

EARLY WARNING SYSTEM AND AFRICAN EXPERIENCES OF DISASTER MANAGEMENT

EJIMA, Man-of-God Ebiojo¹

Abstract

Early warning system and disaster management have become a point of reference in Africa as the continent is faced with several disaster occurrences. However, the critical role of early warning systems (EWS) in mitigating the impacts of natural and human induced disasters across the continent is examined. The study highlights the growing vulnerability of African nations to disasters, driven by factors such as climate change, population growth, and socio-economic challenges. It underscores why early warning system are essential for disaster risk reduction, providing timely information that allows communities to take preventive actions. Despite advancements in technology and international cooperation, significant challenges remain, including resource limitations, infrastructure gaps, and data deficiencies. This study advocates for strengthening the integration of early warning system into disaster management strategies to enhance resilience and preparedness for affected African countries. It also underscores the need for a people centred approach, ensuring that local communities are actively involved in early warning system implementation and disaster response. This study adopts a qualitative methodology and relies on secondary data. This study concludes by stressing that improving the effectiveness of early warning system and addressing existing challenges like, technical capacity to issue the warning and the public's capacity to respond effectively and mismatch of responses to disaster management as vital for protecting lives, property, and livelihoods in Africa, thereby contributing to the continent's sustainable development.

Keywords: Early Warning, Disaster, Disaster Management, Early Response

Introduction

The world at the moment has been concerned about the vast impacts that disasters have on many societies in industrialised and emerging countries. Regrettably, some societies have not improved their structures of development to the natural environment surrounding them and the losses and costs associated with disasters of natural origin. According to Munichre (2021), the economic losses of disasters increased five times due to rising vulnerability in the sub-regions of West Africa. These vulnerabilities to natural hazards are increasing because of high population growth and people living in prone areas. Virtually a million people have been killed over the last ten years by disasters triggered by storms, droughts, and floods (UNODRR Report, 2015). While some material losses seem to be inevitable, in some cases, the loss of human lives could have been avoided if the proper precautions and measures had been put in place.

¹ Ejima, Man-of-God Ebiojo is with the Department of Defence and Security Studies, Nigerian Defence Academy, Kaduna, me.ejima@nda.edu.ng

The provision of opportunities to present a new and innovative early warning project to discuss natural hazards, their risks around the world, and their impacts can be minimised through the implementation of people-centred early warning, which cannot be more than usually emphasised. Early warning is a major element of disaster risk reduction. It prevents loss of life and reduces the economic and material impact of disasters. To be effective, early warning systems need to actively involve the communities at risk, facilitate public education and awareness of risks, effectively disseminate messages and warnings, and ensure there is a constant state of preparedness (Early Warning Conference Report, 2006).

On the other hand, disaster management in Africa can be seen in the occurrence of disasters triggered by natural hazards, where a great number of people are affected, and economic losses are rising in Africa. In line with the Special Emergency Assistance Fund (SEAF) in 2004, Africa is the only continent where the region shares reported disasters in the world, and its total has increased over the past decade. Hydro-meteorological hazards (drought, flood, windstorms, particularly tropical cyclones, landslides, and wildfire) occur most pervasively and account for most of the people affected by disasters. There are numerous to mention. However, the implications of natural hazards on people, economies, and the environment cannot be completely evaded but can be substantially reduced. One of the 'best bets' is to implement early warning systems (EWS), as they nurture learning and understanding of natural hazards, provide us with warnings, and give time to allow early response so as to avoid the unnecessary consequences that accompany' disaster.

The recent report on the state of climate services (World Metrological Organisation 2020) shows that, in the 73 countries considered, one-third of people are not covered by early warnings, and just 40% have multi-hazard EWS. The world's climate is changing, and those changes also manifest themselves in a changing risk from weather-related hazards in every country. The intensity and frequency of hazards will change with climate change. This implies that, in some countries, there will be additional hazards for which EWS are required (e.g., EWS for heat waves in locations where this was previously not necessary) while others may become less significant. At the same time, socio-economic development in each country is changing the exposure to hazards and the vulnerability of their populations. Mitigating the increases in risk arising from these changes and further adaptation is crucial for the sustainable development of societies.

Concept of Early Warning, Early Response, and Concept of Disaster and Disaster Management

