including CSOs and NGOs, should have prepared food and shelter, as well as water, sanitation and hygiene (WASH), and health and other interventions at the designated safe havens. The lack of appropriate shelters at the safe havens, for instance, implied a lack of privacy for women and girls. Before the alert on 12 September, per the VRA's EPP, appropriate forms of transportation, including boats, local canoes, motorbikes and even bicycles, could have been ready for those who needed them, especially women, children, the sick, and the elderly. The government could not be said to have been disaster-prepared to the extent that these arrangements were not in place or rolled out timeously.

Infrastructure and Resource Preparedness

Disaster preparedness and management also encapsulate infrastructure and resource preparedness in ensuring that critical infrastructure, such as hospitals, emergency response centres, and transportation systems, including roads, bridges and other vital communication networks, are prepared, regularly maintained and inspected to withstand and respond to disasters. For instance, hospitals, health facilities, and emergency response centres must have backup systems and stockpiles of essential drugs, medical consumables, and the necessary.

The post-spillage crisis narrative, however, showed scarce evidence that any EPPs were timeously detailed to meet and efficiently coordinate contingency scenarios with other stakeholders. While the so-called SIMEX was the initial stage of an attempt to develop a plan, it was merely coincidental, showing disconnectedness in the emergency responses and management. Overall, key government agencies needed to prepare better to protect such critical infrastructure, keep vital roads and bridges from turning into canals, submerge existing natural islands, and create new ones.

These realities implied a higher premium being placed on riverine operations. At the request of the VRA and NADMO, the Ghana Navy, the Ghana Army (48 Engineer Regiment) and the Marine Police of the GPS were expected to provide boats for evacuation and water transportation. Indeed, in an area where the population engages in river fishing and where men, women and children can paddle canoes, the VRA and NADMO could have mobilised canoes from other sources for the communities to operate within the disaster preparedness framework and as part of the disaster management operational plan.

In the domain of evacuation and transportation/ferrying by boat, the Ghana Navy played a more significant role in evacuation, transportation of relief items, provision of security, and riverine patrols, both upstream and downstream of the Akosombo Dam. Besides the Naval Training Command (NAVTRAC) at Sogakope, the Ghana Navy deployed detachments downstream at Ada Foah and Akosombo and upstream at Yeji, Kete Krachi, Dambai, Tapa Abotase, Kpando Tokor and at the Bui Dam. All the naval detachments came under the Riverine Command and had been on standby since the Chief of the Naval Staff (CNS) and the Ghana Maritime Authority toured Bui, Yeji and Dambai on 5 October 2023.

With effect from 16 October 2023, the Naval Riverine Command detachments deployed a total of ten boats with fifty-five active personnel and 30 on standby at NAVTRAC, Sogakope, to support the rescue operations as follows:

- Akosombo (upstream): From the Akosombo Dam to Dodi and surrounding villages—one Defender Class Boat with eleven personnel.
- Akosombo (downstream): From the Akosombo Dam to Akuse and surrounding villages—1 boat with eight personnel.
- Sogakope and surrounding NAVTRAC: Two Rigid Hull Inflatable Boat (RHIBS) with ten personnel on standby.
- Sogakope (deployed with VRA/NADMO): Two aluminium boats with ten personnel deployed in Aveyime, Mepe, Bakpa, Battor, and Keta as required.
- Ada Foah and surrounding areas: Two boats, Including one RHIB, with fourteen personnel.
- NAVTRAC: two Penguin Boats with thirty personnel designated on standby in Commands ready for emergency deployment.

By 15 October 2023, the Navy had rescued more than 8,000 victims of the spillage from the Akosombo and Kpong Dams. The 48 Engineer Regiment of the Ghana Army played a similar but limited role compared to the Ghana Navy.[6] The Regiment deployed six aluminium boats in two trucks. At the same time, NADMO took responsibility for the detachment's feeding, accommodation, petroleum, oils, and lubricants for the boats. Given its limited role, the Regiment operated with three boats, two at Mepe and one at Seko for ferrying, with three in reserve. In this context, the allegation by the North Tongu MP in the media that the Engineers had withdrawn their resources from the Mepe area upon an order from a higher authority is unexplainable. Nevertheless, the GAF dismissed the reports.

Two significant exceptions emerged from the malaise of infrastructure preparedness and management. The first was the construction of a bypass road connecting the St Kizito SHTS Safe Haven road to the Battor-Mepe road in the North Tongu District by the VRA as a quick response to the flooding of the main road to the haven to facilitate relief items, drugs, health services and supplies to be delivered to the Mepe community.

The second was VRA's restoration of the Aveyime water supply system, also in the North Tongu District, days after the flooding of the town from the Akosombo Dam spillage, by relocating the town's raw water intake pumps to higher ground, constructing a pump protection shed with power panels and connecting it to the water treatment system. Simple as that might seem, the VRA team worked around the clock digging trenches and installing pipes to provide the community with an immediate potable water supply.

