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Examining Disaster Preparedness and Management in Command Centers: A Case Study of Lusaka District

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Abstract

For a long time now, Zambia has been exposed to a variety of hazards and disasters and the frequency of their occurrence and magnitude has been increasing. These disasters have had a negative impact on the economy, having caused loss of life, damage to property and degradation of the environment. Tremendous setbacks in economic growth and development have also been the main result, as scarce national resources have had to be redirected from productive investments to relief and emergency operations. This study examined disaster preparedness and management in command centers of Lusaka district in Zambia. The study addressed the following specific objectives: To examine disaster preparedness and management at DMMU command centers in Lusaka; To evaluate the effectiveness of disaster preparedness interventions in disaster areas; To establish challenges in disaster preparedness and management processes in DMMU command centers. The sample size of this study was 50 respondents who were selected from various DMMU command centres in Lusaka. This research study used both quantitative and qualitative methods, as well as surveys and focus group interviews. The key findings highlighted the strategies, protocols, procedures, and interventions

implemented at command centers. The results also highlighted the challenges faced at DMMU command centers in addressing disasters effectively 24% being failure to consistently document experiences and outcomes which in turn leads to loss of valuable insights, 26% is that organizational inertia may hinder the adoption of new strategies based on past lessons, 28% being difficulty in consolidating information from different agencies which complicates the integration of lessons learned, and 22% being the absence of formal evaluation mechanisms which may prevent systematic learning from previous disasters. Despite the challenges, DMMU command centers strive to ensure the implementation of effective interventions to enhance resilience and recovery of communities from disasters. Preliminary findings suggested a significant correlation between implementation of effective interventions and the impact on resilience and recovery of communities. These findings hold crucial implications for policymakers, highlighting the importance of implementing effective interventions which enhance the impact of disaster preparedness and management efforts by command center and how they help reduce the negative impact of disasters on the community such as loss of life and property

Keywords: Disaster, Disaster Management, and Disaster Preparedness

1. Introduction

Disaster management, according to Zurich (2015) is the process of preparing for, responding to, recovering from, and mitigating the impacts of disasters. For the past years, the world has been facing quite a number of disasters both natural and man-made disasters which have led to loss of life, property, and has increased the levels of poverty in many countries, especially in less developed and developing countries. Natural disasters such as floods, drought, hurricanes, earthquakes, storms, epidemic, pandemics, landslides, extreme temperatures, climate change, and man-made disasters like crime, war, terrorism, chemical threats etc., have all led to loss of lives and high poverty levels (Global Natural Disaster Assessment Report, 2021). According to Lopez and Thomas (2015), the first half of this decade will be remembered for deadly climate-related disasters, among them, the great floods in Thailand in 2011, Hurricane Sandy in the United States (US) in 2012, and Typhoon Haiyan in the Philippines in 2013.

Zambia is one of the developing countries that have been facing a number of natural and man-made disasters. Zambia has, for

the past years, been facing climate change, floods, droughts, pandemics and epidemics. Chitondo *et al* (2024) ^[9] 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. Adequately, nutrition is crucial for physical and cognitive development, immune function, and overall productivity. According to the World Bank (2019), 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 (Devine *et al*, 2014). 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 and the Disaster Management and Mitigation Unit (DMMU) is responsible for coordinating disaster management efforts in Zambia (DMMU, 2015). Lusaka district is located in Lusaka province of Zambia, with a population of 3,079,964 people. This study will examine disaster preparedness and management among DMMU offices in urban areas of Lusaka district.

1.2 General Objective

The general objective of this study is examining disaster preparedness and management in command centers of Lusaka district in Zambia.

1.2.1 Specific Objectives

1. To examine the types of disaster preparedness interventions implemented at command centers.
2. To evaluate the effectiveness of disaster preparedness interventions in disaster areas.
3. To establish challenges in disaster preparedness and management processes in DMMU command centers.

1.3 Theoretical Framework

The study was guided by the Disaster Risk Management Framework. According to UNDRR (2020), the purpose of the disaster risk management is to reduce the underlying factors of risk and to prepare for and initiate an immediate response should disaster hit. The Disaster Risk Management Framework (DRMF), considers conceptually, Disaster Risk Management (DRM) as a continuum, and thus as an ongoing process of interrelated actions, which are initiated before, during or after disaster situations. The framework is aiming, in particularly, at countries and regions, which face recurrent exposure to natural hazards. DRM actions are aimed at strengthening the capacities and resilience of households and communities to protect their lives and livelihoods, through measures to avoid (prevention) or limit (mitigation) adverse effects of hazards and to provide timely and reliable hazard forecasts (Tearfund, 2015).

During emergency response, communities and relief agencies focus on saving lives and property. In post-disaster situations, the focus is on recovery and rehabilitation, including, however, the concept of “building back better”. This implies to initiate Disaster Risk Reduction (DRR) activities also during recovery and rehabilitation. The paradigm shifts to conceptualize DRM as continuum (and

no more in phases) reflects the reality, that the transition between pre- during and post disaster situations is fluid, in particularly in countries, which are regularly exposed to hazards. The elements of the framework include both structural (physical and technical) and non-structural (diagnostic, policy and institutional) measures (UNDP, 2024). The value of this framework is its ability to promote a holistic approach to DRM and demonstrate the relationships between hazard risks/disasters and development. For instance, the activities on mitigation and prevention comprise the development portion, while relief and recovery comprise the humanitarian assistance portion, with preparedness linking both types of efforts. Furthermore, the framework provides the basis to address public commitment and institutional systems, including organizational capacities, policy, legislation and community action, as well as environmental management, land-use, urban planning, protection of critical facilities, application of science and technology, partnership and networking, and financial instruments (UNISDR, 2017).

2. Literature Review

2.1 Types of Disaster preparedness Interventions at command centers

In Zambia, the Disaster Management and Mitigation Unit (DMMU) sitting within the Office of the Vice-President is the national coordination node for disaster preparedness and response; its mandates and operations set the expectations for what Lusaka’s DMMU command-center interventions should deliver in times of crisis (DMMU/OVP). Zambia’s disaster governance is anchored in the Disaster Management Act No. 13 (2010) and the National Disaster Management Policy (2015), which vest national disaster-coordination authority in DMMU and require a tiered system of plans, SOPs and an operation manual to guide activations (Government of the Republic of Zambia). The DRM Framework (2017–2030) and subsequent national documents reaffirm that DMMU is responsible for anticipation, mitigation, preparedness, coordination and response, and they mandate multi-sectoral information sharing during disasters (GRZ, 2018).

In practice, DMMU acts as a convener of line ministries, the Zambia Meteorological Department (ZMD), the Water Resources Management Authority (WARMA), Zambia Red Cross, the Ministry of Health and humanitarian partners to sustain a common operating picture and to mobilize national assets (fiscal, logistics, KDF support) when local capacity is overwhelmed. The roles and outputs of DMMU command centers in Lusaka fall into a consistent typology observed across Zambia’s recent emergencies: Information, analysis and planning (the “planning engine”) (IFRC GO, 2022). EOCs aggregate meteorological, hydrological, surveillance and rapid-need assessments to produce SITREPs, maps and operational plans for fixed operational periods. DMMU chairs technical working groups (for example, Anticipatory Action) to convert forecasts into pre-agreed actions. Anticipatory activation (e.g., forecast-based cash or prepositioning) has become an institutional tool for proactive interventions when credible flood/drought signals appear (WHO Zambia, 2025).

Interventions include dissemination of forecasts and life-safety messages via ZMD bulletins, radio, mobile messaging, community leaders and organized roadshows. Command centers must decide timing, content, target

groups, languages and channels to maximize last-mile reach. EOCs task provincial and district authorities to open pre-identified shelters, manage camp WASH, and coordinate food and NFI distributions. They also allocate transport assets and security escorts as needed. Pre-site selection and SOPs for shelter management are routine outputs of EOC planning. For sudden-onset incidents (floods, dam spills, urban flash floods), DMMU coordinates SAR tasking, medical triage, and referral pathways to treatment centers. SAR coordination includes mobilizing national rescue assets and, where needed, employing civilian aviation or military lift (TropMed and Health, 2025).

