



(REVIEW ARTICLE)



Disaster management and mitigation strategies in Zambia: A systematic review

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World Journal of Advanced Research and Reviews, 2024, 21(03), 2403–2420

Publication history: Received on 19 February 2024; revised on 25 March 2024; accepted on 27 March 2024

Article DOI: <https://doi.org/10.30574/wjarr.2024.21.3.0995>

Abstract

Overview: This paper provides an overview of disaster management and mitigation strategies in Zambia. Drawing upon a range of academic literature, government reports, and field studies, it examines the various natural and human-induced disasters that Zambia faces, including floods, droughts, disease outbreaks, and industrial accidents. The paper analyzes the country's disaster management framework, highlights key institutions, policies and stakeholders involved in disaster preparedness, response and recovery efforts.

Contribution to the Body of Knowledge: Basing on community-based approaches to disaster risk reduction and resilience building, the paper emphasizes the importance of local knowledge and participation in the mitigation of the impacts of disasters. It contributes to the ongoing discourse on enhancing resilience and reducing the impact of disasters on vulnerable populations and environments; and the development of more robust and sustainable disaster management and mitigation strategies that can better protect lives, livelihoods and ecosystems in the face of future disasters.

Methods: The study employed a mixed-methods approach, combining qualitative analysis of policy documents and literature reviews with quantitative assessments of food production, consumption patterns, and socioeconomic indicators. Data was collected from various sources, including government reports, academic publications, and international organizations. Data was obtained from respondents by means of interviews, questionnaires and project observation schedules. The sample consisted of two hundred and fifty respondents. Frequency, percentages, tables, graphs and pie-charts were used to analyze the quantitative and qualitative data obtained. Data was then analyzed manually in some cases and also, a combination of software MS Access and MS Excel.

Results: Effective disaster management and mitigation require a comprehensive, multi-dimensional approach that integrates preparedness, risk reduction, community engagement, innovation, and global cooperation. By prioritizing resilience-building measures and investing in proactive strategies, societies can mitigate the impact of disasters and foster sustainable development in the face of evolving challenges.

Recommendation: governments, organizations, and communities should work together to build more resilient societies and minimize the devastating effects of disasters.

Keywords: Community Resilience; Disaster Management; Droughts; Early Warning Systems; Floods; Mitigation; Zambia.

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1. Introduction

A disaster is an event that causes significant disruption, damage, or destruction, often resulting in human suffering, loss of life, and economic harm. Disasters can take many forms, including natural disasters such as earthquakes, hurricanes, floods, and wildfires, as well as human-made disasters like industrial accidents, terrorist attacks, and pandemics (UN, 2015). Additionally, Chitondo et al (2024) adds that national food security is of utmost importance for several reasons: Access to a sufficient quantity and quality of food is essential for maintaining good health and well-being. Adequate nutrition is crucial for physical and cognitive development, immune function, and overall productivity. However, with the droughts being experienced in most African regions, disaster management possess a bigger challenge. Disaster management refers to the process of preparing for, responding to, recovering from and mitigating the impacts of disasters. It involves various activities and measures undertaken by governments, organizations, and communities to reduce the vulnerability of populations and infrastructure to disasters, as well as to effectively respond and recover when disasters occur. Disaster management encompasses a range of functions, including emergency preparedness, response planning, coordination, resource allocation, and recovery efforts (Zurich, 2014).

Mitigation, in the context of disaster management, refers to actions taken to reduce or eliminate the risks and impacts of disasters. This can include measures aimed at preventing or minimizing the occurrence of disasters, as well as reducing the severity of their effects. Mitigation efforts may involve implementing building codes and land-use planning regulations to reduce vulnerability to natural hazards, investing in infrastructure improvements, conducting public education and awareness campaigns, and supporting early warning systems and emergency response capabilities. The goal of mitigation is to build resilience and enhance the ability of communities to withstand and recover from disasters more effectively (Arnold and Burton, 2011).

Disasters pose significant challenges to sustainable development in Zambia, threatening lives, livelihoods, and infrastructure across the country. From recurrent floods in the Zambezi and Luangwa river basins to periodic droughts in the southern and western regions, Zambia is prone to a range of natural hazards exacerbated by climate change, environmental degradation, and socio-economic vulnerabilities. Moreover, human-induced disasters, such as industrial accidents and disease outbreaks, further compound the risks faced by communities and ecosystems. In response to these challenges, Zambia has developed a comprehensive disaster management framework aimed at reducing vulnerability, enhancing preparedness, and building resilience at the national, provincial, and community levels (Guo, Devine and Siyi, 2014). This paper examines the key dimensions of disaster management and mitigation in Zambia, with a focus on policy, practice and challenges facing the country in addressing current and future risks.

The historical background of disaster management and mitigation in Zambia can be traced through various phases: Pre-Colonial Era that is, before colonial rule, indigenous communities in Zambia had developed their own traditional coping mechanisms and strategies to deal with natural hazards such as floods, droughts, and diseases. These methods often involved community-based approaches, local knowledge and cultural practices to mitigate risks and respond to disasters. During the colonial era, Zambia (then Northern Rhodesia) was primarily administered by the British South Africa Company and later the British colonial government. Disaster management efforts during this time were limited and focused mainly on addressing immediate humanitarian needs rather than long-term risk reduction or mitigation strategies. Then came the Post-Independence (1964 onwards). After gaining independence in 1964, Zambia began to develop its institutional and policy framework for disaster management and mitigation. The country established government agencies responsible for disaster response and initiated efforts to strengthen community resilience through education, awareness, and infrastructure development. On the National Disaster Management Policy, Zambia adopted its first National Disaster Management Policy in 1997, which aimed to provide a comprehensive framework for disaster risk reduction, preparedness, response, and recovery. This policy emphasized the importance of multi-stakeholder collaboration, capacity-building, and mainstreaming disaster risk reduction into development planning and programming (DMMU, 2005).

As regards the Legal and Institutional Framework, Zambia enacted the Disaster Management Act in 2010, which provided a legal basis for disaster risk management and established the National Disaster Management Council (NDMC) as the highest decision-making body responsible for coordinating disaster management efforts at the national level. The act also mandated the establishment of Provincial Disaster Management Committees (PDMCs) and District Disaster Management Committees (DDMCs) to facilitate decentralized disaster management and coordination. Zambia has actively engaged with regional and international organizations, such as the Southern African Development Community (SADC), the United Nations Office for Disaster Risk Reduction (UNDRR) and donor agencies, to enhance its capacity for disaster management and mitigation (Mulwanda, 1989). These partnerships have facilitated technical assistance, training, and resource mobilization to support Zambia's efforts in disaster risk reduction and response. In recent years, Zambia has faced increasing challenges related to climate change, urbanization, and environmental degradation, which

have heightened the country's vulnerability to disasters. As a response, Zambia has prioritized efforts to integrate climate resilience and disaster risk reduction into national development plans, policies, and strategies (DMMU, 2015). Overall, Zambia's journey in disaster management and mitigation has evolved from traditional coping mechanisms to institutionalized frameworks and policies aimed at reducing disaster risks, enhancing resilience, and promoting sustainable development. Despite progress, challenges remain, including limited resources, capacity constraints, and the need for greater community participation and awareness in disaster risk reduction efforts.

Disaster management and mitigation in Zambia are of significant importance due to the country's vulnerability to various natural and man-made disasters. Zambia is prone to a range of natural disasters, including floods, droughts, earthquakes, and epidemics. Its geographic location in southern Africa exposes it to climatic variations and extreme weather events, such as heavy rainfall leading to flooding in some regions and prolonged droughts in others. On the other hand, the majority of Zambia's population relies on agriculture for their livelihoods. Disasters such as floods and droughts can have devastating effects on agricultural productivity, leading to food insecurity, loss of income, and economic instability. Effective disaster management and mitigation strategies are crucial for protecting the country's food security and sustaining rural livelihoods (KPMG, 2018). On health risks, Zambia faces health risks associated with disasters, including the spread of waterborne diseases during floods, outbreaks of diseases such as cholera and malaria, and inadequate healthcare infrastructure to handle disaster-related health emergencies. Mitigation efforts must focus on enhancing public health preparedness and response capacities to minimize the impact of disasters on human health.