Public Education and Awareness

Educating the public about potential risks and how to prepare for and respond to disasters is vital. While this includes disseminating information through various channels, conducting training and awareness programmes, and promoting individual and community preparedness, VRA, NADMO, and other agencies must plan to conduct such activities jointly to the extent possible. This helps to establish a common front and approaches to shared problems and challenges.

Indeed, the VRA and NADMO have since 2010 been conducting annual disaster-related engagements with communities in the nine districts that are heavily impacted by dam spillage flooding. From these engagements, these communities could be conversant with the self-evacuation drills. They would, however, not be acquainted with assisted evacuation in extreme inundation situations, given that the agencies would normally not deploy the full range of support capabilities. And they would certainly only be prepared to cope with the aftermath of significant emergencies with external relief and assistance, especially from government agencies.

Amid the crisis, and almost four weeks after its first press release (12 September), the VRA, on 9 October, updated the public that the water level upstream of the dam continued to rise owing to persistent rains and, therefore, intensified the spill rate, advising the downstream communities to move to higher ground to ensure their safety. Furthermore, the VRA said it was collaborating with NADMO, the Metropolitan, Municipal, and District Administrations (MMDAs) and all the relevant stakeholders to educate, inform and support the downstream communities to minimise any adverse impact.

Given the spread and scale of the devastation, public education could have been done more effectively through periodic daily updates using local radio and television stations and Ministry of Information public announcement vans, and by the regional offices of the National Commission for Civic Education (*NCCE*), and local chiefs, churches and mosques, and civic groups, among others.

Relief Aid and Support

Emergency humanitarian relief, especially food assistance in the disaster areas, was due to the temporary food insecurity arising from the destruction of farms, crops and foods. This created a situation where affected populations faced challenges in attaining both physical and economic access to sufficient, safe, and nutritious food, crucial for meeting their dietary needs and preferences, essential for maintaining an active and healthy life. In that situation, the chiefs, representatives and individuals solicited support from philanthropic Ghanaians and organisations as the government's arguably insufficient packages trickled in.

Contrary to the urgent need for relief aid in the immediate aftermath of the spillage and inundation, assistance from the VRA and NADMO was delayed. Initially, VRA claimed to have released about GH₵6 million of its humanitarian aid budget of GH₵20 million, increasing to about GH₵9 million by 24 October 2023. However, assessing NADMO's disaster relief performance requires acknowledgement that less than 2 per cent of the national budget is allocated to the organisation. As of October, only 15 per cent of its budget had been released. NADMO lacked the capacity for meaningful disaster preparedness and effective management.

Both organisations provided relief items to the flood victims, including canned food, rice, sugar, toiletries, boats, and hot meals worth millions of Ghana cedis. Additionally, VRA supplied tanker water services to impacted communities and potable drinking water to those in need. In line with its existing EPP, VRA delivered fourteen mobile toilets to Mepe and ten to Adidome in North Tongu. It also restored water supply to the Aveyime community to enhance relief efforts. However, these initial emergency relief efforts needed to be more substantial. For instance, in one widely reported story, about fifty-three displaced persons were given a 5-kilo bag of rice, a cup of gari, a gallon of maise, beans and oil for an unspecified period. As late as 13 November, for instance, the South Tongu District Chief Executive (DCE) lamented the lack of funds to purchase fuel to transport relief items for victims in the area after expending an initial amount of GH₵10,000 provided by the VRA.

Given these realities, and mainly because of the sustained campaign by some Members of Parliament for the affected communities, several media houses—Citi FM/Citi TV, Ignite Medi Group, Multimedia Group, and the Media General Group's 3 Foundation, launched their own fundraising and mobilised aid materials to donate to affected communities. Under its Operation Rebuild, for instance, Citi FM/Citi TV cut sod on 25 October 2023 to construct resettlement centres at Tokpo (Village by the River) to be completed in a month and as a result of the media sensitisation and mobilisation efforts, the Volta Regional Chiefs, National House of Chiefs, tertiary educational institutions and student unions, the ECG, religious bodies and clergy/imams, political organisations (NDC), members of political parties and political figures, banks, performing artists, foundations, commercial businesses and construction firms,

the Judiciary and the Judicial Service of Ghana, and citizens, also stepped up to the plate to assist the relief efforts. Engineers & Planners and First Sky Group were notable examples of businesses that fully self-funded engineering, construction works and insurance support amounting to GH₵2.5 million. This list of donations and support is inexhaustive.

Selected examples of relief and philanthropic donations to communities



Source: CNR



Source: CNR



Source: VRA

In addition, the North Tongu Constituency Member of Parliament (MP) facilitated the establishment of a Teachers Rent Support Fund and support to fifty tertiary students from the MP's through a 7-member Accountability Elders Council to coordinate and supervise aid distribution. These efforts helped to plug the gaping hole in the government's slow, minimalist approach to the crisis.

Despite these efforts, the humanitarian relief activities suffered from NADMO's lack of capacity for data collection and disaggregation, hindering a quick response to the needs of the affected people and proper rapid assessment for early recovery. This challenge was alleviated by the United Nations (UN) Inter-Agency Working Group on Emergency Response's deployment of an emergency data response team and tool to assist NADMO in collating disaggregated data on the number of people displaced by the spillage of the Akosombo and Kpong Dams.