Command centers direct pre-positioning of commodities, prioritize road and bridge repair, manage convoys and coordinate energy/water/telecom liaisons to accelerate lifeline restoration. DMMU routinely partners with the Zambia Defense Force and the Ministry of Transport on heavy-lift and access tasks. After stabilization, DMMU coordinates Post-Disaster Needs Assessments (PDNAs), documents losses for donor funding, and shifts leadership toward sectoral recovery plans and resilience investments. These outputs are central to ensuring the response moves into durable recovery. Heavy rains in January 2022 (and again in January 2023) produced flash and riverine floods across Southern, Central and Lusaka provinces; characterized some outbreaks as the worst in decades and declared multiple districts affected. By early 2023 hundreds of thousands were impacted and tens of thousands displaced (OCHA, 2024).

2.2 Effectiveness of disaster preparedness interventions in disaster areas

Assessing disaster-preparedness interventions involves determining whether pre-hazard measures—like early warning systems, community training, evacuation planning, and anticipatory financing—effectively reduce mortality, limit asset losses, and speed recovery (UNDRR, 2015) ^[34]. Zambia offers a compelling case with its statutory Disaster Management and Mitigation Unit (DMMU), its activation for drought, floods, and outbreaks, and its involvement in anticipatory action mechanisms. Zambia's legal and policy framework is anchored by the Disaster Management Act No. 13 of 2010, which mandates the DMMU under the Vice-President's office to coordinate national preparedness and response (Government of Zambia, 2010). The Act is complemented by the National Disaster Risk Management Framework (2017–2030), aligning with global DRM standards and assigning cluster leadership across sectors (Government of Zambia, 2018). Forecasting responsibility lies with the Zambia Meteorological Department (ZMD) and Water Resources Management Authority (WARMA), both feeding into multi-sectoral SITREPs (Parliament of Zambia, 2023; ZMD/MGEE, 2025). Since 2023, Zambia has engaged in the Anticipation Hub, designing early action protocols for shocks like drought and floods. While institutional structures are robust, implementation remains uneven across provinces.

Research and operational reports describe five core intervention areas: 1. Early Warning & Information Flow (ZMD forecasts, hazard advisories, and national SITREPs), 2. Community-Based Preparedness (Local early-warning systems, community volunteers (CBVs), and risk communication), 3. Evacuation & Shelter Systems (Pre-

designated shelters, transport arrangements, evacuation plans), 4. Anticipatory Action & Pre-positioning (Emergency cash transfers, pre-deployed supplies, seed/fodder distributions triggered by forecast thresholds), and 5. Structural Mitigation & Governance (Dam safety, pre-flood infrastructure, borehole repair, and risk-sensitive land-use planning) (Climate Centre, 2021). Evaluation of these interventions focuses on both process metrics (e.g., timing, coverage, activation) and impact metrics (e.g., mortality, duration of displacement, outbreak cases, service restoration time). ZMD's seasonal and short-range forecasting informs national SITREPs and programming decisions. For example, the 2023/24 El Niño forecasts of below-normal rainfall triggered early planning in agricultural districts (Parliament of Zambia, 2023; ZMD/MGEE, 2025). Anticipatory action pilots suggest pre-agreed triggers can prompt early resource allocation, but Ethiopia-style case studies reveal that lack of local dissemination limits uptake (Anticipation Hub, 2022). Field reports underscore that national advisories do not necessarily reach remote or informal communities without trusted channels, diminishing life-saving potential (Climate Centre, 2021).

Zambia's drought response included emergency repairs of hundreds of dams and boreholes, a demonstration of the link between structural investment and preparedness effectiveness (Parliament of Zambia, 2024). Similarly, OH assessments reveal ongoing challenges in WASH infrastructure and flood-prone settlement risk, indicating that even robust planning can be undermined by physical vulnerabilities. In the National Flood Response (2022–2023), Severe flooding affected multiple provinces. DMMU coordinated early action, including pre-deployment of relief items and community alerts. Districts with active community systems and functional shelters responded faster, though structural damage and weak infrastructure limited outcomes in other areas (ReliefWeb, 2023; IFRC, 2022). Severe cholera epidemic saw DMMU and Health cluster activate emergency protocols, including setting up temporary treatment centers and deploying extensive WASH and RCCE programming. The response contributed to declining daily cases by March 2024, though vaccine shortages and sanitation gaps in urban hubs (e.g., Lusaka informal settlements) exacerbated risk (WHO, 2024; UNICEF, 2024; AP News, 2024). The El Niño-induced drought triggered national response. Early warning informed pre-positioned cash, food, and WASH scales. Where these reached, counties experienced reduced coping stress and sustained food consumption. However, inequities in delivery and ongoing IPC Phase 3 projected crisis-level food insecurity indicate capacity reached, but was insufficient for full protection (World Bank, 2024; IPC, 2024).

Zambia has made meaningful strides in disaster preparedness through institutional frameworks, anticipatory action pilots, and multi-cluster coordination. Operational evidence from floods, cholera, and drought shows that preparedness interventions can reduce outcomes—when warnings are actionable, community systems are resourced, and infrastructure vulnerabilities are addressed. To enhance effectiveness moving forward, Zambia must deepen evaluation quality, empower local capacity, and prioritize structural risk reduction.

2.3 Challenges in disaster preparedness and management processes in DMMU command centers

Zambia faces a myriad of disaster risks, including floods, droughts, disease outbreaks, and industrial accidents. The Disaster Management and Mitigation Unit (DMMU), operating under the Office of the Vice President, is the central agency responsible for coordinating disaster risk management (DRM) efforts in the country. Despite a robust legislative framework, including the Disaster Management Act of 2010 and the National Disaster Management Policy of 2015, several challenges impede the effectiveness of disaster preparedness and management processes within DMMU command centers (DMMU, 2023). The DMMU's mandate encompasses prevention, mitigation, preparedness, response, and post-disaster recovery. However, the decentralized nature of disaster management in Zambia poses significant challenges. While the DMMU provides national coordination, provincial and district-level command centers often operate with limited resources and capacity. A study by Libanda (2021) highlights that local governments face difficulties in implementing disaster risk management strategies due to inadequate infrastructure, insufficient training, and limited financial resources. This decentralization, while aiming to enhance local responsiveness, sometimes leads to inconsistencies in disaster preparedness and response across regions.

Furthermore, the DMMU's coordination with other government ministries and agencies is often hindered by weak inter-ministerial collaboration. The United Nations Development Programme (UNDP) notes that one of the identified challenges in implementing risk reduction in Zambia is weak inter-ministerial and inter-agency coordination, which affects the efficiency of disaster management efforts (UNDP, 2024). Effective disaster management requires seamless coordination among various stakeholders, including government agencies, non-governmental organizations, and the private sector. However, inter-agency collaboration in Zambia's disaster management efforts has been suboptimal. A report by the International Federation of Red Cross and Red Crescent Societies (IFRC) indicates that while the DMMU has established frameworks for coordination, the actual implementation often falls short due to overlapping mandates, lack of clarity in roles, and communication barriers among stakeholders (IFRC, 2023) ^[21]. The 2024 drought response in Zambia serves as a pertinent example. The DMMU, in collaboration with the World Food Programme (WFP) and the European Union (EU), employed cutting-edge drone technology to conduct rapid assessments and monitor damage caused by droughts. While this initiative demonstrated the potential for effective collaboration, challenges such as data sharing protocols, logistical constraints, and coordination among multiple actors impacted the overall efficiency of the response (WFP, 2024).