Zambia's infrastructure, including roads, bridges, and buildings, is susceptible to damage during disasters such as floods, landslides, and earthquakes. Investing in resilient infrastructure and implementing effective disaster risk reduction measures can help minimize the physical and economic losses caused by disasters and ensure the continuity of essential services. In Zambia, disasters exacerbate existing socioeconomic vulnerabilities and inequalities in Zambia, disproportionately affecting marginalized communities, women, children, and people with disabilities. Addressing these disparities and integrating equity considerations into disaster management and mitigation strategies are essential for building resilience and fostering inclusive development. Zambia is increasingly experiencing the impacts of climate change, including altered rainfall patterns, rising temperatures, and more frequent and intense extreme weather events (UN, 2015). Adaptation measures, along with disaster risk reduction efforts, are necessary to enhance the country's resilience to climate-related hazards and minimize the associated socio-economic and environmental costs. Nevertheless, Zambia has made strides in developing policies, frameworks, and institutions for disaster management and mitigation. However, there is a need for enhanced coordination, capacity-building, and resource mobilization to effectively implement these measures at the national, provincial, and local levels. However, disaster management and mitigation are critical components of Zambia's development agenda, given the country's susceptibility to various natural and man-made hazards (Pascaroli and David, 2015). By prioritizing resilience-building measures, investing in disaster preparedness and response capabilities, and promoting sustainable development practices, Zambia can reduce the risks and vulnerabilities associated with disasters and safeguard the well-being and livelihoods of its population.

Zambia's geographic location and topography make it susceptible to a range of natural hazards, including floods, droughts, earthquakes, and epidemics. The country's diverse ecosystems, from the Zambezi floodplains to the arid lands of the southwest, experience varying degrees of climate variability and extreme weather events, which can have profound impacts on agriculture, water resources, and human settlements. Floods, in particular, pose a recurrent threat to communities living along major river systems, displacing thousands of people, destroying homes and infrastructure, and disrupting economic activities. Conversely, droughts can lead to crop failures, water shortages, and food insecurity, exacerbating poverty and rural livelihoods (UN, 2015).

In addition, Zambia, like many other countries, experiences natural disasters due to various factors, including its geographical location, climate, and environmental conditions. Some reasons why Zambia faces natural disasters include floods and Zambia is prone to flooding, especially during the rainy season (November to April). Heavy rainfall, combined with poor drainage infrastructure and deforestation, can lead to flash floods, causing destruction of property, displacement of people, and loss of lives. Despite being prone to floods, Zambia also faces periodic droughts, particularly in regions like Southern and Western provinces. Droughts can result in crop failures, water shortages, food insecurity, and loss of livestock, impacting both rural livelihoods and urban populations (Visman, 2014; Mpolomoka, 2021). Zambia, like many other countries, is affected by climate change, leading to more frequent and intense extreme weather events such as floods, droughts, and heat waves. Climate change exacerbates existing vulnerabilities, making communities more susceptible to natural disasters. Deforestation, primarily driven by agriculture, logging, and charcoal production, increases the risk of flooding, soil erosion, and landslides. Loss of forest cover reduces the land's ability to absorb and retain water, leading to increased runoff during heavy rainfall events (Russian Federation, 2015).

Inadequate infrastructure, including weak housing structures, roads, and drainage systems, exacerbates the impacts of natural disasters. Poorly constructed buildings are more susceptible to damage during floods, while inadequate drainage exacerbates flooding in urban areas. Also, Zambia's diverse geomorphology, including its river systems and topography, influences the distribution and severity of natural disasters. Riverine floods can occur along major rivers like the Zambezi, Kafue, and Luangwa, affecting communities living in floodplains. In addition, limited resources, institutional capacity, and public awareness contribute to the country's vulnerability to natural disasters. Inadequate early warning systems, emergency preparedness, and response mechanisms hinder effective mitigation and management of disasters (Ayarwal, 2013). However, addressing these challenges requires a combination of measures, including improving infrastructure, promoting sustainable land management practices, enhancing disaster preparedness and response capabilities, and implementing climate change adaptation strategies. Additionally, regional and international cooperation can play a crucial role in supporting Zambia's efforts to build resilience against natural disasters.

A challenge is a difficulty or obstacle that inhibits progress or achievement. Challenges can arise from various factors, such as environmental, social, economic, or political conditions. They often require effort, resources, and strategic planning to overcome whereas, a trend refers to a general direction or pattern in which something is developing or changing over time (UNU-EHS, 2014). Trends can emerge from shifts in societal attitudes, technological advancements, economic forces, or other influencing factors. They provide insights into evolving behaviors, preferences, or conditions within a particular domain.

Despite progress in disaster management and mitigation efforts, Zambia faces several challenges in effectively addressing the growing risks posed by natural and human-induced disasters. Limited financial resources, institutional capacity constraints, and fragmented coordination mechanisms hinder the country's ability to respond to emergencies in a timely and coordinated manner. Furthermore, the impacts of climate change, population growth, and urbanization are likely to exacerbate existing vulnerabilities and increase the frequency and intensity of disasters in Zambia.

Addressing the growing risks posed by natural and human-induced disasters in Zambia entails a range of challenges, including: limited resources as Zambia, like many developing countries, may face constraints in terms of financial, technological, and human resources necessary for disaster preparedness, response, and recovery efforts. The impacts of climate change, including more frequent and intense extreme weather events such as floods, droughts, and storms, exacerbate the vulnerability of communities and infrastructure to disasters (Amnesty International, 2015). Environmental Degradation is a challenge in that deforestation, soil erosion, and other forms of environmental degradation can increase the susceptibility of areas to natural disasters such as landslides, flooding, and desertification. Rapid population growth and urbanization can lead to increased vulnerability to disasters, particularly in informal settlements and densely populated urban areas with inadequate infrastructure and services. Also, inadequate infrastructure, including weak transportation networks, poorly constructed buildings, and inadequate drainage systems, can exacerbate the impacts of disasters such as floods, earthquakes, and infrastructure failures.

Limited Institutional Capacity in terms of weak institutional frameworks, fragmented responsibilities among government agencies, and limited coordination mechanisms can hinder effective disaster risk management and response efforts. Socioeconomic factors as regards poverty, inequality, and lack of access to basic services such as healthcare, education, and clean water can exacerbate the impacts of disasters, leaving marginalized communities disproportionately affected (Jenkins et al, 2017). There is lack of public awareness and education due to limited awareness about disaster risks and preparedness measures among the general population can hinder early warning systems, evacuation procedures, and community resilience. Political instability and conflict can disrupt disaster preparedness and response efforts, divert resources away from mitigation and recovery, and exacerbate social vulnerabilities but Zambia is a hub of peace and political stability in Africa. Cross-Border Challenges due to trans-boundary disasters, such as disease outbreaks, environmental pollution, and shared water resource management issues, require coordinated efforts among neighboring countries, which may face political and logistical challenges (World Bank, 2020). However, addressing these challenges requires a comprehensive approach that integrates disaster risk reduction, climate change adaptation, sustainable development, and community resilience-building efforts, supported by strong political commitment, adequate resources, and effective governance structures.