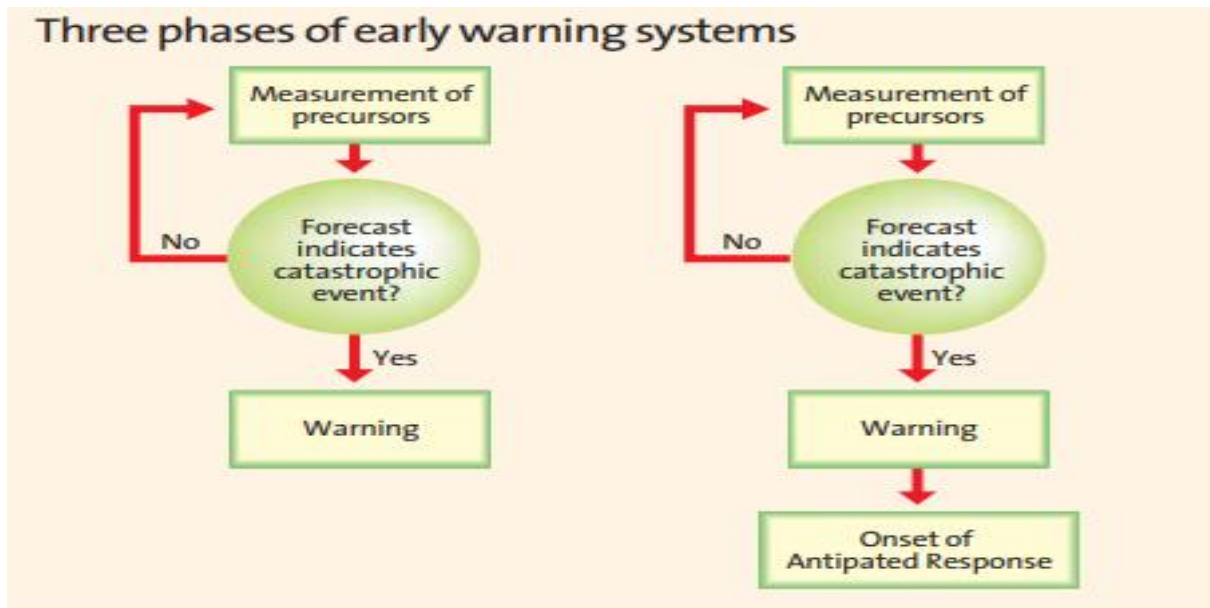
Early warning can be conceptually defined as a proactive system or process designed to detect and provide advance notice of potential threats, risks, or critical events, thereby enabling timely and informed decision-making and response measures to mitigate or prevent adverse consequences. It involves the collection, analysis, and dissemination of relevant information or indicators to forecast, identify, or monitor potential hazards or developments and is typically applied in various fields such as disaster management, public health, finance, and national security (John et al., 2018). It can also be described as a proactive system or process designed to detect and anticipate potential threats, hazards, or adverse events in advance, with the goal of providing timely information and alerts to decision-makers, stakeholders, or the general

public. These approach objectives are to enable preparedness, response, and mitigation efforts to minimize the impact of such events.

A commonly cited definition of early warning comes from the United Nations International Strategy for Disaster Reduction (UNISDR), which states: Early warning is the provision of timely and effective information, through identified institutions, that allows individuals exposed to a hazard to take action to avoid or reduce their risk and prepare for effective response. From the above definition, it can be suggested that the definition has three key components which make up the entire concept. **Timely Information:** Early warning systems must provide information in a timely manner, ideally well in advance of a potential hazard or threat, allowing individuals and communities to take appropriate actions. **Identification of Hazard:** Early warning systems are designed to identify and assess various hazards, such as natural disasters (e.g., flood, drought, earthquakes), health crises (e.g., outbreaks, pandemics), or human-made threats (e.g., political violence, banditry, terrorism), and provide relevant information towards reduction. **Preparedness and Risk Reduction:** The ultimate aim of carrying out early warning studies is to empower people and organizations to make informed decisions and take actions that should reduce the risk and improve preparedness for the looming threat.

It should be noted that early warning is not limited to natural disasters or emergencies alone as it can also be applied to various spheres, including public health, cybersecurity, financial markets, and national security, where timely information and practical measures are crucial to mitigate potential harm or damage. In line with Juan and Janos of the United Nations (UN, 2005), the traditional framework of early warning systems is composed of three phases: monitoring of originators, predictions of likely events, and notification of a warning or an alert in case of an event of disastrous amounts of hazard take place. An upgraded framework being encouraged by National Emergency Agencies and Risk Management Institutions (NEARMI) includes the onset of emergency response activities once the warning has been issued. The purpose of this four-step framework is to recognize the fact that there is a need to make a fast response to the warning, where the initial responsibility relies on emergency response agencies. Effective early warning systems require strong technical foundations and good knowledge of the risks. The phases can be seen in the figure below; -