A 2024 study by the University of Zambia evaluated the capacity of the DMMU in responding to natural disasters. The study found that while Zambia has made progress in terms of policy development, the DMMU faces challenges including inadequate staffing, limited financial resources, and a lack of comprehensive disaster response plans at local levels. The study suggests that Zambia should focus on building local capacity and increasing the involvement of

the private sector in disaster preparedness (Chilufya & Phiri, 2024) ^[7]. A 2023 study by the Zambia Red Cross Society explored the role of local communities in disaster preparedness, specifically focusing on rural areas. The study found that rural communities often lack access to disaster preparedness information and resources, which hampers their ability to respond effectively. The report called for a more inclusive approach that integrates local knowledge and strengthens community engagement in disaster risk reduction efforts (Zambia Red Cross, 2023).

2.4 Literature gap

Despite the considerable body of literature on disaster preparedness and management in Zambia, several gaps persist that warrant further research and exploration. The identification of these gaps is critical for improving the effectiveness of DMMU command centers and informing policy and practice (UNDP, 2024). Most existing studies rely heavily on institutional reports from organizations such as DMMU, UNDP, IFRC, WFP, and government statements (WFP, 2024; IFRC, 2023 ^[21]). While these sources are authoritative, they may emphasize successes and underreport operational weaknesses or systemic inefficiencies. There is a paucity of independent, peer-reviewed empirical research that critically evaluates the effectiveness of disaster preparedness interventions in Zambia. Future studies could focus on rigorous, field-based assessments of DMMU operations to provide a balanced perspective (Libanda, 2021).

Most literature focuses on single-hazard events, such as droughts or cholera outbreaks (Zambian Parliament, 2024; Caritas Zambia, 2024). There is a notable gap in research that examines multi-hazard preparedness and integrated approaches to disaster management, particularly the intersection between public health emergencies and natural disasters. Exploring how DMMU coordinates multi-hazard responses—including floods, disease outbreaks, and industrial accidents—would provide critical insights into operational weaknesses and best practices. While Zambia has comprehensive disaster management policies and legislative frameworks (Disaster Management Act, 2010; National Disaster Management Policy, 2015), research analyzing the gap between policy formulation and operational implementation remains limited. Existing literature notes that budgetary constraints, human resource limitations, and bureaucratic challenges hinder effective policy execution (IFRC, 2023 ^[21]; Libanda, 2021). Empirical studies assessing why these gaps persist at the provincial and district command centers could guide improvements in policy translation into practice.

3. Research Methods

This research study will use the case study research design because the design involves the collection of data to objectively describe the existing situations or problem. This design is suitable because it is an in-depth study of a research problem and it is often used to narrow down a very broad field of research into one or a few easily researchable examples. This approach excels at bringing an understanding of a complex issue through detailed contextual analysis of a limited number of events or conditions and their relationships, thus making it best suited for this study (Creswell, 2015).

3.1 Target Population

This study's target population are the DMMU officers in Rhodespark in Lusaka District. These consists of officers from the various departments of the command centers including the operations, logistics and management, research and planning, and the information management systems departments (Parliament of Zambia, 2019).

3.2 Sampling Design

This research study will implement the purposive sampling design which is also known as judgmental or selective sampling design. This non-probability sampling method will allow the researcher to intentionally select participants based on specific characteristics or quality that align with the study's purpose. It will allow for the selection of respondents who are most likely to provide relevant information (Creswell, 2014) [11].

3.3 Sample Size Determination

This study's sample size will be 50 participants or DMMU officers from various departments of the unit. A sample size of 10% of a studied population is considered sufficient enough to generate valid results (Mugenda and Mugenda, 2012).

3.4 Data Collection Methods

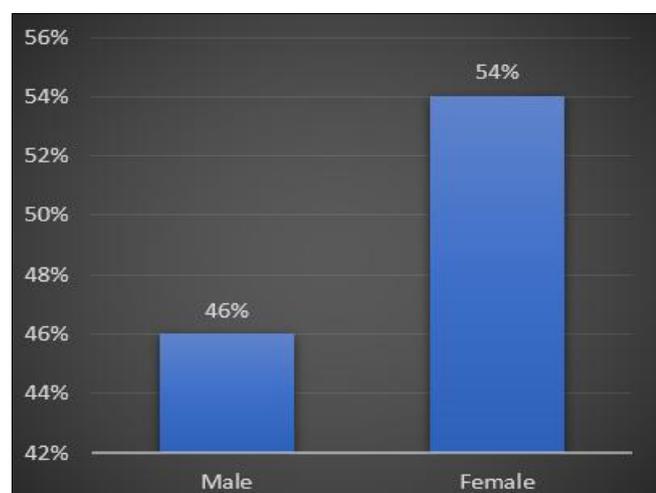
The data collection method to be used in this study is a mixed method design. This design will help combine both qualitative and quantitative approaches to answer research questions. This approach will provide a more comprehensive understanding of the research problem Burke *et al* (2015). Therefore, the study will use structured surveys or questionnaires (quantitative) followed by focus group interviews (qualitative) for further exploration.

3.5 Data Analysis

For data analysis, this research study will utilize Microsoft Excel as a data visualization tool and then the statistical Software tool STATA to help in analyzing survey data.

4. Findings and Results

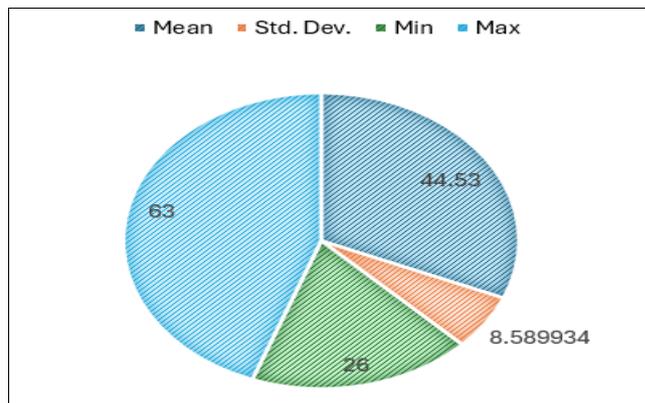
4.1 Background characteristics of the respondents



Source: Primary Data 2025

Fig 4.1.1: Sex of the respondents

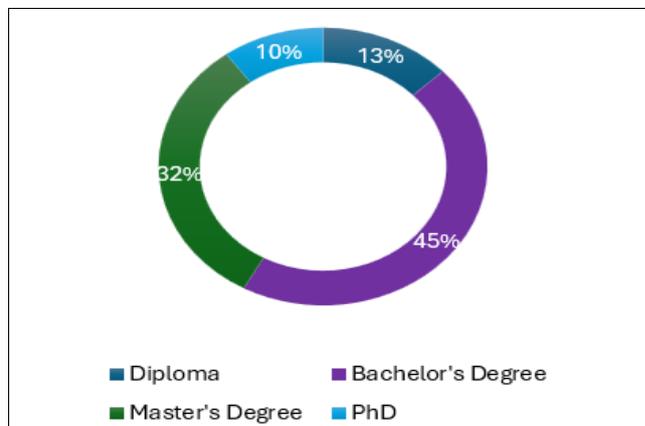
The figure above illustrates the sex of the respondents, 46% of which were male and 54% were female.



Source: Primary Data 2025

Fig 4.1.2: Age of the respondent

The figure shows the age of the respondents, from the 50 respondents, the average age was 44.53, with standard deviation of 8.589934, the minimum age of the respondents was 26, and the maximum age was 63.

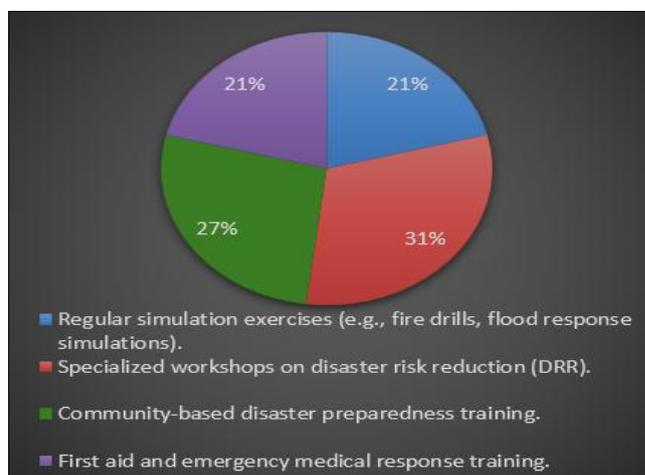


Source: Primary Data 2025.