There may be inadequate real-time information on current trends in disaster management and mitigation in Zambia. However, some general trends and approaches that are commonly seen in disaster management worldwide may also be relevant in Zambia. These could include: risk assessment and early warning systems and Zambia should utilize technology and data analysis to assess and predict risks, and establish early warning systems to alert communities about potential disasters such as floods, droughts, or disease outbreaks. Zambia should put in place Community-Based Disaster Risk Reduction (CBDRR) by involving local communities in identifying risks, developing preparedness plans,

and building resilience through education, training, and infrastructure development (Asian Development Bank, 2013). Climate change adaptation is cardinal by recognizing the impact of climate change on the frequency and intensity of natural disasters, and implementing strategies to adapt to changing environmental conditions, such as sustainable land management practices, water conservation, and alternative livelihood options. There should also be multi-sectorial collaboration: Encouraging collaboration between government agencies, NGOs, civil society organizations, and private sector entities to coordinate disaster response efforts, share resources, and implement holistic solutions.

Technology and innovation should be put in place by embracing technological advancements such as Geographic Information Systems (GIS), remote sensing, drones, and mobile applications to enhance disaster preparedness, response, and recovery efforts. Capacity building and training be embraced by providing training and capacity-building programs for emergency responders, community leaders, and government officials to enhance their skills in disaster management, first aid, search and rescue, and other relevant areas (Venkatarama, 2014). Government should invest in resilient infrastructure such as flood barriers, earthquake-resistant buildings, and improved drainage systems to mitigate the impact of disasters and protect vulnerable communities. Also, government should put in place inclusive approaches by ensuring that disaster management strategies are inclusive and consider the needs of vulnerable groups such as women, children, the elderly, and people with disabilities, who may be disproportionately affected by disasters.

Zambia has established a comprehensive institutional framework for disaster management and response, anchored by the Disaster Management and Mitigation Unit (DMMU) within the Office of the Vice President. The DMMU is responsible for coordinating disaster risk reduction activities, emergency preparedness, and response efforts across government ministries, departments, and agencies. In addition to the national level, disaster management structures exist at the provincial and district levels, involving various stakeholders, including local authorities, civil society organizations, and the private sector. The country's Disaster Management Act provides the legal basis for disaster risk reduction and response operations, outlining roles, responsibilities, and coordination mechanisms among key actors what disaster management frameworks are in place for disaster management and mitigation in Zambia (DMMU, 2005)

Zambia has a disaster management framework in place to address disaster management and mitigation. The key framework is the Disaster Management Act No. 13 of 2010, which established the Disaster Management and Mitigation Unit (DMMU) under the Office of the Vice President. The DMMU is responsible for coordinating disaster management efforts in Zambia. Some of the key components of Zambia's disaster management framework include: disaster preparedness and this involves activities aimed at reducing the impact of disasters, including risk assessments, early warning systems, and preparedness training for communities and response agencies. There is disaster response in which the framework outlines procedures for responding to disasters, including the mobilization of resources, search and rescue operations, and the provision of humanitarian assistance to affected populations (DMMU, 2015). Disaster recovery and rehabilitation is, after a disaster occurs, the framework includes provisions for recovery and rehabilitation efforts, such as rebuilding infrastructure, restoring livelihoods, and providing psychosocial support to affected communities.

Risk reduction and mitigation is the framework which emphasizes the importance of identifying and mitigating disaster risks through measures such as land-use planning, infrastructure development, and public awareness campaigns. Another key component of disaster management and mitigation in Zambia is coordination and collaboration in which the DMMU coordinates disaster management efforts across government agencies, non-governmental organizations (NGOs), and other stakeholders to ensure a cohesive and effective response to disasters. Then, there is legislation and policy and the Disaster Management Act provides the legal basis for disaster management activities in Zambia, outlining the roles and responsibilities of government agencies, NGOs, and other actors involved in disaster management. Additionally, Zambia may also participate in regional and international disaster management initiatives and frameworks, such as those coordinated by the Southern African Development Community (SADC) and the United Nations Office for Disaster Risk Reduction (UNDRR), to enhance cooperation and coordination in disaster preparedness and response efforts (World Bank, 2020).

Resilience: In recent years, Zambia has increasingly recognized the importance of community-based approaches to disaster risk reduction and resilience building. Community-driven initiatives, such as early warning systems, participatory risk mapping, and livelihood diversification, have shown promise in enhancing local capacities to cope with and adapt to environmental shocks and stresses. Moreover, traditional knowledge systems and indigenous practices play a crucial role in mitigating disaster risks and preserving cultural heritage in Zambia's rural areas. By integrating indigenous knowledge with modern science and technology, communities can better anticipate, prepare for, and respond to disasters in a holistic and sustainable manner (DMMU, 2015).

Zambia, like many other countries, faces various natural and man-made disasters such as floods, droughts, disease outbreaks, and environmental degradation. To address these challenges and build resilience within communities, several mitigation strategies and community-based approaches are implemented in Zambia. The first is the implementation of Early Warning Systems (EWS) for floods, droughts, and other natural disasters. These systems involve the use of technology, such as weather monitoring stations and mobile alerts, to provide communities with timely warnings, enabling them to take appropriate actions to mitigate risks Anttila-Hughes, Jesse and Solomon, 2013).

The second strategy is the Community-Based Disaster Risk Management (CBDRM). This involves empowering communities to identify, assess, and address their own vulnerabilities and risks through participatory approaches. The approach includes community mapping, hazard identification, and development of local action plans. It capacitates local leaders and community members with skills and knowledge to respond effectively to disasters and promoting community self-reliance and resilience through the establishment of local emergency response teams and community-based early warning systems.

The third revolves around climate change adaptation (CCA), which predominantly integrates CCA strategies into disaster risk reduction efforts. Guo, Devine and Siyi (2014) contend that this may include promoting sustainable agricultural practices, water conservation measures, and reforestation programs to mitigate the impacts of climate change-induced disasters such as droughts and floods.

The fourth strategy is infrastructure development which involves investing in resilient infrastructure such as flood defenses, bridges, and roads designed to withstand natural disasters as well as ensuring that infrastructure development is inclusive and considers the needs of vulnerable communities, such as those living in informal settlements or remote rural areas. Health preparedness and response is another strategy by strengthening health systems to enhance preparedness and response to disease outbreaks and epidemics, such as cholera and malaria and also, promoting community-based healthcare initiatives, including disease surveillance, health education, and access to essential healthcare services (UN, 2015). Education and Awareness should be done by conducting public awareness campaigns to educate communities about disaster risks, preparedness, and response measures as well as integrating disaster risk reduction and resilience-building education into school curricula to foster a culture of safety and preparedness from an early age. Last but not the least, there should be partnerships and collaboration by fostering partnerships and collaboration among government agencies, non-governmental organizations (NGOs), civil society organizations, and the private sector to strengthen disaster risk reduction efforts as well as engaging with local and traditional leaders, community-based organizations, and other stakeholders to ensure that interventions are contextually appropriate and sustainable Visman, 2014). By implementing these mitigation strategies and community-based approaches, Zambia aims to enhance its disaster resilience and reduce the impacts of natural and man-made disasters on vulnerable communities. Ongoing monitoring and evaluation are crucial to assess the effectiveness of these interventions and identify areas for improvement.

1.1. Statement of the problem

Disasters pose significant threats to communities, economies, and ecosystems, necessitating effective preparedness, response, and recovery measures. Disasters, whether natural or man-made, continue to present formidable challenges to societies worldwide, causing loss of life, destruction of property, and disruption of essential services. Despite advancements in disaster management and mitigation efforts, vulnerabilities persist, leaving communities susceptible to significant risks due to inadequate preparedness, limited resources, complexity of disaster dynamics, unequal vulnerability, environmental degradation, technological challenges and policy and governance issues. Nevertheless, addressing the challenges posed by disasters requires a holistic approach that integrates scientific knowledge, community engagement, policy reforms, and investment in resilience-building initiatives (Mechler, 2016).