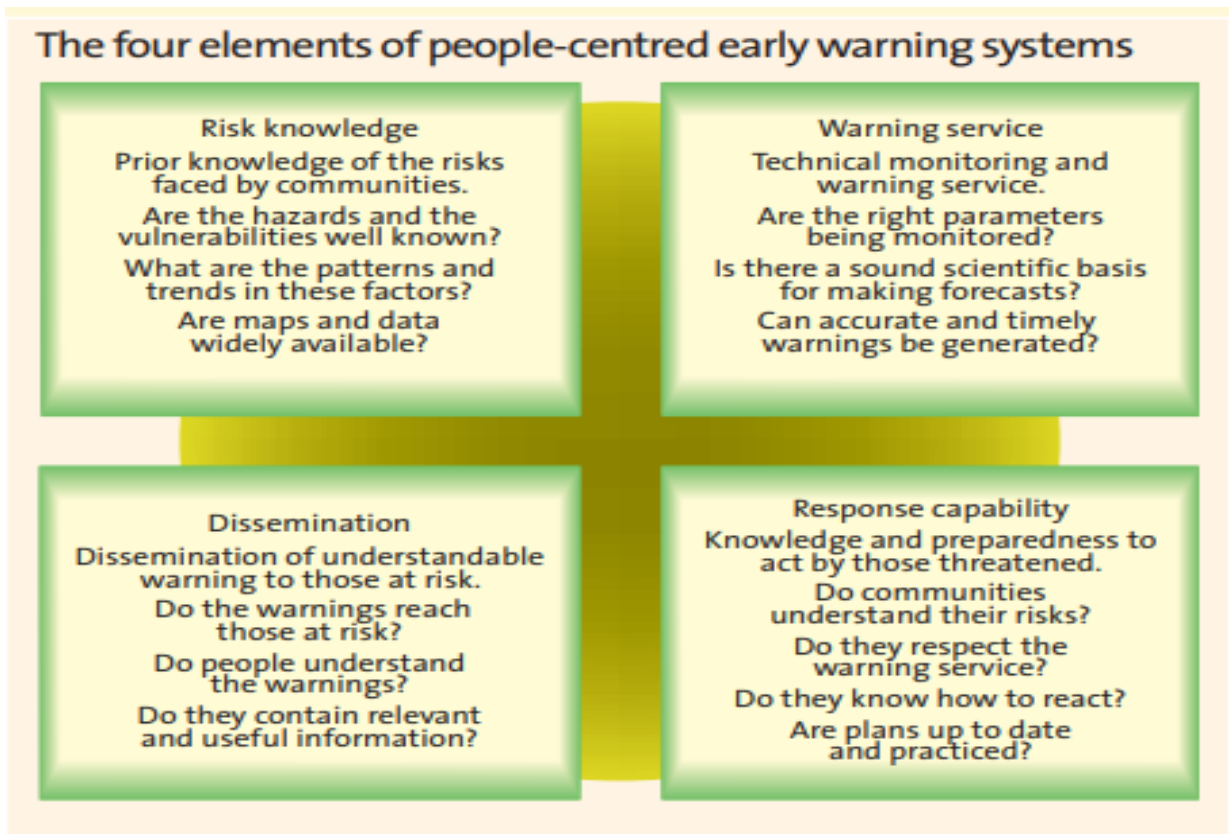
Figure 1: Three Phases of Early Warning System



Source; (UNU-EHS 2015)

The knowledge of Risks arises from both the hazards and vulnerabilities that are present. One could ask, what are the arrays and trends in these factors? Will risk assessment and mapping of prone areas solve the challenge? How can one set priorities in an early warning system? What can be the needs to guide for preparations in response to disaster prevention activities? Risk assessment could be based on historical experience and human, social, economic, and environmental vulnerabilities. While warning services are sound scientific basis for predicting potentially catastrophic events is required. Constant monitoring of possible disaster precursors is necessary to generate accurate warnings on time. Approaches that address many hazards and involve various monitoring agencies are most effective. On the other hand, in communication and dissemination, a clear, understandable warning must reach those at risk. For people to understand the warnings, they must contain clear, useful information that enables proper responses. Regional, national, and community level communication channels must be identified in advance, and one authoritative voice must be established (Stefanie & Reid,2015).

Figure 2: The Four Elements of People-Centred Early Warning System



Source: International Federation of Red Cross (2020)

Amidst all this, there are shortcomings and backdrops facing the early warning system. The UN Secretary-General in 2004 United Nations International Strategy for Disaster Reduction Report, on the implementation of the Millennium Declaration towards development, security and human rights for all. And to coordinate a survey of the world's early warning capacities and gaps. This survey primarily highlighted the following as the challenges facing EWS (UNISDR 2015).

- i. Different disaster requires different approaches to early warning systems this is because the needs for the warning of flooding, for example, are very different. From various experiences around the world, it is believed that some disasters are very difficult to predict. For instance, forecasting catastrophic eruptions or tsunamis in any part of the world is still facing major difficulties because of inadequate measuring techniques to predict the true magnitude and timing of potentially catastrophic events. Nevertheless, efforts are underway to advance such knowledge and improve the precision of such forecasts.
- ii. Currently, there are a number of systems capable of issuing warnings for a number of natural hazards at a place. However, there is a weak linkage between the technical capacity to issue this warning and the public's capacity to respond effectively to the aforementioned warning, i.e., the capacity of the warning to trigger the appropriate response by emergency management agencies, community-based organisations, and the public at large. Moreover, the understanding by the public and community

organisations of their risk and vulnerabilities is often lacking. Therefore, preparedness programs, as well as land use and urban planning, public education, and awareness programs, are needed.