Fig 4.1.3: Level of education

The figure presents the highest level of education of the respondents, 13% had diplomas, 45% had bachelor's degrees, 32% had master's degrees, and 10% had PhDs.

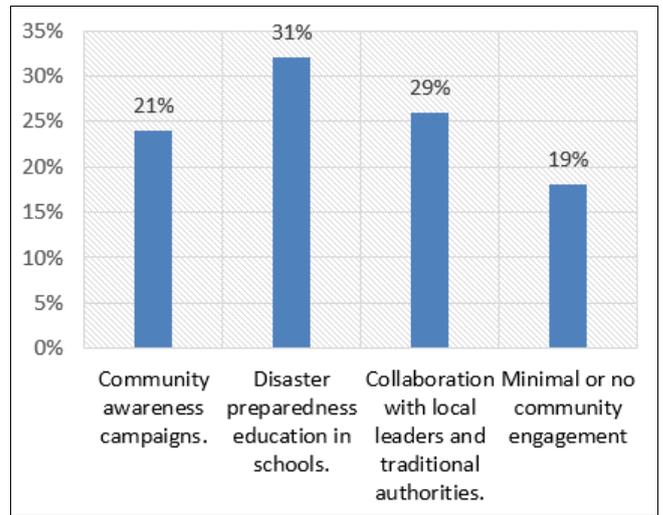
4.2 Types of Disaster preparedness Interventions at command centers



Source: Primary Data 2025.

Fig 4.2.1: Types of training programs provided at disaster command centers to enhance preparedness

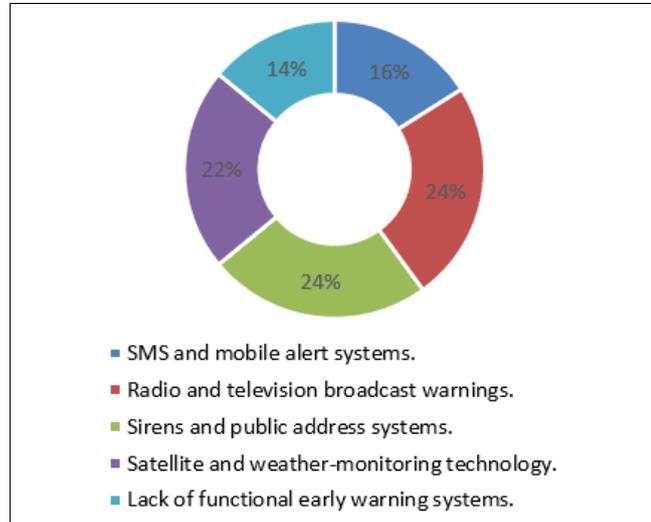
The figure above explains the types of training programs provided at disaster command centers to enhance preparedness. 21% of which are regular simulation exercises such as fire drills, flood response simulations, 31% are specialized workshops on disaster risk reduction (DRR), 27% are community-based disaster preparedness training, and 21% are first aid and emergency medical response training.



Source: Primary Data 2025

Fig 4.2.4: How disaster command centers engage communities in preparedness interventions

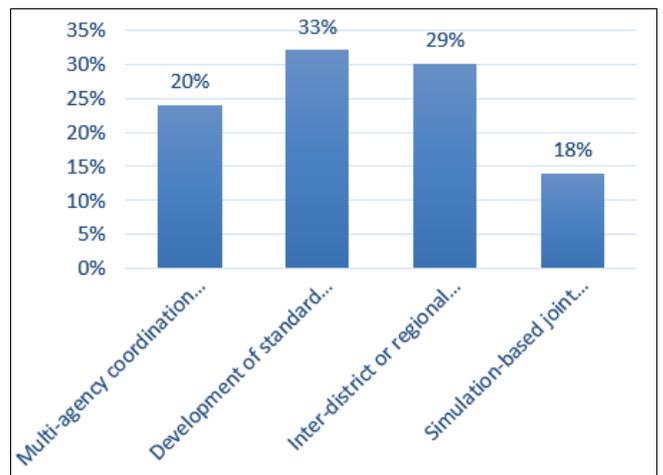
The figure above displays how disaster command centers engage communities in preparedness interventions. 21% were through community awareness campaigns, 31% were disaster preparedness education in schools, 29% every collaboration with local leaders and traditional authorities, and 19% were minimal or no community engagement.



Source: Primary Data 2025

Fig 4.2.2: Early warning systems in place at disaster command centers

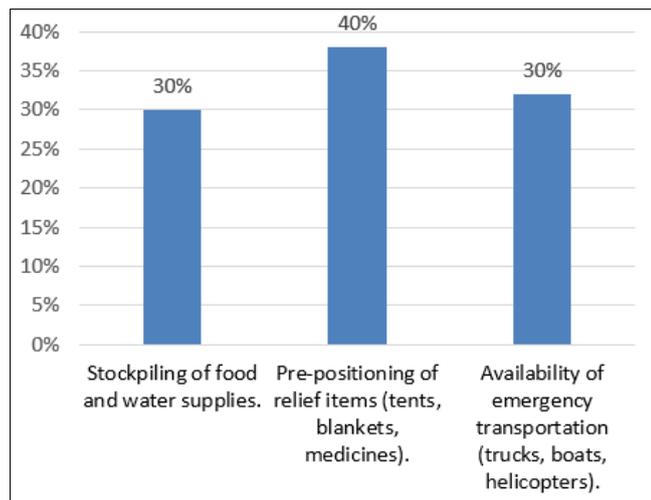
The figure depicts the early warning systems in place at disaster command centers. 16% of which are SMS and mobile alert systems, 24% are radio and television broadcast warnings, 24% are sirens and public address systems, 22% are satellite and weather-monitoring technology, and 14% lack functional early warning systems.



Source: Primary Data 2025

Fig 4.2.5: Coordination mechanisms established at command centers for disaster preparedness.

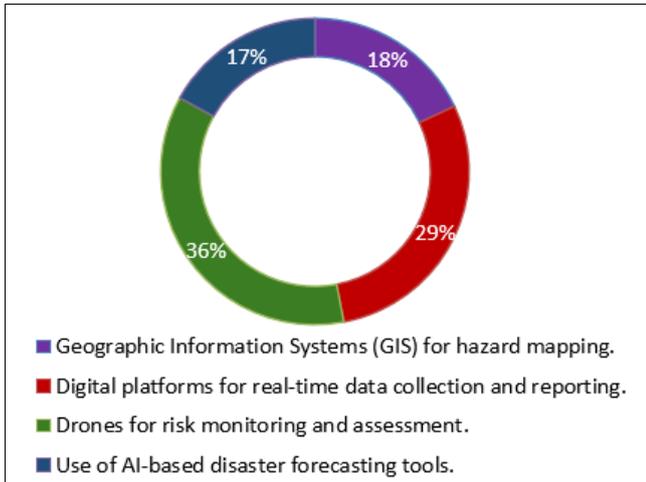
The figure demonstrates the coordination mechanisms established at command centers for disaster preparedness. 20% were multi-agency coordination meetings (government, NGOs, military), 33% were development of standard operating procedures (SOPs), 29% were inter-district or regional information-sharing platforms, and 18% were simulation-based joint operations with stakeholders.