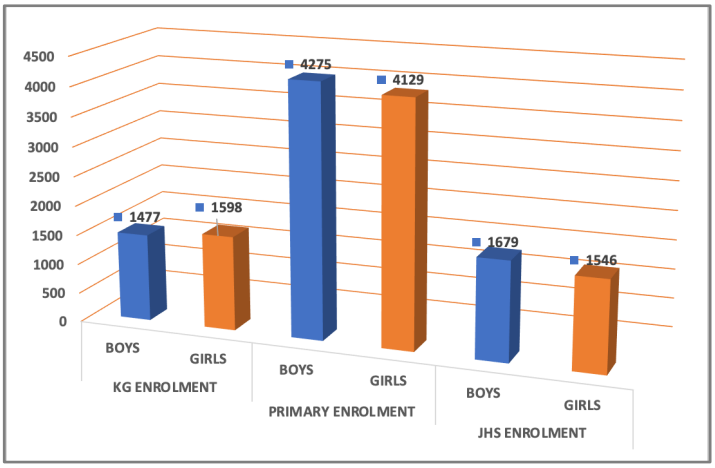
By 24 November, many victims had returned to their homes after fumigation, decontamination, and structural integrity tests by NADMO, and Engineers and Planners had pumped water from the valley communities. However, about 7,000 persons were still at the schools, delaying the reopening of schools until the victims had fully relocated to alternative places. This represented 74 per cent of the 9,160 at the safe havens (Table 1) because some 1,500 houses had been damaged. Potable water sources had also been contaminated and unsafe for consumption and contact, necessitating the provision of chlorine tablets for water treatment and education in water purification methods.

Prioritising the Needs of Children

In Fig 2, it is evident that the floods had a profound adverse impact on 14,704 school children, comprising 7,431 boys (50.1 per cent) and 7,273 girls (49.5 per cent). The floods also disrupted the lives of 15,182 individuals involved in teaching and learning, including 478 teachers.

The dire situation faced by children gained prominence through the concerns raised by Child Rights International (CRI). The organisation expressed worry about the sleeping arrangements at NADMO's designated safe havens, where men, women, young boys, and young girls shared the same space, posing the risk of child exploitation and abuse, particularly the sexual abuse of young girls. The absence of clear guidelines on engaging with children in an inadequately protected environment further exacerbated the plight of children. The overcrowded holding shelters also exposed children to physical harm, compounded by the lack of safe drinking water, sanitation facilities, and health services.

Figure 2: Affected numbers of school children



Source: GES/Emergency Operation Centre (Battor), 24 October 2023

Amid the crisis, many schoolchildren were idling around, playing truant, gambling, hawking, and riding *"Okada"* tricycles. In a country with approximately 5,400 schools under trees and dilapidated structures in mid-2023, expectations of the government providing classrooms, or even temporary shelter, for the flood-affected children were not high. Some parents were understandably hesitant to send their children to such schools.

While the Ghana National Association of Teachers (GNAT) reported over 300 teachers displaced by the spillage in the Volta and Oti regions, the CRI pointed out that its data showed that 10,896 of the displaced people (between 32 and 37 per cent of the 31,000 or 27,000) were children facing social and emotional stress from missing out on education. The absence of alternative education and clinical support arrangements, apart from the rather age-focused health screening arrangements by the Ghana Medical Association (GMA), added to their challenges. Furthermore, children with disabilities identified among the displaced people would also require special care and protection.

Flood-affected North Tongu schoo s



Source: Adom Online



Source: Pulse Ghana



Source: Ghheadlines

The CRI helped to address the situation by presenting GH¢50,000 to NADMO to help procure relief items for the affected children and an additional offer to print 10,000 notebooks and exercise books and procure school uniforms and other school supplies. However, the organisation emphasised the need for the government and allied stakeholders managing the disaster to develop systems that were more sensitive and responsive to the needs of the children, many of whom were at risk of malnutrition due to insufficient access to food and clean water. Until then, there was little support that NADMO and the District Assembly could do to relieve the situation, especially if the government did not see the need to declare a state of emergency in the area.

At the level of government, the disaster should be an opportunity to leapfrog the quality of education in the affected areas during recovery. By Implication, the Ministry of Education (MoE) should promptly engage with stakeholders to restructure the academic calendar, as urged by GNAT, to accommodate students affected by the disaster and align with, aiming for inclusive and quality education for all by 2030.

Other Critical Considerations

Critical National Infrastructure/Asset

On the one hand, it is assumed that the Ghanaian state and society are keenly aware of the imperative of defending the dam's integrity against military threats in a traditional national security context. On the other hand, however, it cannot be taken for granted that, given the dam's political and socio-economic significance for national security, the state and society are acutely aware of the utmost need to protect the dam, a critical national infrastructure/asset, from such non-traditional threats as climate change, natural and environmental disasters, seismic activity, and even cybersecurity. The latter was clear from the actions leading to the precipitate spilling from the dam.