- iii. Many developing countries, in particular the least developed among them, have limited capacities for effective early warning systems, and in some cases they are virtually non-existent. Key requirements appear to be the development of national integrated risk reduction and risk management capabilities, and improved technical equipment and training.
- iv. Different hazards are handled widely differently. Weather-related hazards are generally well covered worldwide through the national meteorological and hydrological services of the WMO system, and forecast accuracy has improved greatly over recent decades. These capacities still need to be extended to other hazards and complemented by other risk reduction measures that are sorely missing, as was well illustrated by the Indian Ocean tsunami tragedy.
- v. By considering hazards and vulnerabilities together with a view to reducing risk, it should be possible to increase the effectiveness within institutions, the efficiency of outgoing actions, and public preparedness for early warning systems to be effective.

Early Response

Early response refers to the prompt and well-coordinated actions taken by relevant authorities, organisations, and individuals in anticipation of, or immediately after, the occurrence of an adverse event or crisis identified through early warning systems. It is a proactive and strategic approach to mitigate the impact of such events and to provide aid, relief, and support to affected populations. Early response aims to reduce vulnerability and enhance resilience by mobilising resources and implementing predefined plans and strategies in a timely manner.

Early response, in the context of disaster management and risk reduction, refers to the prompt and organised actions taken to address the immediate needs and mitigate the impacts of a disaster or emergency event shortly after it occurs. It involves the deployment of resources, personnel, and measures aimed at saving lives, reducing suffering, and stabilising the affected area. Early response is a critical component of disaster management and is often initiated based on information and warnings provided by early warning systems (Harsh & Gupta et al., 2011)

It is essential to know the response capacity of communities to understand their risks; they must respect the warning service and should know how to react. Building up a prepared community requires the participation of formal and informal education sectors, addressing the broader concept of risk and vulnerability (Twigg, 2015).

In the search for prompt response to disaster management, the International Peace Institute (IPI), in August 2012, submitted that there are some basic challenges facing the early response system. A major challenge is moving from early warning to a response that concretely prevents disaster, that is, making a situation on the ground inspire action is particularly difficult in the context of limited financial, human, and material resources. In other to Incapacitate this challenge, it requires, at least, the identification of the authors of the response. Some scholars found it useful to draw a line between early-warning and early-response actors, unlike at the

local level, where both early warning and response can be initiated by national and community-based initiatives. For instance, it is the political organs of the RECs, the AU, or the UN that have the responsibility to respond to disasters at the regional and international levels. It is also important to identify the mechanism that is most adequate for addressing a particular disaster. The response can come from the UN Risk Reduction Council at the global level or from the AU Risk Reduction Council at the regional level. Not every disaster will require a response by the Risk Reduction Council. At national or local levels, the response to a disaster can be initiated by national and community-based mechanisms.

Another concern raised by the International Peace Institute was the appropriateness of the response. The institute found it critical to ensure that the right type of response is provided to a specific disaster. Referring to the drought and flooding that recently took place in some parts of West Africa. The need to respond to disaster in a timely manner using concrete examples. Considering the recent drought and flooding in Northern Sahara and Nigeria, respectively, it was emphasized that it is always difficult to predict some natural disasters (IPI, 2012).

Nonetheless, better responses to disasters are conditioned by the availability of adequate resources. It is important to consider the gaps between organizations at regional, continental, and global levels and the stressed need for coordination and mutual support among disaster-prevention actors.

Disaster and Disaster Management

Ogban-Iyam (2004) conceptualises disaster as a life or system threatening occurrence that happens unexpectedly and requires emergency intervention in order to remedy the impact. This exposit that disaster has three basic attributes, namely, a dire situation, happens unexpectedly or by chance, and requires prompt or emergency response. These three attributes translate to the three elements of disaster, i.e., danger, surprise, and urgency. Obvious examples from this definition are death, displacement, disease, loss of trade, damage to physical and service infrastructure, institutional weakness, and a general disruption of economic and social activity. Disasters caused by natural menaces are killing more people over time and costing more. This is the trend revealed by data collected by the Centre for Research on the Epidemiology of Disaster (CRED) in Africa (EM-DAT, 2015) and by the world wide re-insurance industry. The world's poorer nations are excessively affected (IFRC, 2020), and the most vulnerable and marginalised people in these nations bear the brunt.

The data mentioned above refer to losses stemming from natural disasters of all types; however, there is increasing concern about the impacts of disasters related to climate change. Climate change brings with it long-term shifts in mean weather conditions and the possibility of increasing frequency and severity of extreme weather events. Most disasters, or more correctly, hazards that lead to disasters, cannot be prevented. But their effects can be mitigated. What is clear is that disasters are conditioned by human activities. Hazards may be natural in origin, but it is the way in which societies have developed that causes them to become disasters (Wisner & Adams et al., 2014). The intensity of disaster often represents the connection between human and natural disasters, conditions of poverty, poor housing, lack of information about disaster risk, poor telecommunications, and inadequate physical infrastructures,

including bridges or roads, frequently exacerbate natural disasters such as floods, earthquakes, hurricanes, and volcanic eruption (Olorunfemi & Raheem et al., 2015).