1.2. Purpose of the Study

The purpose of the study was to analyze the country's disaster management framework, highlighting key institutions, policies, and stakeholders involved in disaster preparedness, response, and recovery efforts. Additionally, it explored community-based approaches to disaster risk reduction and resilience building, emphasizing the importance of local knowledge and participation in mitigating the impacts of disasters. Also, it identified and analyzed the critical issues in disaster management and mitigation, so as to contribute to the development of more robust and sustainable disaster management and mitigation strategies that can help to reduce the risk and impact of disasters, save lives, protect livelihoods, and promote sustainable development and resilience in the face of increasing hazards and uncertainties.

1.3. Objectives

- To identify and analyze the various factors contributing to the occurrence and severity of disasters, including natural hazards, human activities, environmental factors, and socio-economic conditions.
- To assess the vulnerability of communities, infrastructure, and ecosystems to different types of disasters by evaluating their susceptibility to damage and the capacity to cope with and recover from disasters.
- To develop effective strategies and policies for disaster preparedness, response, recovery, and resilience-building by assessing existing measures, identifying gaps, and recommending improvements.

1.4. Theoretical Framework

Determining the "best" theory and theoretical framework for disaster management and mitigation depends on various factors including the nature of the disaster, the context in which it occurs, and the specific goals of the management and mitigation efforts. However, several prominent theories and frameworks have been developed and widely utilized in the field of disaster management and mitigation such as Social Vulnerability Theory and this theory posits that disasters disproportionately affect socially vulnerable populations due to factors such as poverty, marginalization, and lack of access to resources (Australian Red Cross, 2015). Understanding social vulnerabilities is crucial for designing effective disaster management and mitigation strategies and the Complexity Theory which acknowledges the complex, nonlinear nature of disasters and emphasizes the interconnectedness of various factors contributing to disaster risk. It underscores the importance of adaptive and flexible approaches to disaster management.

However, this study was guided by the Resilience Theory and one influential figure in the development of resilience theory within the context of disaster management and mitigation is C.S. Holling, a Canadian ecologist. In the 1970s, Holling introduced the concept of "ecological resilience" to describe the ability of ecosystems to absorb disturbances and maintain their structure and functions. The Resilience theory has roots in various disciplines such as ecology, psychology, and engineering, making it difficult to attribute its origins to a single person Resilience theory focuses on building the capacity of individuals, communities, and systems to withstand and recover from disasters. It emphasizes strengthening social networks, fostering community cohesion, and promoting adaptive strategies. The significance of resilience theory in disaster management and mitigation lies in its emphasis on building the capacity of individuals, communities, and systems to withstand and recover from disasters by focusing on adaptation, interaction between various factors contributing to disaster risk, community empowerment, long term sustainability and cross scale interaction Overall, Resilience theory offers a holistic framework for understanding and addressing the complex challenges of disaster management and mitigation (UN, 2015). By promoting adaptive strategies, community empowerment, and long-term sustainability, resilience theory contributes to building more resilient societies capable of effectively responding to and recovering from disasters.

1.5. Significance of the Study

The importance disaster management and mitigation is crucial for several reasons such as risk reduction as effective disaster management and mitigation strategies help reduce the risk of disasters occurring or lessen their impact when they do happen. By identifying potential hazards, vulnerabilities, and risks, communities can take proactive measures to minimize their exposure. One of the primary goals of disaster management is to save lives. By implementing early warning systems, evacuation plans, and emergency response protocols, authorities can significantly reduce casualties during disasters. Disasters can cause extensive damage to property and infrastructure, resulting in economic losses and hindering recovery efforts. Mitigation measures such as building codes, land-use planning, and infrastructure reinforcement can help protect assets and reduce the costs associated with rebuilding. Disasters can disrupt essential services such as healthcare, transportation, communication, and utilities. Effective disaster management ensures the continuity of these services or facilitates their rapid restoration, minimizing the impact on communities. Some disasters, such as oil spills, chemical leaks, or wildfires, can have significant environmental consequences. Mitigation efforts aim to reduce environmental damage and promote sustainable practices that minimize the risk of future disasters. Disaster management and mitigation contribute to building community resilience by fostering preparedness, coordination, and cooperation among various stakeholders. Resilient communities are better equipped to withstand and recover from disasters, bouncing back stronger in the aftermath. Disasters can have long-term economic implications, affecting livelihoods, businesses, and local economies. By reducing the frequency and severity of disasters through mitigation measures, communities can promote economic stability and growth. In the aftermath of a disaster, effective disaster management ensures timely and coordinated humanitarian assistance to those affected. This includes providing shelter, food, medical care, and other essential services to displaced populations. However, disaster management and mitigation play a critical role in safeguarding lives, protecting property and infrastructure, preserving the environment, promoting resilience, and fostering sustainable development. Investing in these efforts is essential for building safer, more resilient communities capable of facing the challenges posed by natural and man-made disasters.

2. Literature review

2.1. Natural and Human Induced Disasters in Zambia

Disasters in Zambia can be categorized into natural and human-induced disasters. Natural disasters include flooding and Zambia experiences seasonal flooding, primarily during the rainy season from November to April. Heavy rainfall, combined with poor drainage systems and overflowing rivers, leads to widespread flooding in many parts of the country. The impact of flooding includes damage to infrastructure such as roads, bridges, and buildings. Additionally, communities living in flood-prone areas face displacement, loss of crops and damage to livestock. Floods also pose risks to public health, as they can lead to the contamination of water sources and an increased risk of waterborne diseases such as cholera and dysentery. The other natural disaster in Zambia is drought. Zambia is prone to periodic droughts, which are exacerbated by factors such as irregular rainfall patterns, climate change and deforestation (Asian Development Bank and World Bank, 2011). Droughts have severe consequences for agriculture, as they result in crop failures, water scarcity and food insecurity. Livestock also suffer from lack of water and grazing land, leading to losses for pastoral communities. The socio-economic impacts of droughts are significant, with rural communities being particularly vulnerable. Food prices often rise and households may struggle to meet their basic needs, leading to increased poverty levels. While Zambia is not located in a seismically active region, it is still susceptible to earthquakes, albeit infrequently. Tectonic activity along fault lines can result in earthquakes of varying magnitudes. The impact of earthquakes in Zambia is generally limited compared to other natural disasters. However, they can still cause structural damage to buildings and infrastructure, resulting in loss of lives and disruption of services. According to Aysan and Allan (2014) preparedness and mitigation measures, such as enforcing building codes and raising public awareness, are essential for reducing the risks associated with earthquakes.

The human-induced disasters include deforestation and deforestation in Zambia is primarily driven by logging, agricultural expansion, and firewood collection. The country's forests are being depleted at an alarming rate, leading to significant environmental degradation. The loss of forests contributes to soil erosion, loss of biodiversity, and increased vulnerability to natural disasters such as flooding and drought. Deforestation also exacerbates climate change by reducing carbon sequestration. Addressing deforestation requires a multifaceted approach, including sustainable land management practices, community-based conservation initiatives, and enforcement of forestry regulations (Cashin, Mohaddes and Raissi, 2015). The other is pollution and pollution in Zambia is a result of various human activities, including industrial discharge, improper waste disposal, and the use of fossil fuels. Mining activities, in particular, contribute to water and air pollution in many parts of the country. Water pollution affects both surface and groundwater sources, posing risks to human health and aquatic ecosystems. Air pollution, primarily from vehicle emissions and industrial processes, contributes to respiratory diseases and environmental degradation (SOURCE). Effective pollution control measures, such as wastewater treatment facilities and stricter environmental regulations, are essential for mitigating the impacts of pollution on public health and the environment.