There is a need to also look at the 2023 spillage disaster in conjunction with other risks to the dam, such as seismic-tectonic. Given that the moderate-risk seismic classification of the Akosombo dam could be critical to the dam, the precipitate spillage to save the dam could also have compounded the eastward shift of the mouth of the River Volta. In that sense, it is likely that the spillage, albeit episodic, has intensified the risk of the shoreline erosion of the barrier separating the Keta Lagoon from the sea and, in turn, the continuing coastal erosion across Togo into Benin.

The loss of the dam from a combination of poor water management, which almost materialised in 2023, and other risks will thus impose incalculable costs—physical, biological habitats, weather, and human welfare, among others—ultimately worsening Ghana and the sub-region's human security. Therefore, this dam's security must enter the national security consciousness of the Ghanaian state and society from now on. That means translating the academic provisions of the National Security Strategy into prioritised practical measures to ensure the dam's integrity.

Redeeming the VRA Resettlement Trust Fund

The VRA Resettlement Trust Fund, collaboratively established with the Ghana Government as a special fund in 1995, is precisely to address the socio-economic needs and economic empowerment of individuals and fifty-two resettlement communities affected by the construction and operation of the Authority's hydroelectric dams, particularly the Akosombo and Kpong Dams. These funds are crucial in ensuring those affected receive adequate compensation and support to rebuild their lives and livelihoods in new locations. Annually, the VRA is expected to contribute US$500,000 to the fund dedicated to poverty alleviation initiatives in the fifty-two designated townships. These initiatives cover education, socio-economic empowerment, sanitation, disease eradication, and public health.

However, the releases have been in arrears for about three or more years, almost coinciding with the allusion to its possible suspension by the government in 2021. The inadequacy and delayed disbursements of these releases raise significant concern and worry. Suppose the VRA is allegedly in arrears for such a considerable period. In that case, it implies the required payments and compensations have yet to be promptly disbursed to the affected individuals and communities. This policy option is especially problematic in the current circumstances. On the contrary, the government should reconsider the exit strategy for the annual grant entrusted to the Trust's board.

If these arrears are the reality, serious questions arise about the VRA's commitment to fulfilling its obligations and responsibilities towards those affected by its projects. This lack of timely support can severely affect the affected individuals and communities, potentially hindering their rebuilding efforts without the necessary resources. In addition to the Trust Fund, the VRA also allocates extra resources to its corporate social responsibility (CSR) programme to improve living standards by providing employability and entrepreneurial skill sets to individuals within the impacted communities. In the immediate aftermath of its man-made disaster, it is logical to expect the VRA to urgently release funds from these twin-funding resources to support programmatic alleviation projects and expedite recovery. Furthermore, the VRA should consider expanding the beneficiary communities, if necessary, to include new areas affected by the 2023 spillage.

Community Engagement

While central government engagement is pivotal for decision-making throughout the disaster preparedness and management chain, community involvement and collaboration at the regional, district, and local unit committee levels are essential for engaging communities in disaster preparedness efforts and building resilience. This entails cultivating partnerships with local organisations, businesses, and community groups, establishing community-based early warning systems, and involving community members in decision-making.

It would be inaccurate to assert a complete absence of community engagement by the VRA, NADMO, and other agencies. However, the engagement may have needed to sufficiently permeate the community fabric and reach vital stakeholders and community members. It remains uncertain whether all critical stakeholders were involved, as some MPs and other representatives claimed there was insufficient stakeholder engagement by VRA ahead of the SIMEX and the spillage. It is equally uncertain whether the VRA (and NADMO) conducted a comprehensive stakeholder mapping to identify all stakeholders accurately.

Community engagement before the flooding needed to adequately consider or map out community needs in the areas where relocation was necessary, leaving communities exposed to the weather and the disaster's aftermath. As time progressed, however, community engagement by the VRA, NADMO, and other agencies appeared to have improved, allowing the agencies to target relief efforts. This improvement may have been facilitated through continuity planning, ensuring essential services and operations continued during and after the disaster. This was crucial for minimising disruptions, identifying critical functions, establishing alternative facilities and systems, and developing strategic plans for resuming and expediting disaster management operations.

Apart from the role-play by some community members in the SIMEX in May, it was only in late October that NADMO established a Relief Administration Committee involving local authorities and communities.

Central Government Engagement

In the broader context, central government engagement represents a continuation of community engagement, albeit operating at a higher administrative echelon. In that sense, the formation of the Inter-Ministerial Committee (IMC) on the Akosombo Dam spillage should have been initiated immediately after the SIMEX and, at the latest, before the spilling commenced on 15 September 2023. Early policy engagement would have empowered the government to craft a cohesive strategic plan to bolster the country's disaster preparedness. More crucially, it would have allowed for fine-tuning strategic decisions regarding the timing of the spillage to prevent a catastrophic disaster. Unfortunately, the government's initial substantive engagement occurred belatedly on 13 October 2023, when the IMC[7] was launched, following the president's directive, to coordinate the government's response to the spillage and address downstream havoc caused by the Akosombo Dam.