On the other hand, Disaster management is a multidisciplinary approach to mitigate, prepare for, respond to, and recover from natural or man-made disasters, emergencies, and crises. It encompasses a wide range of strategies, policies, and actions aimed at minimising the adverse effects of disasters on individuals, communities, infrastructure, and the environment (Charles & Christopher et al., 2008). Disaster management is a critical and evolving field that draws on knowledge and expertise from various disciplines, including emergency management, public health, engineering, environmental science, and social sciences. Disasters, whether they are earthquakes, hurricanes, floods, pandemics, industrial accidents, or any other unexpected events, can have devastating consequences. The key machineries of disaster management include risk assessment, mitigation, preparedness, response, and recovery.

Disaster management is a proactive and cyclical process that begins with identifying and assessing potential hazards and vulnerabilities within a community or region. This risk assessment forms the foundation for risk reduction and mitigation efforts, which aim to minimize the likelihood and severity of disasters. Preparedness activities involve planning, training, and capacity building to ensure that communities and response agencies are ready to respond effectively when a disaster occurs. The response phase focuses on immediate actions to save lives, protect property, and provide emergency assistance, while the recovery phase aims to restore normalcy and rebuild affected communities (Pamela and Pelling et al., 2014). As an African imperative, Disaster management is not limited to a single African country or region; it is a continental imperative, the interconnectedness of our world means that disasters in one part of the region can have far-reaching consequences. International cooperation and agreements, such as the Sendai Framework for Disaster Risk Reduction, underscore the need for a unified approach to disaster management. This framework sets priorities for reducing disaster risk and strengthening resilience at the national and local levels, aligning with the broader context of sustainable development (UNDRR, 2015). Despite advances in disaster management, challenges persist. Climate change, population growth, and urbanization are altering the disaster risk landscape. Moreover, the COVID-19 pandemic emphasized the need for adaptive and agile disaster management strategies. As such, the concept is in a constant state of evolution, seeking innovative approaches, technologies, and policies to address emerging threats and vulnerabilities.

African Experiences of Disaster

Africa is a continent of diverse landscapes, cultures, and challenges, and it has a long history of confronting a wide range of disasters, including natural, human-induced, and health-related crises. These experiences have shaped the resilience and adaptation strategies of African communities. For instance, climate change can be described as both a complex and protracted threat and, as such, does not sit comfortably in either of the current response regimes outlined earlier. It is a natural phenomenon but one that is caused by anthropogenic emissions of greenhouse gases. Climate change is multifaceted (from drought to flood) and multidimensional (from local to global) threat that has short, medium, and long-term aspects and unknown outcomes (O'Brien & Joanne et al., 2016). The little knowledge of climate

change is basically in its intensifying threats that affect human livelihoods, settlements, and infrastructure. It is also weakening the resilience of livelihood systems in the face of increasing uncertainty and frequent disasters (Masika, 2022).

Africa is prone to a variety of natural disasters, including droughts, floods, cyclones, earthquakes, and epidemics. The 1984-1985 Ethiopian famine, resulting from a severe drought, serves as a poignant example of a natural disaster's impact. This crisis led to widespread food shortages, malnutrition, and a significant loss of life (UNDP, 1987). In contrast, the 2019 Cyclone Idai, affecting Mozambique, Zimbabwe, and Malawi, highlighted the devastation that extreme weather events can cause, resulting in extensive flooding and displacement (OCHA, 2019). The human-induced disasters, including conflicts, displacement, and violence, have ravaged African nations. Ongoing conflict in South Sudan has resulted in displacement, food insecurity, and widespread suffering, affecting millions of people (UNHCR, 2022)

Health-related disasters, such as epidemics, have also taken a toll on African countries. The 2014-2016 West African Ebola outbreak is a sobering case. This crisis, which impacted Guinea, Sierra Leone, and Liberia, emphasised the importance of a coordinated international response and early warning system to health emergencies. Thousands lost their lives, and the outbreak strained healthcare systems and resources (WHO, 2016). Socioeconomic vulnerability, often linked to poverty, exacerbates the impact of disasters in Africa. The Horn of Africa, prone to recurrent droughts, exemplifies the challenges faced by communities struggling to cope with natural disasters. One of the most significant droughts in recent history affected the Horn of Africa in 2011. This drought caused widespread famine, particularly in Somalia, where an estimated 260,000 people died (Maxwell & Fitzpatrick, 2012). The drought led to severe food insecurity in Ethiopia, Kenya, and Djibouti as well. The international community responded with emergency food aid, but the delayed response highlighted weaknesses in early warning systems and preparedness. Disaster management efforts included the establishment of regional bodies such as the Intergovernmental Authority on Development (IGAD), which initiated a Drought Disaster Resilience and Sustainability Initiative to build long-term resilience in affected areas. Despite these efforts, the region still suffers from poor infrastructure, limited resources, and insufficient coordination among agencies (OCHA, 2012), not only in Somalia, Ethiopia, Kenya, and Djibouti. Mozambique and some parts of West Africa, like; Nigeria, Niger, Benin, and Sierra Leone, experienced one of the worst floods in its history in the year 2022. In Mozambique, it was a result of the Limpopo and Save rivers overflowing due to heavy rains and tropical storms. Over 700 people died, and approximately half a million were displaced in Nigeria, Niger, and Benin were as a result of the release of dams (Christie & Hanlon, 2023). The various governments, overwhelmed by the scale of the disasters, had to rely on international assistance from the UN and non-governmental organizations (NGOs). The flood exposed the various country's vulnerability due to inadequate infrastructure, such as poor drainage systems and weak flood defences. However, in collaboration with international agencies, they improved their disaster risk reduction (DRR) strategies by establishing early warning systems, conducting public awareness campaigns, and improving urban planning (Massingue, 2023). These measures have helped reduce the impact of future floods, though challenges remain in maintaining coordination and sustaining funding for disaster preparedness.