Source: Primary Data 2025

Fig 4.2.3: Logistical preparedness measures implemented at disaster command centers

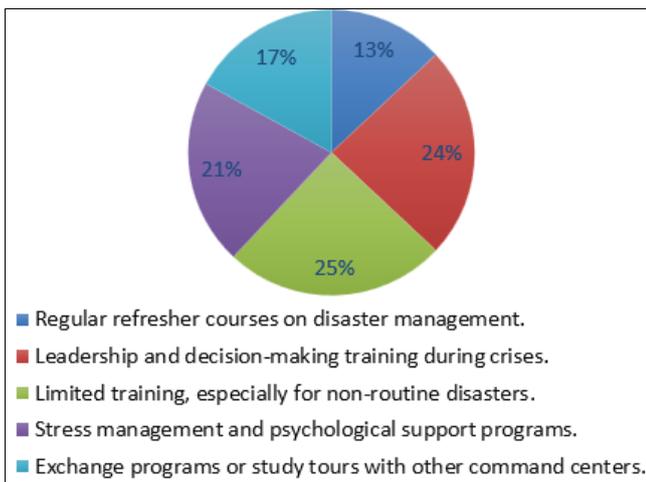
The figure shows the logistical preparedness measures implemented at disaster command centers. 30% are stockpiling of food and water supplies, 40% are pre-positioning of relief items such as tents, blankets, medicines, while 30% are availability of emergency transportation (trucks, boats, helicopters).



Source: Primary Data 2025

Fig 4.2.6: The role technology plays in disaster preparedness interventions at command centers

The figure explains the role technology plays in disaster preparedness interventions at command centers.. 18% use Geographic Information Systems (GIS) for hazard mapping, 29% use digital platforms for real-time data collection and reporting, 36% use drones for risk monitoring and assessment, and 17% use AI-based disaster forecasting tools.

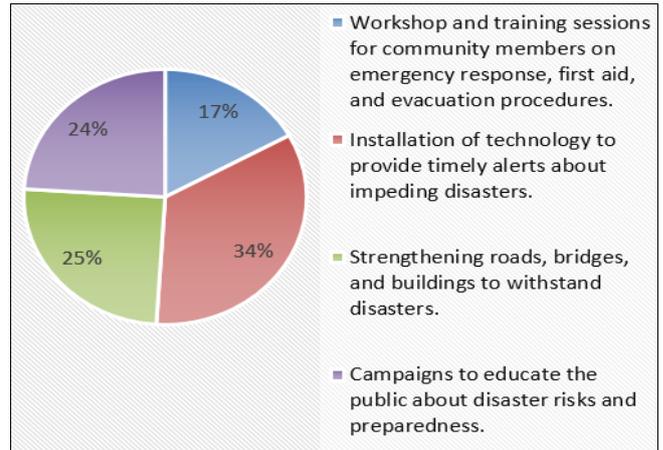


Source: Primary Data 2025

Fig 4.2.7: Capacity-building interventions implemented at disaster command centers to strengthen staff readiness

The figure above is a display of the capacity-building interventions implemented at disaster command centers to strengthen staff readiness. 13% are regular refresher courses on disaster management, 24% are leadership and decision-making training during crises, 25% have limited training, especially for non-routine disasters, 21% are stress management and psychological support programs, and 17% are exchange programs or study tours with other command centers.

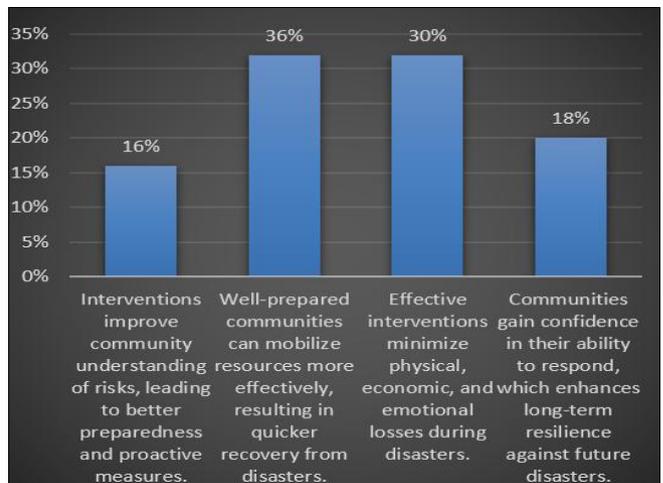
4.3 Effectiveness of disaster preparedness interventions in disaster areas



Source: Primary Data 2025

Fig 4.3.1: Specific disaster preparedness interventions implemented

The figure shows the specific disaster preparedness interventions being implemented in disaster prone areas. 17% are workshop and training sessions for community members on emergency response, first aid, and evacuation procedures, 34% are installation of technology to provide timely alerts about impending disasters, 25% are strengthening of roads, bridges, and buildings to withstand disasters, while 24% are campaigns to educate the public about disaster risks and preparedness.

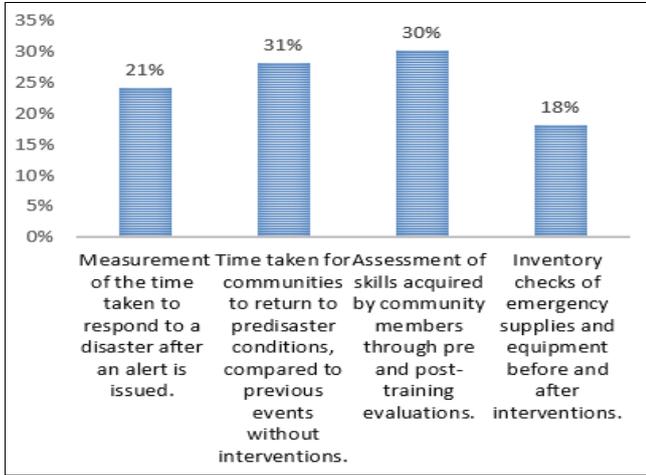


Source: Primary Data 2025

Fig 4.3.2: How disaster preparedness interventions impact the resilience and recovery of communities in disaster-prone areas

Figure resents how disaster preparedness interventions impact the resilience and recovery of communities in disaster-prone areas. 16% agreed that interventions improve community understanding of risks, leading to better preparedness and proactive measures, 36% agreed that well-

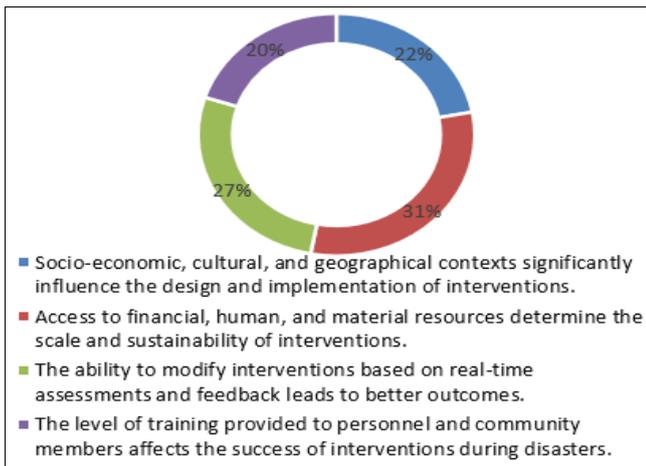
prepared communities can mobilize resources more effectively, resulting in quicker recovery from disasters, 30% agreed that effective interventions minimize physical, economic, and emotional losses during disasters, while 18% agreed that communities gain confidence in their ability to respond, which enhances long-term resilience against future disasters.



Source: Primary Data 2025

Fig 4.3.3: Metrics and indicators used to measure the effectiveness of disaster preparedness interventions in disaster areas

The figure above shows the metrics and indicators used to measure the effectiveness of disaster preparedness interventions in disaster areas. 21% are measurements of the time taken to respond to a disaster after an alert is issued, 31% is time taken for communities to return to pre-disaster conditions, compared to previous events without interventions, 30% is the assessment of skills acquired by community members through pre and post-training evaluations, and 18% are inventory checks of emergency supplies and equipment before and after interventions.