This delay had cascading implications for the not-so-rigorous strategic and operational emergency response and coordination, perpetuating challenges within the disaster response and management effort. In the subsequent weeks, various ministers announced aid packages and allocations, including during visits to affected areas.

On 16 October, for instance, the President and IMC members toured flooded areas in the lower Volta basin, expressing sympathy and pledging the government's commitment to alleviating the plight of flood victims. This visit occurred amidst a crisis due to the President's prior four-day visit to the United States, including a speaking engagement at the United States Institute for Peace (USIP) in Washington on 11 October. These events reveal the government's priority for the disaster.

Even during the President's visit (and gaffing) and several days after the IMC's establishment, no coherent plan was provided for coordinating and mitigating the flood's impact on victims. It was on 30 October that the IMC announced a three-pronged strategy involving a joint rescue mission, mobilisation of relief items, and property assessment for rehabilitation. Subsequent government pronouncements needed more substantive programmatic recovery and restoration content and information. A high-level government delegation, led by the Minister of State at the Local Government Ministry and officials from various ministries and agencies, visited Mepe and other flood-affected areas on 16 October to assess the situation and provide relief to victims.

While it was expected that the Vice President would visit flood-affected areas in the President's absence, his belated visit to parts of the Volta Region—including New Bakpa in Central Tongu District and Sogakope and Sokpoe in South Tongu District—occurred on 18 October, two days after the President's visit. Accompanied by ministers and officials, the Vice President donated GH₵160,000 of his funds to the Akosombo Dam spillage victims.

A day after the Vice President's visit and pending strategic policy direction from the ministerial committee, the Agriculture Minister stated at the launch of the "Youth In Agric" initiative under the Youth Employment Agency that farmers in the Volta Region who lost their farmlands due to the Akosombo Dam spilling had been granted $40 million (about GH₵476.5 million) of the World Bank-funded Food Systems Resilience Programme to be restructured to restore farmers.

Much later, on 27 October, while visiting the affected areas within the North Tongu District, the Finance Minister, on behalf of the government, made a "generous" donation of GH₵2 million in aid to the victims of the Akosombo Dam spillage. Further, during the briefing of Parliament on 31 October, the Energy Minister emphasised the establishment of the inter-ministerial advisory committee to investigate the matter without providing comprehensive details or understanding.

During the 2024 budget presentation on 15 November, the government announced a GH₵220 million (about US$18.4 million) allocation to support the relief phase for flood-affected communities in the Oti, Savannah, and Bono-East Regions. Still, details for the other two regions were not provided. Additionally, the Finance Minister alluded to additional resources from the Ministry of Agriculture for the restoration phase, seeking World Bank funding under the International Development Association (IDA) Crisis Response Window (CRW)[8] to support resettlement, restoration, compensation, and infrastructure reconstruction in the affected communities.

Again, on 22 November, the IMC Chairperson announced the government had provided the VRA and NADMO with GH₵240 million to support their efforts in improving the social and economic conditions of all persons affected by the spillage, including the environmental and public health challenges stemming from the dam spillage.

Despite these announcements, the government's response did not match the scale of the crisis as a national emergency, contrasting with more proactive responses to recent disasters like the Apeate explosion[9] in January 2022, when the Ministry of Lands and Natural Resources launched the Apeate Endowment Fund to support people affected by the explosion and help rebuild the community. The government's minimal and ad hoc approaches reflected a lack of preparedness and empathy for victims, raising concerns about financial accountability and the potential use of promised funds for political influence during the 2024 election campaign.

Whether considered a national emergency or a state of emergency, the central government's response and level of engagement should have matched the scale of the disaster, arguably affecting close to 40,000 persons and impacting livelihoods and infrastructure in six regions. Each of the government's contributions was made without any coherent assessment framework or details of tangible provisional emergency assistance. That makes it challenging to know the build-up of the funds and the basis on which the government promised the various ad hoc assistance packages. It also affects the certainty of when the allocated funds would be released or committed. Bearing in mind the government's inability or unwillingness to account fully for the COVID-19 relief, it will not be far-fetched to assume the possibility that, a couple of years after the floods, the government could saddle the population with a relief budget that was not adequately accounted for.

On balance, it does not appear the government approached the disaster with a sense of purpose, urgency and responsiveness commensurate to the scale of the disaster. The minimalist and ad hoc approaches adopted by the government betrayed its lack of preparedness and empathy for the victims. It is tempting not to rule in other political factors surrounding the baffling central government disengagement. Why did the Vice not find it politically expedient to visit the communities affected by the dam spillage in the President's absence per Article 60(8) of the 1992 (rev. 1996) Ghana Constitution?

Was there an embargo on executive members of government visiting the disaster area until the President did so after returning from his overseas lecture engagement? The empirical evidence appeared to suggest so. Be that as it may, the central government's seemingly disengaged response, especially the Presidency's delayed visit and questions surrounding executive visits to the disaster area, underscored the need for more effective disaster management strategies and proactive governmental engagement.