The Ebola Virus Disease (EVD) outbreak in West Africa (2014-2016), primarily affecting Nigeria, Niger, Guinea, Liberia, and Sierra Leone, was a devastating health disaster. The outbreak caused over 15,000 deaths and overwhelmed the healthcare systems of the affected countries (World Health Organization, 2016). One of the key issues was the slow international response, with local health authorities and communities being unprepared for the scale and severity of the outbreak. But a lesson learned from the Ebola crisis was the need for stronger health systems, improved surveillance, and better communication among government agencies and international bodies. Efforts like the African Centres for Disease Control and Prevention (Africa CDC) were established to improve continental coordination and health emergency preparedness (Moon et al., 2015). Since then, Africa CDC has played a critical role in improving response mechanisms to health emergencies like the COVID-19 pandemic.

Not excluding Southern Africa, Cyclone Idai, which struck Mozambique, Zimbabwe, and Malawi in 2019, was one of the deadliest tropical cyclones recorded. Over 1,000 people were killed, and millions were affected by flooding and landslides (ReliefWeb, 2019). The storm caused extensive damage to infrastructure, including roads, bridges, and healthcare facilities. Disaster response was hampered by poor preparedness and the lack of coordinated response strategies. Post-cyclone assessments revealed the importance of integrated climate adaptation strategies to prevent future disasters. In Mozambique, for example, community-based adaptation programs have been initiated to build local capacities for disaster risk management (Posthumus et al., 2020). Regardless of these initiatives, there is still a gap in funding, technical expertise, and access to real-time data that hinders effective disaster management.

Furthermore, the ongoing civil conflict in South Sudan has led to one of Africa's worst humanitarian disasters, with widespread famine and displacement of people. Millions of South Sudanese have faced food insecurity, with parts of the country declared as famine zones in 2017 (Integrated Food Security Phase Classification, 2017). The conflict has disrupted food production, destroyed livelihoods, and hampered the delivery of humanitarian aid. International agencies, including the World Food Programme (WFP) and various NGOs, have coordinated efforts to provide emergency food and medical assistance. However, the lack of political stability, ongoing violence, and limited infrastructure continue to challenge disaster management efforts in South Sudan (Bashir & Mohamed, 2023).

African communities have displayed remarkable resilience and adaptive capacity in response to disasters. Local initiatives, community-based disaster risk reduction, and traditional knowledge have played essential roles in managing and mitigating the impact of disasters yet there exist challenges and opportunities in the African experience of disaster. Some of these challenges that persist, according to Young (2021), include a lack of infrastructure. Many African countries suffer from inadequate infrastructure, making it difficult to respond quickly to disasters. Limited resources, both financial and human resources, are often not enough to cope with large-scale disasters. In some regions, especially those affected by conflict, governance structures are bad and weak, which complicates the coordination of disaster responses. Poor early warning systems are also a challenging case as early warning systems are either non-existent or underdeveloped, leading to delayed responses.

Nonetheless, there are positive prospects for improving disaster management in Africa. Young (2021) posited that regional cooperation such as IGAD, the Southern African Development Community (SADC), and the Economic Community of West African States (ECOWAS) have been instrumental in promoting regional disaster management frameworks. Also, investment in technology, such as the use of mobile technology and satellite imagery, can enhance early warning systems and improve coordination during disasters. Community-based approaches like engaging local communities in disaster preparedness and resilience-building efforts can also lead to more sustainable disaster management.

Early Warning Mechanism and Disaster Management in Africa: Strengthening Resilience and Preparedness

Africa is a continent marked by its exposure to a wide range of disasters, including natural disasters, health crises, and conflict displacement. Early warning mechanisms, when integrated into comprehensive disaster management strategies, play a pivotal role in enhancing the resilience of African nations. In exploring the early warning mechanism and coping mechanism in Africa, the following plays a crucial role in disaster management in Africa.