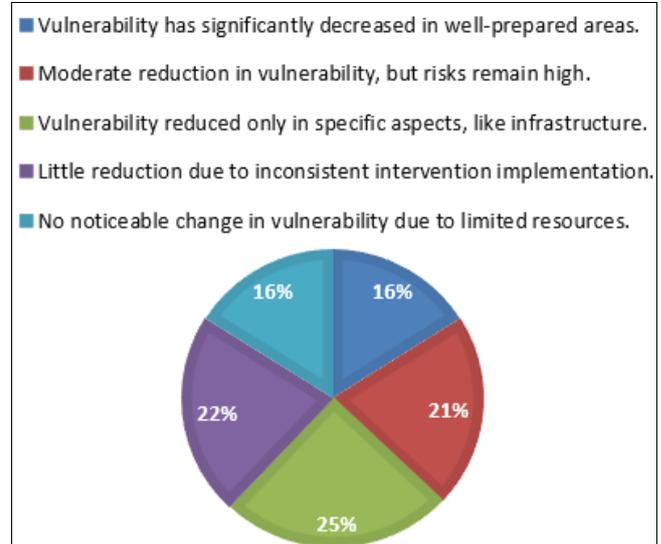


Source: Primary Data 2025

Fig 4.3.4: Key factors contributing to the success or failure of disaster preparedness interventions in different types of disaster scenarios

The figure shows the key factors that contribute to the success or failure of disaster preparedness interventions in different types of disaster scenarios. 22% are socio-economic, cultural, and geographical contexts which significantly influence the design and implementation of

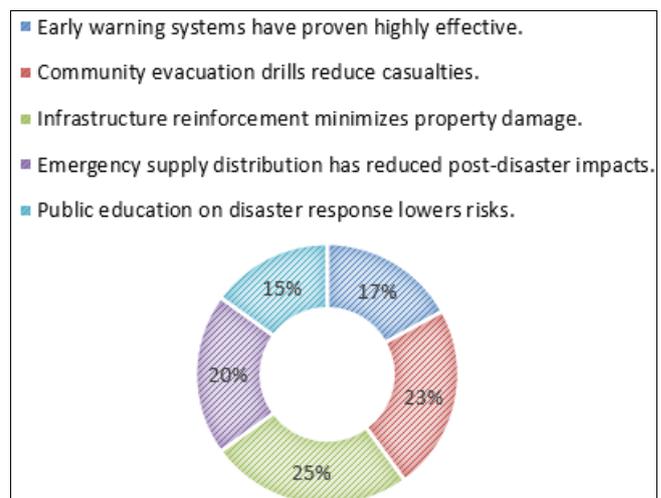
interventions, 31% are access to financial, human, and material resources which determine the scale and sustainability of interventions, 27% are the ability to modify interventions based on real-time assessments and feedback which lead to better outcomes, and 20% are the level of training provided to personnel and community members affects the success of interventions during disasters.



Source: Primary Data 2025

Fig 4.3.5: How well disaster preparedness interventions have reduced vulnerability in disaster-prone areas

The figure illustrates above shows how well disaster preparedness interventions have reduced vulnerability in disaster-prone areas. 16% vulnerability has significantly decreased in well-prepared areas, there has also been 21% moderate reduction in vulnerability, but risks remain high, 25% vulnerability has reduced only in specific aspects, like infrastructure, there has been 22% little reduction due to inconsistent intervention implementation in some areas, and there has been 16% no noticeable change in vulnerability due to limited resources in other areas.

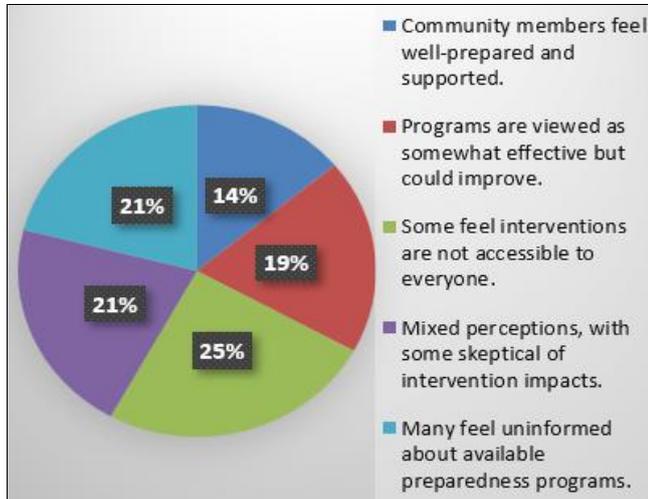


Source: Primary Data 2025

Fig 4.3.6: Specific disaster preparedness interventions that have been most effective in minimizing impacts

Figure above depicts the specific disaster preparedness interventions that have been most effective in minimizing

impacts. 17% are early warning systems which have proven highly effective, 23% are community evacuation drills which reduce casualties, 25% are infrastructure reinforcements which minimize property damage, 20% are emergency supply distribution which have reduced post-disaster impacts, and 15% are public education on disaster response which lowers risks.

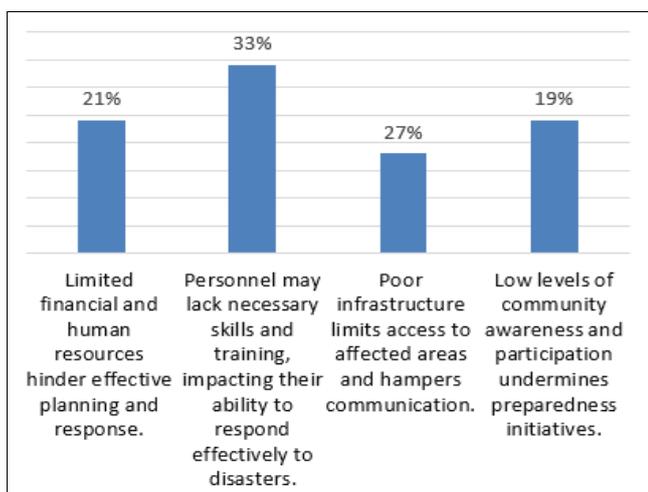


Source: Primary Data 2025

Fig 4.3.7: How community members perceive the effectiveness of disaster preparedness programs

Community members were asked how they perceive the effectiveness of disaster preparedness programs. 14% of the community members feel well-prepared and supported, 19% of the programs are viewed as somewhat effective but could improve, 25% of them feel the interventions are not accessible to everyone, 21% of the others have mixed perceptions, with some skeptical of intervention impacts, and 21% feel uninformed about available preparedness programs.

4.4 Challenges in disaster preparedness and management processes in DMMU command centers

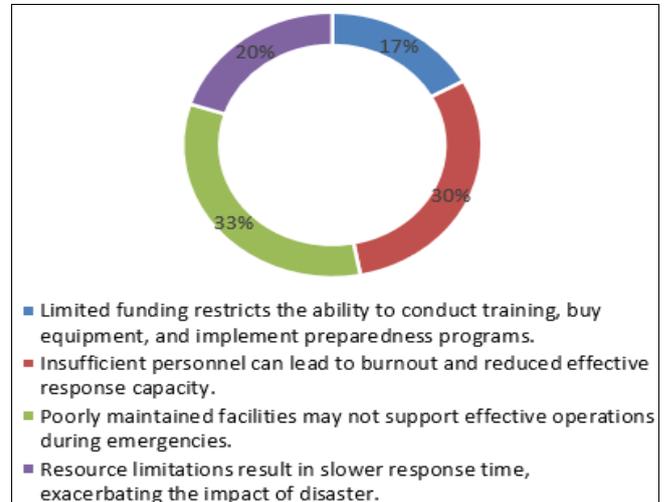


Source: Primary Data 2025

Fig 4.4.1: Primary challenges faced by DMMU command centers in disaster preparedness and management processes

The figure represents the primary challenges faced by DMMU command centers in disaster preparedness and

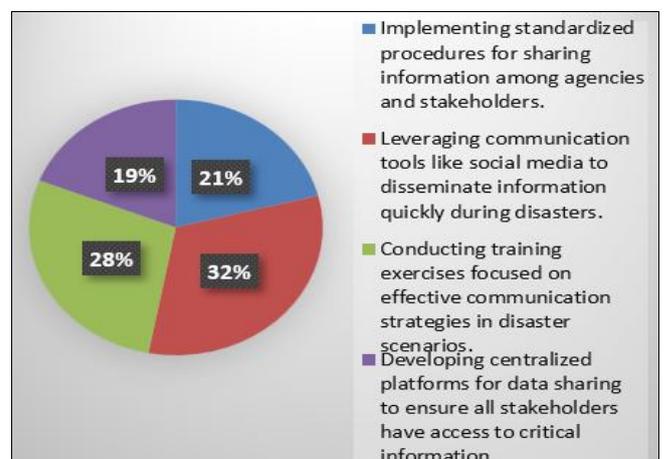
management processes. 21% are that limited financial and human resources hinder effective planning and response, 33% are that personnel may lack necessary skills and training, impacting their ability to respond effectively to disasters, 27% are that poor infrastructure limits access to affected areas and hampers communication, and 19% are that low levels of community awareness and participation undermines preparedness initiatives.