Enhancing Disaster Preparedness through a Whole-of-Society Approach

The response to the Akosombo Dam spillage and flooding highlights a significant need to shift from the conventional view of disaster management solely as the responsibility of government entities and emergency services. Instead, it underscores the efficacy of adopting the Whole-of-Society Approach to disaster preparedness—a best practice grounded in inclusivity.[10]

This default approach proved particularly valuable due to the government's sluggish response, illustrating that addressing the intricate challenges posed by disasters requires the active participation of many stakeholders. These include media networks, political organisations and individual politicians, civil society organisations, traditional leaders, religious bodies and clergy, communities, businesses, academia, individuals, government institutions (including security services), and external partners outlined earlier under Relief Aid and Support. The media were exceptional in using their platforms to create awareness, mobilise public and private support and assistance, and use their resources for reconstruction projects employing local artisans.

The multi-stakeholder approach highlights the importance of integrating diverse stakeholders' knowledge, skills, resources, and capacities into disaster preparedness and response strategies that are

attuned to the needs of all individuals and communities. It stems from the understanding that each sector possesses unique expertise, perspectives, and resources that, when amalgamated, can bolster overall disaster resilience—from individual households to national systems. This approach also fosters collaboration and partnerships among stakeholders, encouraging the exchange of information, resources, and best practices between government agencies, non-governmental organisations, private sector entities, and communities. It emphasises the need for proactive measures, such as risk assessments, early warning systems, public education campaigns, and community-based initiatives, to reduce vulnerabilities and enhance preparedness.

C t Supacem resett ement centre, Tokpo Eng neers & P anners dredg ng stagnant f ood waters n Mepe



Source: CNR



Source: Myjoyonline

Aligned with the Whole-of-Society Approach to Disaster Preparedness, the Akosombo Dam disaster highlights the imperative to transition from the conventional top-down and top-heavy approach to a more inclusive and collaborative model. This will recognise that disaster management is not the exclusive responsibility of government agencies but demands active involvement from all segments of society. It will include the crucial role played by insurance in building resilience, particularly for commercial businesses, by facilitating a quicker recovery for those affected by events.

Improving Coordination for Emergency Response and Recovery

An efficient and well-coordinated emergency response system, drawing on critical resources from the military, police, fire service, ambulance services, and the nation, is crucial for saving lives, minimising damage, and mobilising emergency personnel and resources. This includes activating emergency operations centres and coordinating more comprehensive response efforts.

Despite improvements in community engagement and planning during the crisis, it became evident that the coordination of state institutions' operations during the spillage left much to be desired. The IMC was only established by 23 October, more than five weeks into the crisis, which raises concerns about the delayed setup of NADMO's disaster coordination centre at Mepe. The Emergency Management Committee in North Tongu, established in late October, aimed to address the ad hoc and uncoordinated approach to receiving and distributing aid materials.

The absence of a joint emergency response operations centre posed challenges for NADMO in conducting rapid assessments of victims, many of whom had sought refuge with relatives and friends and in the face of NADMO's capacity shortfalls, security services and civil society mobilisation significantly prevented the crisis from escalating into a national security debacle, prompting higher government intervention. Coordination challenges were evident between state and civil society agencies, potentially resulting in uneven distribution of relief efforts among affected communities. This was evident at Aveyime, which complained of not receiving sufficient or no aid by the sixth week after the flooding, and the chaotic distribution of relief materials at Mepe (St Kizito SHTS Safe Haven) on 26 October.

A critical aspect of effective coordination is monitoring and evaluation, which is essential for identifying gaps, measuring progress, and refining policy directions and operational plans for disaster management. Ongoing drills and exercises are conceptually tied to monitoring and evaluation, ensuring readiness for future contingencies, analysing response and recovery performance, and incorporating lessons learned into future planning and preparedness activities. Failure in comprehensive coordination not only disrupts the distribution of relief materials, as witnessed in Mepe, but also hampers early recovery efforts, emphasising the need for a more structured and collaborative approach to emergency response and recovery.

State of Emergency: A Political or Technical Dilemma?

Calls for a state of emergency echo the broader societal plea for enhanced national disaster management capabilities, especially in the aftermath of the Akosombo Dam spillage. Notably, the Assemblies of God Ghana was among the first entities urging the government to declare a state of emergency. This sentiment found support from the North Tongu Constituency MP and various individuals and organisations, citing the unprecedented scale and devastating consequences of the floods in the Volta, Eastern, and Greater Accra regions. Advocates argued that such a declaration would facilitate broader support, including from the diplomatic community, for alleviating the plight of flood victims.

GNAT supported the call, contending that a state of emergency would ensure public safety, maintain order, and guarantee the supply of essential goods and services to affected communities. Other voices, such as the CCCFS, urged investigations and prosecutions related to the Akosombo Dam spillage. The opposition NDC and the Minority Caucus in Parliament similarly pressed for a state of emergency to ease the suffering of flood victims.