Early warning systems (EWS) in Africa encompass a variety of tools, technologies, and processes aimed at detecting and forecasting potential threats. These mechanisms provide critical information to authorities, communities, and individuals, enabling them to take timely and informed actions in the face of impending disasters (African Union, 2022). Natural Threats and Climate-Related Risks, Africa faces a myriad of natural threats, including droughts, floods, cyclones, and desertification. These threats are often exacerbated by climate change. For instance, the African Risk Capacity (ARC) provides climate risk insurance to African countries, using early warning and climate information to trigger payouts that assist in disaster response and recovery (ARC, 2021). Man-made disasters, including conflicts and violence, have also threatened the stability and well-being of African nations. Early warning mechanisms, like conflict analysis and monitoring, have been employed to predict and respond to potential conflicts and crises, as seen in initiatives by organizations like the United Nations and the African Union (UN, 2021).

Resilience and Preparedness: Early warning systems contribute to disaster resilience by enabling proactive measures. They facilitate early evacuation, resource allocation, and communication with affected communities. For instance, the use of mobile phone-based early warning systems in flood-prone areas, like the Nile Basin region, has improved disaster preparedness and response (Nile IWRM, 2017). Despite the progress made in early warning systems, challenges persist in Africa. These challenges include limited resources, infrastructure gaps, and data deficiencies. Nonetheless, opportunities for improvement exist, driven by advancements in technology, increased international cooperation, and the recognition of the importance of early warning mechanisms in sustainable development (WMO, 2022)

Conclusion

Early warning systems are indispensable in the context of disaster management in Africa as they contribute ominously to reducing the loss of life, property, and livelihoods. By improving the effectiveness and reach of these systems and addressing existing challenges, African

nations can enhance their resilience and preparedness in the face of a wide range of threats. Early warning coping mechanisms and disaster management in Africa are intertwined, playing a pivotal role in protecting communities from the devastating impacts of disasters, whether natural, health-related, or conflict-induced.

REFERENCES

- Africa Centres for Disease Control and Prevention (Africa CDC). (2021). Retrieved from <https://africacdc.org/> accessed 08th November, 2023
- African Risk Capacity (ARC). (2021). Retrieved from <https://www.africanriskcapacity.org/> accessed 08th November, 2023
- African Union. (2022). Early Warning and Response Mechanism. Retrieved from <https://africa-union.org> accessed 08th November, 2023
- Bashir, A., & Mohamed, A. (2023). Famine in South Sudan: The Impact of Conflict and Climate Change. *African Studies Review*, 62(2), 127–145.
- Charles A. Cutter, Christopher T. Emrich, and Jerry T. Mitchell (2008). "Disaster Risk Management: Systems Analysis and Modelling to Enhance Understanding and Usefulness of Early Warning." Published in *Natural Hazards Review*, Volume 9, Issue 3, 2008 DOI: 10.1061/(ASCE)1527-6988(2008)9:3(137)
- Christie, F., & Hanlon, J. (2023). *Mozambique and the Great Flood of 2023*. Indiana University Press.
- Early Warning Conference III (2006), Third International Conference on Early Warning, 27 – 29 March 2006, Bonn, Germany. Retrieved from www.unisdr-earlywarning.org accessed 2nd November, 2023
- EM-DAT (Emergencies Disasters Data Base) (2015). 'EM-DAT: The International Disaster Database.' Centre for Research on the Epidemiology of Disasters (CRED), Ecole de Santé Publique, Université Catholique de Louvain, Brussels. Retrieved from <http://www.em-dat.net/index.htm>. Accessed on 08th November 2023
- Geoff O'Brien, Phil O'Keefe, Joanne Rose & Ben Wisner (2016). Climate change and disaster management. *Journal of Disaster Prevention and Management*. Vol. 14(3). pp. 353–361
- Harsh K. Gupta, Bhattacharya, & H. M. Golwala. (2011). "Early Warning and Early Response: A Systematic Approach to Increasing Effectiveness of Disaster Management" Published in: <https://www.jstor.org/stable/24100718>, Vol. 101, No. 3, 2011
- Integrated Food Security Phase Classification (IPC). (2017). *IPC Famine Review in South Sudan*.
- International Federation of Red Cross (2020) *World Disasters Report 2020*. IFRC, Geneva. Retrieved from <http://www.ifrc.org/publicat/wdr2020/> accessed 08th November, 2023
- International Peace Institute (IPI) in August 2012. *Preventing Disaster in Africa: The Role of Early Warning and Response Systems*. Retrieved from <http://www.ipinst.org> accessed 07th November, 2023