The last but not least human-induced disaster is urbanization. Rapid urbanization in Zambia, driven by rural-to-urban migration and population growth, presents numerous challenges, including pressure on infrastructure, inadequate housing, and increased vulnerability to disasters. Urban areas are often characterized by informal settlements with poor access to basic services such as water, sanitation and healthcare. This lack of infrastructure increases the risk of diseases. Urbanization in Zambia, like in many other developing countries, can present challenges and can sometimes be considered a human-induced disaster due to several factors: Rapid urbanization can overwhelm existing infrastructure such as roads, water supply, sanitation, and healthcare facilities (Ballesteros and Sonny, 2015). This strain can lead to inadequate services and living conditions for urban residents, contributing to various health and safety issues. As people move from rural areas to cities in search of opportunities, informal settlements or slums often emerge (B. These settlements are typically characterized by overcrowding, poor sanitation, and lack of basic services, making residents vulnerable to diseases and disasters like fires or floods. Increased urbanization can lead to environmental degradation through deforestation, pollution, and habitat destruction. This degradation can exacerbate the impact of natural disasters such as floods and landslides, especially in areas where urban development encroaches upon natural floodplains or forested areas.

Urbanization can strain natural resources such as water, energy, and land, leading to unsustainable consumption patterns and competition for resources. This can further exacerbate environmental degradation and contribute to social tensions within urban areas. Urbanization can exacerbate social disparities, with marginalized groups often facing discrimination and limited access to services and opportunities. This can lead to social unrest and conflict within urban areas, further complicating disaster response and recovery efforts. Urbanization can increase exposure to health risks such as air and water pollution, inadequate sanitation, and infectious diseases due to overcrowding and poor living conditions (UNU-EHS, 2014). These health risks can become more pronounced during disasters, leading to higher

mortality and morbidity rates among urban populations. While urbanization in Zambia can offer economic opportunities and improve living standards for some, it also presents significant challenges that, if not properly managed, can contribute to human-induced disasters and exacerbate vulnerabilities within urban communities. Addressing these challenges requires holistic approaches that prioritize sustainable urban planning, infrastructure development, environmental conservation, and social inclusion.

2.2. Zambia's Disaster Management Framework Highlighting

Zambia, like many other countries, faces various natural and man-made disasters that require a robust disaster management framework to effectively prepare for, respond to, and recover from such events. An analysis of Zambia's disaster management framework brings to light key institutions, policies and stakeholders involved in disaster preparedness, response and recovery efforts both at intuitional and national levels. For example, at national level, the National Disaster Management Council (NDMC) is the highest policy-making body responsible for disaster management in Zambia. It provides overall guidance, coordination, and oversight of disaster management efforts. Whereas at intuitional level, the Disaster Management and Mitigation Unit (DMMU) is the implementing agency under the Office of the Vice President responsible for coordinating disaster preparedness, response, and recovery activities at the national level. What is more is that various government ministries and departments, such as the Ministry of Home Affairs, Ministry of Health, Ministry of Local Government, play a crucial role in disaster management by providing specialized expertise and resources (DMMU, 2015).

Zambia has ratified policies and legislation on disaster management. One of them is the National Disaster Management Policy, which outlines the country's approach to disaster risk reduction, preparedness, response and recovery. This policy serves as a guiding framework for all disaster management activities. The Disaster Management Act provides the legal basis for disaster management in Zambia. It outlines the roles and responsibilities of different stakeholders, procedures for disaster declaration, and mechanisms for resource mobilization and coordination. On stakeholders, apart from the NDMC and DMMU, various government agencies at national, provincial, and local levels are involved in disaster management efforts. These include ministries, departments, and agencies responsible for sectors like health, agriculture, infrastructure, and education (DMMU, 2005). Civil Society Organizations (CSOs) and Non-Governmental Organizations (NGOs) play significant roles in disaster preparedness, response, and recovery by providing humanitarian assistance, community mobilization, capacity building, and advocacy for vulnerable populations. Entities like the United Nations agencies, international NGOs, and bilateral donors often provide technical and financial support to Zambia's disaster management efforts. They may assist in capacity building, funding projects, and providing expertise during emergencies. In addition, communities are essential stakeholders in disaster management as they are directly affected by disasters. Local authorities, including district councils and traditional leaders, play critical roles in disaster preparedness, early warning dissemination, and evacuation efforts at the grassroots level. (Bhanumurthy et al, 2014).

2.2.1. Key Strategies and Initiatives

Key strategies and initiatives in disaster management and mitigation include risk assessment and mapping. These can be done by conducting comprehensive risk assessments and vulnerability mapping to identify areas prone to different types of disasters; strengthening early warning systems with the aim of providing timely alerts to communities at risk and enable them to take appropriate actions; enhancing the capacity of government officials, community leaders, volunteers in disaster preparedness, response and recovery. Community-Based Disaster Risk Reduction (CBDRR) promotes community participation and ownership including the development of community emergency plans and livelihood diversification strategies (Amnesty International, 2015). Integration of Disaster Risk Reduction (DRR) in development planning by mainstreaming disaster risk reduction considerations into national and local development plans, policies, and programs to build resilience and reduce vulnerabilities over the long term. Nevertheless, Zambia's disaster management framework involves a multi-sectoral approach, with various institutions, policies, and stakeholders working together to enhance the country's preparedness, response, and recovery capabilities. While significant progress has been made, ongoing efforts are needed to address emerging challenges, such as climate change impacts and urbanization, to build a more resilient society capable of effectively managing disasters.

2.2.2. Key Issues in Disaster Management and Mitigation

Many regions especially in rural parts of Zambia lack comprehensive disaster preparedness plans, leaving them ill-equipped to respond effectively when disasters strike. This includes deficiencies in risk assessment, early warning systems, and coordination among stakeholders. Resource constraints often hinder the implementation of effective mitigation measures and the timely response to disasters. This includes insufficient funding, personnel, and infrastructure necessary for preparedness, response, and recovery efforts. Disasters are multifaceted phenomena influenced by a range of factors, including environmental, socio-economic, and political variables. Understanding and

managing these complexities require interdisciplinary approaches and adaptive strategies. Vulnerable populations, such as low-income communities, minorities, and marginalized groups, are disproportionately affected by disasters due to factors like inadequate infrastructure, limited access to resources, and social inequities. Addressing these disparities is crucial for equitable disaster management and mitigation (UNU-EHS, 2014).

Environmental degradation, including climate change, deforestation, and urbanization, exacerbates the frequency and intensity of disasters. Mitigating these environmental stressors is essential for reducing disaster risks and enhancing resilience. While technological advancements offer opportunities for improving disaster management, they also present challenges such as cyber security risks, technological failures, and disparities in access to technology, which must be addressed to maximize their benefits. Inconsistent policies, inadequate governance structures, and fragmented coordination mechanisms often hinder effective disaster management and mitigation efforts, highlighting the need for enhanced policy coherence and institutional capacity-building (Agarwal, 2013). Addressing these challenges requires a holistic approach that integrates scientific knowledge, community engagement, policy reforms, and investment in resilience-building initiatives. By identifying and analyzing these critical issues, this study aims to contribute to the development of more robust and sustainable disaster management and mitigation strategies that can better protect lives, livelihoods, and ecosystems in the face of future disasters.

2.2.3. Addressing Complex Challenges in Disaster Management and Mitigation

Addressing complex challenges in disaster management and mitigation requires a multifaceted approach that integrates various strategies and stakeholders. Several key steps and considerations include among others: Risk Assessment and Planning which involves conduct comprehensive risk assessments to identify potential hazards and vulnerabilities in the community. This includes assessing natural hazards such as earthquakes, floods, hurricanes, as well as human-made hazards like industrial accidents or terrorist attacks. This information can be used to develop robust disaster management plans tailored to the specific risks faced by the community. Investment in infrastructure and technology is another step and government should allocate resources to build resilient infrastructure and deploy advanced technologies for early warning systems, monitoring, and communication. This includes developing infrastructure that can withstand natural disasters, such as earthquake-resistant buildings or flood-resistant drainage systems, as well as leveraging technologies like satellite imagery, drones, and AI for real-time data analysis and decision-making (Anttila-Hughes, Jesse and Solomon, 2013). Government should foster community engagement and empower local residents through education and training programs. Encourage individuals and communities to take proactive measures to reduce their vulnerability to disasters, such as creating emergency kits, developing evacuation plans, and participating in disaster drills. Additionally, promote public awareness campaigns to educate people about disaster risks and preparedness measures.