Source: Primary Data 2025

Fig 4.4.2: How resource limitations affect the disaster preparedness and management capabilities of DMMU command centers

The figure shows how resource limitations affect the disaster preparedness and management capabilities of DMMU command centers. 17% showed that limited funding restricts the ability to conduct training, buy equipment, and implement preparedness programs, 30% showed that insufficient personnel can lead to burnout and reduced effective response capacity, 33% showed that poorly maintained facilities may not support effective operations during emergencies, and 20% showed that resource limitations result in slower response time, exacerbating the impact of disaster.

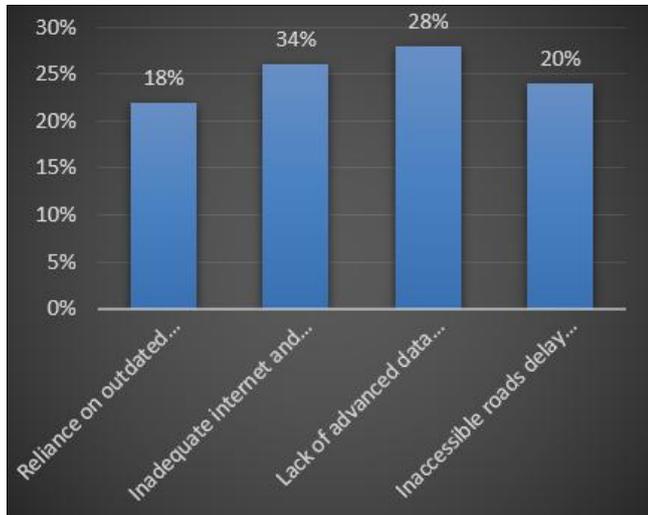


Source: Primary Data 2025

Fig 4.4.3: How DMMU command centers address issues related to communication and information sharing

The figure representation above demonstrates how DMMU command centers address issues related to communication

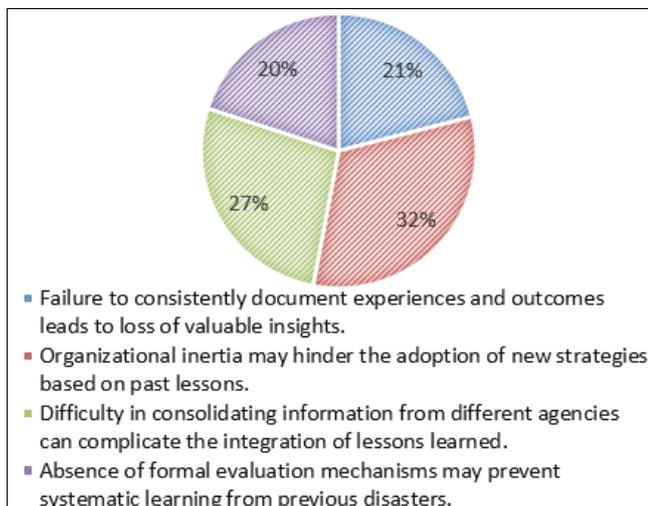
and information sharing during disaster events. 21% are by implementing standardized procedures for sharing information among agencies and stakeholders, 32% are by leveraging communication tools like social media to disseminate information quickly during disasters, 28% are by conducting training exercises focused on effective communication strategies in disaster scenarios, and 19% are by developing centralized platforms for data sharing to ensure all stakeholders have access to critical information.



Source: Primary Data 2025

Fig 4.4.4: Technological limitations and infrastructure issues

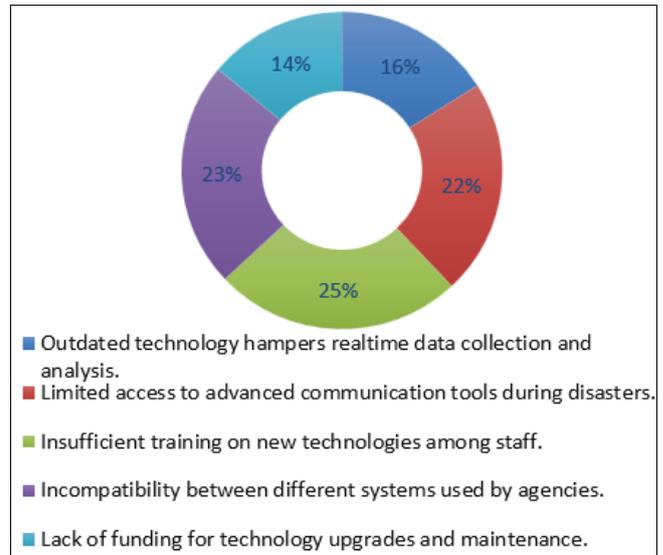
The figure depicts how technological limitations and infrastructure issues affect the disaster preparedness and management processes. 18% being reliance on outdated communication and monitoring tools which can hinder effective response coordination, 34% being inadequate internet and telecommunications infrastructure which disrupts communication during disasters, 28% being lack of advanced data analytics capabilities which limits the ability to predict and assess disaster risks, and 20% being inaccessible roads which delay response teams and supplies from reaching affected areas.



Source: Primary Data 2025

Fig 4.4.5: Challenges in integrating lessons learned from past disasters

The figure presents the challenges in integrating lessons learned from past disasters into current disaster preparedness and management strategies. 21% being failure to consistently document experiences and outcomes which in turn leads to loss of valuable insights, 32% is that organizational inertia may hinder the adoption of new strategies based on past lessons, 27% being difficulty in consolidating information from different agencies which complicates the integration of lessons learned, and 20% being the absence of formal evaluation mechanisms which may prevent systematic learning from previous disasters.



Source: Primary Data 2025

Fig 4.4.6: Technological limitations

The figure above shows the technological limitations encountered by DMMU command centers in managing disaster preparedness. 16% being that outdated technology hampers real-time data collection and analysis, 22% being limited access to advanced communication tools during disasters, 25% being insufficient training on new technologies among staff, 23% being incompatibility between different systems used by agencies, and 14% being lack of funding for technology upgrades and maintenance.

4.5 Discussion of Results

The findings above show that the respondents or participants were 46% male and 54% female and the average age was 44.53 with a minimum age of 26 and the maximum age was 63. The highest level of education of the respondents was such that 13% had diplomas, 45% had bachelor's degrees, 32% had master's degrees, and 10% had PhDs. The level of education helped the respondent's understanding of the disaster preparedness and management concept.