- John S. Brownstein, Clark C. Frefield, & Lawrence C. Madoff (2018). "Early Warning for Infectious Disease Outbreaks: Current Progress and Future Directions" Published in "Nature Reviews Microbiology" DOI: 10.1038/nrmicro.2017.95
- Juan Carlos Villagran de León and Janos Bogardi, (2005). United Nations University – Institute for Environment and Human Security (UNU-EHS) Bonn, Germany
- Masika, R. (ed.) (2022) Gender, Development and Climate Change. Oxfam, Oxford.
- Maxwell, D., & Fitzpatrick, M. (2012). The 2011 Somalia famine: Context, causes, and complications. *Global Food Security*, 1(1), 5–12.
- Moon, S., Sridhar, D., Pate, M. A., Jha, A. K., Clinton, C., Delaunay, S. & Piot, P. (2015). Will Ebola change the game? Ten essential reforms before the next pandemic: The report of the Harvard-LSHTM Independent Panel on the Global Response to Ebola. *The Lancet*, 386(10009), 2204-2221.
- Munichre (2021), Natcatservice; Geo Risks Research to UN Economic and Social Council (ECOSOC), July 14th, 2021, retrieved from <http://www.unisdr.org/eng/media-room/pointview/WJC-ECOSOC-.pdf>. Accessed 2nd November 2023
- Nile Integrated Water Resources Management (Nile IWRM). (2017). Nile Basin Initiative: Transforming the Water Sector in the Nile Basin. Retrieved from <https://nileis.nilebasin.org/transforming-the-water-sector/> accessed 08th November, 2023
- OCHA. (2012). Drought Response in the Horn of Africa: Lessons Learned. United Nations Office for the Coordination of Humanitarian Affairs.
- OCHA. (2019). Cyclone Idai: OCHA Flash Update. Retrieved from <https://www.unocha.org> accessed 08th November, 2023
- Ogban-Iyam, (2004). *International Journal of Development and Economic Sustainability*. Retrieved from <https://www.ndu.edu.ng/wp-content/uploads/PDF> file accessed 08th November, 2023
- Olorunfemi, F.B, and Raheem U. Adebimpe, (2015). "Sustainable Disaster Risk Reduction in Nigeria: Lessons for Developing Countries," ISSN 19520-1-10-20080418
- Pamela M. Knox, Antonio Rocha, & Mark Pelling (2014). "Early Warning Systems: State-of-the-Art Review and Future Directions". Published in: *Natural Hazards Review*, Volume 15, Issue 3, 2014 DOI: 10.1061/(ASCE)NH.1527-6996.0000140
- Posthumus, H., Nesbitt, H., & Carr, E. R. (2020). Enhancing climate resilience through integrated adaptation: A case study from Mozambique. *Climate and Development*, 12(3), 214-226.
- ReliefWeb. (2019). Cyclone Idai: Emergency Response in Southern Africa Report. Retrieved from <http://www.ReliefWeb.com//2019>. Assessed 24 Sep. 2024
- Stefanie Dannenmann and Reid Basher (2015) Platform for the Promotion of Early Warning (UN/ISDR) Bonn, Germany
- Twigg J (2015). Disaster risk reduction. Good practice review 9. Humanitarian Policy Group, Overseas Development Institute, London

- UNDP. (1987). Environmental Management and Sustainable Development: An Overview of Environmental Issues and Opportunities in Sub-Saharan Africa. United Nations Development Programme.
- UNHCR. (2022). South Sudan Emergency. Retrieved from <https://www.unhcr.org> accessed 08th November, 2023
- United Nations (UN). (2021). United Nations – African Union Cooperation: Peace and Security. Retrieved from <https://www.un.org/en/sections/peace-and-security/africa/> accessed 08th November, 2023
- United Nations International Strategy for Disaster Reduction (UNISDR) 2015 Report. Retrieved from <http://www.unisdr.org/eng/sasakawa/2015/sk-2015-description-eng.htm>. accessed 06th November 2023
- United Nations Office for Disaster Risk Reduction (UNDRR). "Sendai Framework for Disaster Risk Reduction 2015-2030" Report. Retrieved from <https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030> accessed on 08th November, 2023
- WHO. (2016). Ebola Virus Disease. Retrieved from <https://www.who.int> accessed 08th November, 2023
- Wisner, B. & J. Adams (2014). Environmental Health in Emergencies and Disasters: A Practical Guide. World Health Organization, Geneva. Retrieved from http://www.who.int/water_sanitation_health/hygiene/emergencies/emergencies2014/en/ accessed 08th November, 2023
- WMO, (2020). World Metrological Organisation report; State of Climate Services. Geneva: WMO. https://library.wmo.int/doc_num. Accessed 04th November, 2023
- WMO. (2022). World Metrological Organisation Regional Specialized Meteorological Centre (RSMC) Dakar. Retrieved from <https://public.wmo.int/en> accessed 08th November, 2023
- World Health Organization (WHO). (2016). Ebola Virus Disease – West Africa.
- Young, D. (2021). Emergency and disaster relief coordinator: CARE Madagascar. CBDRR in Africa retrieved from [http://dx.doi.org/10.1108/S2040-7262\(2012\)0000010023](http://dx.doi.org/10.1108/S2040-7262(2012)0000010023) accessed 23 September 2024