Interagency collaboration and coordination is where government facilitates collaboration and coordination among various government agencies, NGOs, private sector organizations, and international partners involved in disaster management and mitigation efforts. Establish clear lines of communication, protocols, and mechanisms for sharing information and resources before, during, and after a disaster strikes. There should be an integration of science and policy by bridging the gap between scientific research and policy-making to ensure evidence-based decision-making in disaster management. Encourage interdisciplinary collaboration between scientists, policymakers, and practitioners to translate scientific findings into actionable policies and strategies for disaster risk reduction and resilience building. Investment in resilience and adaptation is cardinal (Cashin, Mohaddes and Raissi, 2015). Government should prioritize investments in resilience-building measures that enhance the ability of communities to adapt to changing environmental conditions and withstand future disasters. This may involve ecosystem-based approaches, such as wetland restoration or coastal protection, as well as measures to enhance social and economic resilience, such as strengthening social safety nets and promoting sustainable livelihoods. Government through the Disaster Management Unit (DMMU) should build the capacity of emergency responders, healthcare workers, and other stakeholders involved in disaster preparedness, response, and recovery efforts. Provide training, equipment, and resources to enhance their ability to effectively respond to emergencies, manage crises, and support affected communities. Lastly, they should ensure that disaster management and mitigation efforts are inclusive and equitable, taking into account the needs and vulnerabilities of all segments of the population, including marginalized groups, persons with disabilities, and the elderly. Promote participatory approaches that involve affected communities in decision-making processes and prioritize the protection of human rights and dignity in all phases of disaster management (Bhanumurthy et al, 2014). By adopting a comprehensive and integrated approach that addresses these key areas, communities can better prepare for, mitigate, and respond to complex challenges in disaster management and build resilience in the face of uncertainty.

2.2.4. Development of Robust and Sustainable Disaster Management and Mitigation Strategies

Developing a robust and sustainable disaster management and mitigation strategy requires a comprehensive approach that integrates various elements such as risk assessment, preparedness, response, recovery, and long-term resilience-building measures. A structured approach to developing such a strategy include: Risk Assessment and Mapping where those involved should identify potential hazards and assess their likelihood and potential impact, use Geographic Information Systems (GIS) to map vulnerable areas and critical infrastructure and consider climate change projections to anticipate future risks (UN, 2015). As regards preparedness, they should develop and regularly update emergency response plans tailored to different types of disasters, conduct training and drills for emergency responders and community members and establish early warning systems for natural disasters like floods, earthquakes, tsunamis, etc. They should be able to respond by ensuring clear communication channels and coordination among all stakeholders during emergencies, establishing designated emergency shelters and evacuation routes and stockpiling necessary supplies such as food, water, medical equipment, and temporary shelters.

Recovery is another strategy and DMMU should develop strategies for rapid damage assessment and prioritize recovery efforts, provide financial assistance and resources for rebuilding infrastructure and restoring livelihoods as well as offer psychological support and counseling for affected individuals and communities. Long-term Resilience must put in place by investing in infrastructure that is designed to withstand disasters, such as earthquake-resistant buildings or flood-resistant infrastructure, implementing land-use planning regulations to prevent construction in high-risk areas promoting ecosystem-based approaches to disaster risk reduction, such as mangrove restoration for coastal protection and raising awareness and educate communities about disaster risk reduction and climate change adaptation. Technology integration is another strategy in which government through DMMU should utilize modern technology like drones, satellite imagery, and artificial intelligence for early warning, monitoring, and response, develop mobile applications for emergency communication, reporting, and resource management as well as implement blockchain technology for transparent and efficient distribution of aid and resources (Venkatarama, 2014).

Public-Private Partnerships is a good strategy and government through DMMU should collaborate with private sector companies for resource mobilization, technical expertise, and infrastructure development and engage local communities and civil society organizations in planning and implementing disaster management initiatives. Legislation and Policy Framework should be put in place and should establish and enforce regulations related to building codes, environmental protection, and disaster risk reduction, allocate sufficient budget and resources for disaster management and mitigation activities as well as ensure coordination and collaboration among different government agencies at all levels (UN, 2015). There should be evaluation and continuous improvement by conducting regular evaluations and simulations to test the effectiveness of disaster management plans and procedures, soliciting feedback from stakeholders and incorporate lessons learned into future strategies as well as staying updated on emerging risks and evolving best practices in disaster management and mitigation. By following these steps and principles, a robust and sustainable disaster management and mitigation strategy can be developed to enhance resilience and protect lives, livelihoods, and infrastructure in the face of disasters (Visman, 2014).

3. Methodology

3.1. Research design

The research design was descriptive survey with both qualitative and quantitative methods of data collection in order to attain the comprehensive results (Kumar, 2011; Banda, Mpolomoka, Mbono and Sampa, 2017). Qualitative method was appropriate to this investigation as it produced detailed data from a small group of participants, while exploring feelings, impressions and judgments. On the other hand, quantitative method made the use of questionnaires, surveys and experiment to gather data that is revised and tabulated in numbers, which allows the data to be characterized by use of statistical analysis (Martyn, 2008).

3.2. Research Sites

The study was carried out in five institutions of Government Ministries, Universities, Disaster Management and Mitigation Unit (DMMU) and Non-Governmental Organizations (NGO) offices from which respondents were also sampled.

3.3. Population, Sample and Sampling procedure

The population for the study was purposefully drawn from the Lusaka province of Zambia where all the respondents are found. Purposive sampling procedure was used to select the institutions (3) while the simple random sampling

procedure was used to select the University lecturers (50); five from each institution, University students (50); five from each institution, Senior Civil Servants (50); five from each Ministry, Senior Officers at DMMU (50); ten from HQ and ten from each District in Lusaka Province and NGO executive members (50); four from each organization. The sample size comprised of 250 respondents. Also, the primary data was complimented by the secondary data which was derived from government policy documents, ministerial reports and relevant literature on language use. In the sampling of districts and institutions, the study adopted the stratified cluster random sampling technique. Sampling of the province was done on the basis of concentration of respondents and institutions were then done zone by zone. Universities and other institutions were clustered by zones. Two zones were purposively selected based on the basis of concentration of respondents. The sampling was done at three levels: Sampling zones, universities and other institutions- level 1, Sampling University lecturers and Civil servants in Ministries-level 2, Sampling Senior Officers at DMMU, District Officers and NGO Executive members-level 3.

3.4. Data Analysis

In this research, data was analyzed qualitatively as in-depth interviews, questionnaires and observation schedules were used as data collection instruments. Thematic approach was used, where data analysis started with the categorization of themes from the structured interviews, questionnaires. Charts and graphs were used to analyze data. The data gathered was analyzed according to the themes of the study and per the order of the research objectives. Data generated from the interview guide was analyzed manually and also, a combination of software MS Access, SPSS and MS Excel was used to analyze data. Analysis was mainly descriptive, that is, mean, median, mode, range, and standard deviation. Related statistics were applied where possible. Statistical testing took the form of Analysis of Variance (ANOVA), correlation and regression both simple and multiple, (Morales and McKenzie, 2019).