Proponents often referenced Article 31(1) of Ghana's 1992 Constitution, which provides the legal basis for the declaration, granting the President the authority to declare a state of emergency with the advice of the Council of State. Despite these calls, the government responded cautiously, with official communicators stating there was no substantive basis for such a declaration. The government's reluctance suggests a perception that the disaster did not qualify as a national crisis despite evident lapses in preparedness, capacity for humanitarian aid, and recovery efforts.

The potential grounds for a state of emergency lie in the extensive impact across six regions and the substantial affected population of nearly 40,000 downstream of the dams. Regardless of the non-declaration, the government should have initiated a national relief fund to assist affected victims immediately. On the contrary, government commitment to a comprehensive plan to address the disaster's short-, medium-, and long-term impacts remained elusive, with the government announcing a three-phase response strategy at a press conference on 24 October: evacuation and relocation, relief item provision, and community rehabilitation, lacking specific programmatic details. The only specific action was activating a National Emergency Contact Centre (311) on all networks to respond to calls from individuals and communities affected so that the centre could dispatch appropriate teams to the concerned locations and addresses.

Amid the clamour for a state of emergency, the UN Resident Coordinator to Ghana emphasised that while Ghana faced a national emergency, a state of emergency declaration might not be warranted. The Resident Coordinator stressed the importance of vigilance, collaboration, continuous monitoring of the situation, and addressing climate change issues. This nuanced perspective called for a careful balance between political considerations and the technical requirements of effective disaster management.

The calls for a declaration of a state of emergency could have sat better with the government, which declined to respond substantively and left it to government communicators to state that there was no

substantive basis for such a declaration. The only way to explain the government's stance is that it did not believe the disaster was a national crisis despite its glaring lack of preparedness, clumsiness and incapacity for humanitarian aid and recovery.

Conclusion

The disaster caused after the spillage of the Akosombo dam on 15 September serves as a reminder of the importance of disaster preparedness, response and management, considering the dam's significance for Ghana's national interest and human security.

At the core of the disaster are persistent nagging questions about the timing of the VRA's decision to open the dam's floodgates as water filled up in reservoirs behind several dams for months. In that sense, the spillage was not a "necessary evil" but a man-made disaster that could have been avoided with diligence and attention to detail.

The disaster exposed the government's lack of preparedness and leadership slowness when it mattered the most. Several weeks after the onset of the disaster, key stakeholders lacked the capacity for constructive, well-coordinated process management that requires continuous planning, training, and collaboration to ensure adequate response and recovery in the face of the disaster.

On the other hand, the event brought to the fore the dedication of various elements of society who demonstrated considerable patriotism in contributing immensely to the relief effort. Much of the humanitarian relief was mobilised by individuals and entities, including the media, civil society, businesses and religious bodies, among others.

These factors underscore the need to mitigate the impacts of climate change, which is likely to make extreme weather events more commonplace and severe. This requires a multi-disciplinary and multi-sectoral approach involving government agencies, non-governmental organisations, businesses, individuals, and communities.

Bad as the disaster was, it provides opportunities for innovative ideas to protect the dam's structural integrity against the effects of climate change and protect communities, livelihoods, and businesses from irresponsible spillage. The way forward is to investigate the proper or improper management of the dam water management and spillage and institute immediate, short-, medium- and long-term measures to prevent and mitigate future catastrophes, including technology, to guarantee Ghana's national and human security.

Recommendations: Towards Mitigation and Resilience Assurance

The aftermath of the Akosombo Dam spillage underscores the critical need for comprehensive measures to safeguard the dam's integrity and mitigate adverse socio-economic and national security consequences. In this context, the following recommendations are proposed:

- The state and society must provide an unparalleled priority to protect the dam's integrity against non-traditional threats.
- The VRA should take immediate action to address any arrears of fund releases, ensure that the resettlement fund operates efficiently and effectively with transparency and accountability, help foster trust and confidence among the affected individuals, communities and the general public, and expand the beneficiary communities as necessary to include newly affected areas.
- Both government agencies, VRA and NADMO, should take immediate action to mitigate the impact of dam spillages and catastrophic occurrences by prioritising infrastructure enhancements and improving monitoring systems.