The findings explain some of the types of training programs provided at disaster command centers to enhance preparedness. These are regular simulation exercises (e.g., fire drills, flood response simulations), specialized workshops on disaster risk reduction (DRR), community-based disaster preparedness training, and first aid and emergency medical response training. Some of the early warning systems put in place at disaster command centers are SMS and mobile alert systems, radio and television broadcast warnings, sirens and public address systems,

satellite and weather-monitoring technology, and while some lack functional early warning systems. The logistical preparedness measures implemented at disaster command centers are stockpiling of food and water supplies, pre-positioning of relief items (tents, blankets, medicines), and availability of emergency transportation (trucks, boats, helicopters). The literature review also showed how the National Civil Defense College (NCDC) in Nagpur plays a key role in training personnel for command center operations. Its programs cover incident command, chemical and biological disaster management, search and rescue, and first aid (NCDC, 2023). Regular capacity-building workshops and simulation exercises are conducted to ensure that EOC staff and responders remain operationally ready.

The results also show some of the ways in which disaster command centers engage communities in preparedness interventions. Some of which are through community awareness campaigns, some through disaster preparedness education in schools, some through collaboration with local leaders and traditional authorities, while some have minimal or no community engagement. The coordination mechanisms established at command centers for disaster preparedness are multi-agency coordination meetings (government, NGOs, military), development of standard operating procedures (SOPs), inter-district or regional information-sharing platforms, and simulation-based joint operations with stakeholders. A study by Lassa and Wiharta (2018) showed that effective engagement involves integrating local knowledge systems and modern technologies such as SMS alerts, community radio, and social media platforms, as well as community leaders in designing and disseminating warnings.

Technology plays several roles in disaster preparedness interventions at command centers. Some of which are the use of Geographic Information Systems (GIS) for hazard mapping, the use of digital platforms for real-time data collection and reporting, the use of drones for risk monitoring and assessment, and the use of AI-based disaster forecasting tools. Some of the capacity-building interventions implemented at disaster command centers to strengthen staff readiness are regular refresher courses on disaster management, leadership and decision-making training during crises, stress management and psychological support programs, and exchange programs or study tours with other command centers. According to UNDRR (2020), the integration of the Internet of Things (IoT) devices, weather monitoring systems, and artificial intelligence (AI) in EWS allows for faster detection and dissemination of hazard information.

The results show the specific disaster preparedness interventions being implemented in disaster prone areas. Some of which are workshop and training sessions for community members on emergency response, first aid, and evacuation procedures, installation of technology to provide timely alerts about impending disasters, strengthening of roads, bridges, and buildings to withstand disasters, and campaigns to educate the public about disaster risks and preparedness. Disaster preparedness interventions impact the resilience and recovery of communities in disaster-prone areas. From the findings, it can be noted that interventions improve community understanding of risks, leading to better preparedness and proactive measures, well-prepared communities can mobilize resources more effectively, resulting in quicker recovery from disasters, effective

interventions minimize physical, economic, and emotional losses during disasters, and communities gain confidence in their ability to respond, which enhances long-term resilience against future disasters. According to Paul (2019), specific disaster preparedness interventions being implemented in disaster prone areas are early warning systems which have proved to have significantly reduced mortality rates in coastal regions. Other interventions are training and simulation exercises which are regularly conducted to enhance readiness among respondents and communities (Paton and Johnston, 2017).

Some of the metrics and indicators used to measure the effectiveness of disaster preparedness interventions in disaster areas are measurements of the time taken to respond to a disaster after an alert is issued, time taken for communities to return to pre-disaster conditions, compared to previous events without interventions, assessment of skills acquired by community members through pre and post-training evaluations, and inventory checks of emergency supplies and equipment before and after interventions. Key factors that contribute to the success or failure of disaster preparedness interventions in different types of disaster scenarios are socio-economic, cultural, and geographical contexts which significantly influence the design and implementation of interventions, access to financial, human, and material resources which determine the scale and sustainability of interventions, the ability to modify interventions based on real-time assessments and feedback which lead to better outcomes, and the level of training provided to personnel and community members affects the success of interventions during disasters. According to the World Bank (2018), financial and resource availability play a pivotal role in ensuring sufficient funding and sustainability of preparedness measures such as infrastructure reinforcement, training programs, and stockpiling of emergency supplies.

The findings show the primary challenges faced by DMMU command centers in disaster preparedness and management processes. These were limited financial and human resources hinder effective planning and response, personnel may lack necessary skills and training, impacting their ability to respond effectively to disasters, poor infrastructure limits access to affected areas and hampers communication, and low levels of community awareness and participation undermines preparedness initiatives. Resource limitations affected the disaster preparedness and management capabilities of DMMU command centers. Limited funding restricts the ability to conduct training, buy equipment, and implement preparedness programs, insufficient personnel can lead to burnout and reduced effective response capacity, poorly maintained facilities may not support effective operations during emergencies, and resource limitations resulted in slower response time, exacerbating the impact of disaster. According to the GRZ (2021), resource limitations such as financial constraints are critical barriers to effective disaster preparedness and management. These restrict the ability of DMMU command centers to invest in early warning systems, emergency infrastructure, and community training programs. The DMMU command centers addressed issues related to communication and information sharing during disaster events by implementing standardized procedures for sharing information among agencies and stakeholders, leveraging communication tools like social media to disseminate information quickly during disasters,

conducting training exercises focused on effective communication strategies in disaster scenarios, and by developing centralized platforms for data sharing to ensure all stakeholders have access to critical information.

Technological limitations and infrastructure issues affected the disaster preparedness and management processes. Reliance on outdated communication and monitoring tools which can hinder effective response coordination, inadequate internet and telecommunications infrastructure which disrupts communication during disasters, lack of advanced data analytics capabilities which limits the ability to predict and assess disaster risks, and inaccessible roads which delay response teams and supplies from reaching affected areas. Challenges in integrating lessons learned from past disasters into current disaster preparedness and management strategies has affected the effectiveness of disaster preparedness and management. Failure to consistently document experiences and outcomes which in turn leads to loss of valuable insights, organizational inertia may hinder the adoption of new strategies based on past lessons, difficulty in consolidating information from different agencies which complicates the integration of lessons learned, and absence of formal evaluation mechanisms which may prevent systematic learning from previous disasters. Some of the technological limitations encountered by DMMU command centers in managing disaster preparedness are outdated technology hampers real-time data collection and analysis, limited access to advanced communication tools during disasters, insufficient training on new technologies among staff, incompatibility between different systems used by agencies, and lack of funding for technology upgrades and maintenance. According to UNDRR (2020), technological constraints often undermine the effectiveness of early warning systems which are crucial for detecting hazards and alerting communities in time.

5. Conclusion

Overall, the findings highlight the strengths and challenges of disaster preparedness and management strategies implemented by DMMU command centers. The presence of early warning systems, standardized operating procedures, and regular drills has improved response effectiveness, enabling command centers to handle various disaster scenarios efficiently. However, challenges such as limited financial and logistical resources, communication gaps between agencies, and poor infrastructure in disaster-prone areas hinder effective disaster response efforts. Despite these challenges, the use of technology, including GIS mapping, data analytics, and mobile applications, has significantly improved disaster risk assessment, communication, and real-time decision-making. The findings also indicate that disaster preparedness interventions in disaster-prone areas have played a crucial role in improving community resilience and recovery. Workshops, training sessions, early warning systems, infrastructure reinforcements, and public awareness campaigns have enhanced preparedness levels, enabling communities to better understand risks, mobilize resources efficiently, and recover more quickly from disasters. Some of the challenges faced by DMMU command centers are limited financial and human resources which restrict the ability to conduct necessary training, acquire essential equipment, and implement preparedness programs effectively. Despite these challenges, DMMU command

centers have taken steps to improve communication and information sharing through standardized procedures, centralized data platforms, and the use of social media for rapid dissemination of information. However, outdated technology, weak telecommunications infrastructure, and limited data analytics capabilities continue to pose barriers to effective disaster preparedness and response. These technological gaps slow down decision-making and reduce the effectiveness of early warning and risk assessment systems which are crucial for detecting hazards and alerting communities in time. While the current disaster preparedness strategies and protocols have proven effective in many areas, addressing resource constraints, improving inter-agency coordination, and enhancing training programs will further strengthen disaster response efforts and community resilience.

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