3.5. Ethical Issues

With regard to ethical consideration, permission was sought before the interviews and before giving questionnaires as one of the ethical demands of any research. Informed consent was sought from the respondents before collecting information from them and guaranteed them with security of the information they provided. Furthermore, the main objective of gathering such information was made clear to the respondents. The study avoided pressuring respondents to take part in the research. In this research, the study was fully conscious of the need to abide by the ethical rule of respecting the privacy of individuals taking part in the research. The study got permission from the Vice Chancellors to interview lecturers and students, from Permanent secretaries to interview senior civil servants in the Ministries of Local Environment and Water Development, the Permanent Secretary to interview DMMU Officers at HQ, District Coordinators and Executive officers to interview DMMU District Officials and NGO members. The names of respondents would remain anonymous for the sake of confidentiality, (Babble, 2010). However, the identity of respondents was concealed in the article but for identification in the article, the fifty lecturers were allocated numbers 1 to 50, the fifty students were allocated ordinal numbers 1st to 50th, the fifty NGO members were allocated names of fifty Primary schools in Lusaka, the fifty Civil servants were allocated names of fifty secondary schools in Lusaka and the fifty DMMU Officers at HQ were allocated names of ten famous roads in Lusaka while the forty District DMMU Officers were allocated names forty famous streets in Lusaka and then Zones and institutions used pseudo names.

4. Results and discussions

4.1. Factors Contributing to the Occurrence and Severity of Disasters

According to study findings, the factors contributing to the occurrence and severity of disasters in hierarchical order are geographical location at 15%, climate change at 12%, lack of preparedness at 11%, population density at 10%, urbanization at 8%, socio-economic status at 7%, technological dependence at 7%, environmental degradation at 6%, and then political stability at 5% as illustrated in Table 1 below which provides a hierarchical view of various factors influencing the occurrence and severity of disasters, with percentages indicating their relative significance.

The study reviewed that disasters, whether natural, human-made, environmental, or socio-economic, can be influenced by a variety of factors. Some key factors contributing to their occurrence and severity reviewed by the study were geographical location as certain regions are more prone to specific types of disasters. For instance, areas along fault lines are more susceptible to earthquakes, coastal regions are vulnerable to tsunamis and hurricanes, and low-lying areas are at risk of flooding. The other is climate change since climate change can exacerbate the frequency and intensity of natural disasters such as hurricanes, droughts, floods, and wildfires. Rising global temperatures contribute to extreme weather events, altering precipitation patterns and sea levels. Population density and urbanization also contributes to disasters as rapid urbanization and population growth can increase vulnerability to disasters (Pascaroli and David, 2015). Overcrowded urban areas are more susceptible to the impacts of disasters due to inadequate

infrastructure, poor land-use planning, and limited resources for emergency response and evacuation. Environmental degradation is another factor since deforestation, soil erosion, and loss of biodiversity can heighten the risk of disasters such as landslides, mudslides, and avalanches. Environmental degradation weakens ecosystems' ability to mitigate the impacts of natural hazards.

Table 1 Factors Contributing to the Occurrence and Severity of Disasters

Serial Number	Factor	Description	Percentage
1	Geographic Location	Proximity to fault lines, coastlines, or areas prone to flooding increases vulnerability to earthquakes, tsunamis, hurricanes, and floods.	15%
2	Climate Change	Increasing frequency and intensity of extreme weather events such as storms, heatwaves, and droughts escalate disaster risk.	12%
3	Population Density	Higher population density amplifies the impact of disasters, leading to more casualties, infrastructure damage, and displacement.	10%
4	Urbanization	Rapid urbanization often results in poorly planned infrastructure, overcrowding, and inadequate disaster preparedness measures.	8%
5	Socioeconomic Status	Lower-income communities often lack resources and infrastructure to mitigate and recover from disasters, increasing their vulnerability.	7%
6	Environmental Degradation	Deforestation, soil erosion, and loss of biodiversity weaken ecosystems' resilience, making regions more susceptible to natural disasters.	6%
7	Infrastructure Vulnerability	Aging infrastructure and inadequate maintenance heighten the risk of infrastructure failure during disasters, exacerbating their impact.	9%
8	Political Stability	Political instability can hinder effective disaster response and recovery efforts, leading to prolonged impacts and increased severity.	5%
9	Technological Dependence	Reliance on complex technological systems increases vulnerability to cyberattacks, system failures, and cascading disasters.	7%
10	Lack of Preparedness	Insufficient disaster preparedness, including early warning systems, evacuation plans, and community education, leaves populations unready to cope with disasters.	11%

Further, the study reviewed that infrastructure vulnerability contributes to disaster occurrences and severity as aging infrastructure, poorly constructed buildings, and inadequate transportation networks can exacerbate the impacts of disasters. Weak infrastructure can lead to significant economic losses, disruptions in essential services, and increased casualties during emergencies. Poverty and inequality is a factor since socio-economic factors play a crucial role in determining vulnerability to disasters. Poverty, lack of access to resources, and socio-economic inequality can limit individuals' and communities' capacity to prepare for, respond to, and recover from disasters (Mechler, 2016). Political instability and conflict affect disaster occurrences and severity as regions experiencing political instability or conflict may have limited resources and capacities to manage disasters effectively. Disrupted governance structures, weakened institutions, and displaced populations can exacerbate the impacts of disasters and hinder humanitarian response efforts. Zambia may not be in this but what goes on in neighboring countries especially the Democratic Republic of Congo has an effect on Zambia. Also, technology and communication is another factor in that advancements in technology and communication improves early warning systems, disaster preparedness, and response capabilities. However, disparities in access to technology and information can exacerbate vulnerabilities, particularly in marginalized communities. Unsustainable land-use practices such as overexploitation of natural resources, unregulated

urban expansion, and improper waste management can increase the risk of disasters and their severity. Poor land-use planning can lead to environmental degradation and amplification of impacts of natural hazards. This explains why Jenkins, et al. (2017) posit that globalization has led to the rapid spread of diseases, economic crises and environmental impacts across borders. Promoting interconnectedness is can lead to reduced effects of disasters, leading to widespread humanitarian crises and socio-economic disruptions. Hence, addressing these factors requires a comprehensive approach that integrates disaster risk reduction, sustainable development, and resilience-building efforts at local, national and international levels.

4.2. Contribution of Vulnerability of Communities, Infrastructure, and Ecosystems to Different Types of Disasters

According to study findings, the vulnerability of communities, infrastructure, and ecosystems significantly contributes to different types of disasters in several ways and by statistics, contributions of vulnerability of communities were highest on social vulnerability at 35%, followed by physical infrastructure vulnerability at 30%, environmental vulnerability at 20%, exposure to hazards at 10% and lack of preparedness and resilience at 5% as illustrated in Figure 1 below:

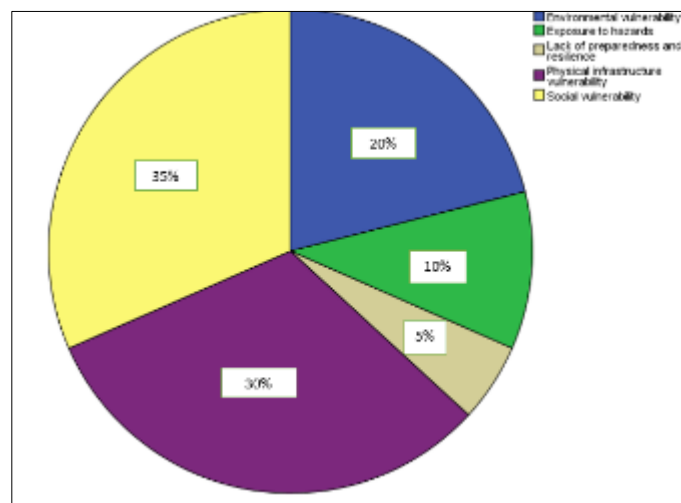


Figure 1 Contribution of Vulnerability of Communities, Infrastructure, and Ecosystems to Different Types of Disasters

The study reviewed that socioeconomic factors such as poverty, lack of access to education and healthcare, discrimination, and inadequate social networks can increase the vulnerability of communities. Socially vulnerable communities often lack the resources and capacity to prepare for, respond to, and recover from disasters. This can lead to higher rates of casualties and greater social disruption during disasters. Also, poorly designed, constructed, or maintained infrastructure is more susceptible to damage during disasters. Vulnerable infrastructure includes buildings, roads, bridges, dams, levees, and utilities such as power, water, and communication systems. Infrastructure failures can exacerbate the impacts of disasters, disrupt emergency response efforts, and prolong recovery efforts (Xing et al,2015). Ecosystems play a crucial role in mitigating the impacts of natural disasters by providing natural buffers against hazards such as floods, storms, and landslides. However, environmental degradation, such as deforestation, wetland destruction, and coastal erosion, can weaken these natural defenses, making ecosystems more vulnerable to disasters. Loss of biodiversity and ecosystem services can also reduce the resilience of ecosystems and increase the likelihood of ecological disasters.