- Enhance NADMO's capacity and preparedness to meet and respond to the exigencies of Ghana's disaster profile,[11] social conflicts, building collapses, vehicular and aviation accidents, lake/boat accidents, marine and railway disasters, etc.
- The government should take concrete steps to enhance the capacity of the Ghana Armed Forces and other agencies to respond decisively to natural and man-made disasters and marry them with the VRA and NADMO into the disaster preparedness and management infrastructure.
- VRA should improve its monitoring systems, including through the use of smart electronic equipment, to provide real-time data on dam conditions, rainfall patterns, and water levels in the reservoir, enabling the authorities to make finely informed decisions about dam releases and flood management, ultimately reducing the risk of catastrophic events.
- The government should establish a robust and comprehensive early warning mechanism or system, including Artificial Intelligence, to address the effects of climate change and prevent the country's susceptibility to climate change or Bagre dam spillages.
- Sustain continuous community preparedness and education programmes with all agencies and institutions to ensure populations along the intake rivers and dams are adequately informed about potential risks and can respond effectively in case of emergencies. The relevant authorities and organisations must provide proper temporary tent shelters and other infrastructure for the affected communities before evacuation and relocation exercises.
- VRA, NADMO and the whole government should urgently design long-term solutions in re-engineering the Akosombo Dam to facilitate effective spillage management, deal with the aftermath of the Akosombo Dam spillage, and prevent such occurrences in future.
- The VRA and government should redesign alternative spillways to improve water channelling for irrigation, energy generation and drainage into the sea. They should examine the possibility of expanding the dam or creating adjoining reservoirs to harvest excess water, which could be used for other purposes, including agriculture.
- The government and relevant stakeholders should construct irrigation dams and fields downstream across the Accra Plains and upstream across the Afram Plains, among others, to hold water and help control the adverse effects of dam spillage by the VRA and other authorities.
- The VRA and government should strengthen climate resilience and adaptation efforts as a long-term strategy through concrete steps to mitigate the frequency and severity of extreme weather events, including heavy rains and floods, which could lead to dam spillages and other natural disasters. They should consider the theoretical possibility that the dam could be destroyed in the event of unpredictably heavy and relentless rainfall because of climate change.
- Further to the above, the government should seek the World Bank's WACA membership to enhance the country's resources and strengthen its climate resilience within a coastal West Africa framework.
- The government should implement ecosystem-based approaches as natural flood mitigation, including reforestation and wetland preservation, to help absorb excess water and reduce the risk of catastrophic flooding, contributing to long-term flood mitigation and improving the resilience of affected areas.
- The government should institute an independent probe, criminal or otherwise, as a policy approach into the circumstances, decisions and indecisions, and actions and inactions

surrounding the spillage, targeting potential criminal negligence and liability against persons with responsibilities to prevent or manage such disasters to serve as a deterrent for such criminal negligence.

- The VRA and government should explore the feasibility of permanently relocating communities in the waterways of the spilt water or effluents.
- VRA and NADMO should undertake a revised stakeholder mapping exercise and develop and publish a comprehensive ERP based on a Whole-of-Society Approach by building upon data captured from the lessons learned from the current inundation.

Endnotes

[1] It was recorded that of some 740 groups, only Kete Krachi town had a population of over 4,000 people; 600 groups had populations of less than 100. There was significant ethnic and linguistic diversity: Akwamu, Ewe, Gonja, Krachi, Krobo and Kwahu, being among the most common, as well as other immigrants from Nigeria and Togo.

[2] The third largest is Lake Nasser in Egypt and Sudan, formed due to the construction of the Aswan High Dam on the Nile River (1958–1970), with a surface area of about 5,250 square kilometres, extending approximately 550 kilometres in length.

[3] The US Embassy and the North Dakota National Guard supported the exercise.

[4] The Sphere Standards, for instance, commonly promote 7.5-15 litres per person per day for survival (drinking and food), basic hygiene practices and basic cooking needs.

[5] The WACA programme was developed in partnership with the West African people who live on the coast and depend on it for their livelihoods, nutrition, food security, and prosperity. The programme supports countries' efforts to improve the management of their shared coastal resources and reduce the natural and man-made risks affecting coastal communities. WACA boosts knowledge transfer, fosters political dialogue among countries, and mobilises public and private finance to tackle coastal erosion, flooding, pollution and climate change adaptation. The WACA Programme comprises country projects, regional integration and support activities, and a WACA Platform to scale up knowledge, dialogue and finance.

[6] Inputs on the Ghana Air Force's role in search and rescue and helicopter drops of equipment, among others, could not be obtained.

[7] The IMC was headed by the Chief of Staff at the presidency and included ministers from National Security, Interior, Defence, Energy, Finance, Local Government, Works and Housing, Roads and Highways, Environment, Sanitation, Lands and Natural Resources and Information.

[8] The Crisis Response Window (CRW) provides IDA countries with a dedicated source of additional resources to: a) respond, as a last resort, to the impact of severe natural disasters, public health emergencies, and economic crises and b) respond at an earlier juncture to slower-onset crises, namely disease outbreaks and food insecurity.

[9] The explosion killed seventeen people, injured 200 and affected 3,300 persons (1,122 males and 2,178 females), excluding those at the various health centres. It also destroyed 500 buildings and rendered about 1,500 people homeless.

[10] The Whole-of-Society Approach is a comprehensive and inclusive strategy that entails collaboration and engagement from all sectors of society in disaster risk reduction and emergency response endeavours. It acknowledges that disasters impact everyone and necessitates a collective effort to effectively mitigate their consequences, foster resilience, and ensure a swift and coordinated response, even though coordination presents challenges.

[11] The profile includes hydro-meteorological, pest and insect infestation, geological/nuclear radiological, fires and lightning, disease epidemics, man-made, covering such areas as flood, windstorm, rainstorm, Drought and tidal waves; armyworm, anthrax, blackfly, locust, larger grain borer etc.; earthquakes, tsunamis, gas emission and landslide etc.; bush/wildfires, domestic and industrial fires and lightening; cholera, yellow fever, cerebrospinal meningitis (CSM), pandemic influenza, etc.