Further, the study reviewed that the location of communities and infrastructure in hazard-prone areas increases their exposure to disasters. Coastal communities are vulnerable to hurricanes and tsunamis, while communities in seismic zones face the risk of earthquakes. Urbanization and population growth often lead to the expansion of settlements into hazard-prone areas, further increasing exposure and vulnerability. Communities, infrastructure, and ecosystems that are not adequately prepared for disasters are more vulnerable to their impacts. Lack of early warning systems, emergency response plans, evacuation routes, and shelters can increase casualties and property damage during disasters (Ballesteros and Sonny,2015). Similarly, communities and infrastructure that lack resilience— the ability to adapt and recover from disasters— are more likely to suffer long-term consequences and struggle to rebuild and recover. Nevertheless, addressing vulnerabilities in communities, infrastructure, and ecosystems is essential for reducing the risk and impact of disasters. This requires comprehensive risk assessment, investments in mitigation and

preparedness measures, strengthening of infrastructure and social systems, and sustainable environmental management practices.

4.3. Developing Effective Strategies and Policies for Disaster Preparedness, Response, Recovery, and Resilience-building

According to study results for developing effective strategies and policies for disaster preparedness, response, recovery and resilience building involves risk assessment at 20%, stakeholder involvement at 17%, policy development at 15%, capacity building at 13%, infrastructure and resource planning at 12%, community engagement and education at 10%, monitoring and evaluation at 8% and continuous improvement and adaptation at 5%. The study reviewed that developing effective strategies and policies for disaster preparedness, response, recovery, and resilience building requires a comprehensive approach that involves multiple stakeholders and considerations. Some steps to help guide the process include: risk assessment and analysis and this is where responsible officers conduct a thorough assessment of potential hazards and risks in the area. This may include natural disasters such as earthquakes, floods, hurricanes, as well as human-made disasters like industrial accidents or terrorism. They should as well analyze vulnerabilities and exposure of communities, critical infrastructure, and essential services to these hazards (UN,2014). Stakeholder engagement is cardinal and government should involve key stakeholders including government agencies, emergency responders, community organizations, businesses, and residents in the planning process as well as gather input from a diverse range of perspectives to ensure inclusivity and effectiveness in strategy development.

In addition, the study reviewed that the government should develop policies that outline clear roles and responsibilities of different stakeholders in disaster preparedness, response, recovery, and resilience efforts. Should ensure that policies are aligned with relevant laws, regulations, and international standards and incorporate flexibility into policies to adapt to changing circumstances and emerging threats. Government should provide training and capacity-building programs for emergency responders, government officials, community leaders, and the general public on disaster preparedness and response techniques as well as establish systems for early warning, evacuation, and emergency communication (UN,2015). Government should invest in infrastructure improvements and upgrades to enhance resilience against disasters. This may include reinforcing buildings, constructing flood barriers, or improving transportation networks. Stockpile essential supplies such as food, water, medical equipment, and shelter materials for use during emergencies and as well develop partnerships with neighboring communities and regions to share resources and support during disasters.

Further, the study reviewed that the government should raise awareness among the public about the importance of disaster preparedness and resilience building, encourage community members to develop their own emergency plans and participate in drills and exercises, and foster community cohesion and social networks that can support resilience and recovery efforts. Government should establish mechanisms for monitoring and evaluating the effectiveness of disaster preparedness, response, recovery, and resilience initiatives, collect data on key performance indicators such as response times, casualty rates, and infrastructure damage to identify areas for improvement as well as use lessons learned from past disasters to inform future planning and decision-making (Pascaroli and David,2015). There should also be regularly review and update strategies and policies in response to changing risks, vulnerabilities, and lessons learned from previous disasters and must foster a culture of continuous improvement and innovation in disaster preparedness and response efforts. Also, by following these steps and engaging in collaborative and iterative planning processes, communities and governments can develop effective strategies and policies for disaster preparedness, response, recovery, and resilience building.

5. Conclusion

In conclusion, disaster management and mitigation are critical components of ensuring the safety, resilience, and sustainable development of communities worldwide. Through comprehensive planning, preparation, response, and recovery efforts, societies can minimize the impact of disasters on human lives, infrastructure, and the environment. Effective disaster management begins with proactive preparedness measures, including risk assessment, early warning systems, and the development of robust emergency response plans. Investing in preparedness reduces vulnerability and enhances resilience to disasters. Addressing the complex nature of disasters requires collaboration across various sectors, including government agencies, NGOs, private sector entities, and local communities. Coordinated efforts facilitate resource allocation, information sharing, and the implementation of holistic strategies. Engaging communities in disaster management processes fosters empowerment, ownership, and localized solutions. Community-based initiatives leverage local knowledge, resources, and social networks to enhance resilience and response capacities. Mitigation efforts focus on reducing underlying risk factors and vulnerabilities to minimize the impact of disasters. This includes land-use planning, infrastructure development, ecosystem restoration, and the implementation of building

codes and standards. Advancements in technology, such as geographic information systems (GIS), remote sensing, and early warning systems, play a crucial role in enhancing disaster preparedness, response, and recovery efforts. Embracing innovation facilitates real-time data analysis, decision-making, and communication during emergencies. Investing in capacity building and training programs strengthens the capabilities of emergency responders, government agencies, and communities to effectively mitigate, respond to, and recover from disasters. Building local capacities ensures a more efficient and sustainable response to emergencies. The increasing frequency and intensity of natural hazards, exacerbated by climate change, necessitate adaptive strategies and resilience-building measures. Integrating climate change adaptation into disaster management frameworks enhances long-term sustainability and reduces future risks. Adequate financing mechanisms, including insurance schemes, contingency funds, and international assistance, are essential for supporting disaster response and recovery efforts. Financial instruments mitigate the economic burden of disasters and promote swift recovery processes.

Recommendations

Disaster management and mitigation are critical areas that require ongoing attention and innovation to effectively address the challenges posed by natural or human-made disasters. Here are some recommendations on challenges to address in disaster management and mitigation:

- Government and stakeholders should strengthen international cooperation and information-sharing mechanisms to facilitate a coordinated response to transnational disasters.
- Government and stakeholders should harness emerging technologies such as artificial intelligence, remote sensing, and drones for more accurate and efficient disaster monitoring, response, and recovery efforts.
- Government and stakeholders should integrate climate change adaptation measures into disaster management strategies to address the increasing frequency and intensity of extreme weather events.
- Government, line ministries and stakeholders should prioritize psychosocial support and mental health services for disaster-affected populations to address trauma, anxiety, and other psychological impacts.
- Government should strengthen legal and regulatory frameworks for disaster risk reduction and management at the national and local levels.
- Government and stakeholders should increase public awareness and education on disaster preparedness and mitigation through campaigns, workshops, and educational programs.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.





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