

Beyond Response: Reimagining Disaster Management For A Changing Climate Through Six Case Studies

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Abstract: *This paper examines disaster management paradigms through six case studies: Bangladesh, Puerto Rico, Myanmar, Sub-Saharan Africa, Australia, and the Philippines. The research focuses on reimagining traditional disaster management frameworks by moving beyond reactive responses toward proactive, climate-informed strategies. Findings indicate that conventional disaster management models often overlook long-term climate projections and the unique vulnerabilities of marginalised populations. The analysis reveals the necessity of shifting toward localised approaches that integrate climate data and foster community engagement, thereby enhancing resilience. Research limitations stem from the reliance on secondary data, which may not fully capture the nuanced challenges faced in specific regional contexts. Additionally, the findings may not be generalisable across all disaster-prone areas due to variations in socio-economic and political factors. Theoretical contribution includes an understanding of the interrelationship between climate adaptation and disaster management, emphasising the integration of humanitarian concerns into existing frameworks. This chapter also aligns with several United Nations Sustainable Development Goals (SDGs), particularly those related to climate action, sustainable cities, and reduced inequalities, showcasing how enhanced disaster management can contribute to broader sustainable development objectives. Practical impact is evident as the insights derived from this research can guide policymakers, NGOs, and local governments in creating more effective and equitable disaster management strategies that transcend mere response to emphasise prevention, preparation, and adaptation. By advocating for proactive measures and collaborative efforts, this chapter highlights the urgency of addressing the multifaceted challenges posed by climate change.*

Keywords: *Climate Change Adaptation, Disaster Management, Resilience, Community Engagement, Localised Approaches, Vulnerable Populations, Proactive Frameworks*

1. INTRODUCTION

The increasing frequency and intensity of climate-related disasters pose significant challenges to humanitarian efforts and disaster management frameworks worldwide. As the effects of climate change become more pronounced, vulnerable populations, particularly in resource-limited regions, face heightened risks from extreme weather events such as hurricanes, floods, droughts, and heatwaves. These disasters not only lead to immediate humanitarian crises but also exacerbate existing vulnerabilities, driving food insecurity, displacement, and long-term socio-economic challenges (IPCC, 2012; McMichael et al., 2012; UNDRR, n.d.-a). This paper aims to explore how disaster management decision-making frameworks must move beyond mere response to address the escalating risks associated with climate change while prioritising humanitarian needs. Moving beyond response means reimagining disaster management as a proactive, rather than reactive, endeavour that anticipates and mitigates climate-related risks before they materialise into catastrophes. It will examine existing disaster management frameworks and identify the modifications required to integrate climate projections and humanitarian concerns, such as food security and forced migration, effectively. This examination is crucial as traditional models often overlook long-term climate risks and the dynamic interplay between climate change and human vulnerability. By analysing key themes and gaps in the literature, this chapter will present strategies for enhancing preparedness and resilience in disaster-prone regions. Emphasis will be placed on the importance of incorporating localised climate data and fostering participatory planning processes that engage communities directly affected by these disasters. Case studies from various regions will illustrate successful adaptations of disaster management frameworks, providing practical insights for local governments, non-governmental organisations (NGOs), and policymakers. Ultimately, this paper seeks to contribute to the growing body of literature on disaster risk reduction and climate adaptation, offering actionable recommendations for integrating these critical elements into future disaster management strategies. Through this exploration, we aim to highlight the urgent need for a collaborative and holistic approach that ensures timely, equitable responses to the multifaceted challenges posed by climate change, thereby safeguarding at-risk populations and enhancing overall resilience in the face of an uncertain future.

By transcending conventional response-centric approaches, we can reimagine disaster management for a changing climate that is proactive, inclusive, and sustainable

2. Aims and Objectives

The aim of this research is to evaluate and enhance existing disaster management decision-making frameworks to better integrate climate change projections and humanitarian concerns. This research seeks to identify strategies that improve resilience and preparedness in vulnerable populations facing the increasing risks associated with climate-related disasters. The objectives include the following (Renaud et al., 2021; Zscheischler et al., 2018). First, to assess existing frameworks: Analyse current disaster management frameworks to identify their strengths and weaknesses in addressing climate change impacts and humanitarian needs. Second, to investigate selected case studies of climate-related disasters to extract lessons learned and best practices in disaster management, with a focus on community resilience and response strategies. Third, to highlight gaps in traditional disaster management models concerning long-term climate risks and human vulnerability, emphasising the need for adaptive planning. Fourth, to develop actionable recommendations for integrating localised climate data and participatory planning into disaster management frameworks to enhance resilience and ensure equitable responses to disasters. Finally, to provide insights that can inform policy documents and frameworks at local, national, and international levels, promoting the integration of climate adaptation into disaster risk reduction. The research questions attempt to answer the following: 1. What are the key strengths and weaknesses of existing disaster management frameworks in addressing climate change risks and humanitarian needs? 2. How have specific case studies of climate-related disasters demonstrated successful strategies for improving resilience and disaster response? 3. What gaps exist in traditional disaster management models regarding long-term climate risks and the vulnerabilities of affected populations? 4. What strategies can be implemented to effectively integrate localised climate data and community engagement into disaster management frameworks? 5. How can findings from this research contribute to the development of more effective policies and frameworks that address the intersection of climate change and humanitarian needs?

3. LITERATURE REVIEW

According to the Intergovernmental Panel on Climate Change (IPCC), climate change is now driving increases in the frequency, intensity, and unpredictability of such events, which in turn heighten risks to human lives, livelihoods, and ecosystems (IPCC, n.d.). To that end, five key types of climate-related disasters need to be outlined for the purpose of this research. Tropical cyclones (hurricanes, typhoons) are powerful storms which form over warm ocean waters and can cause devastating winds, heavy rainfall, and storm surges. As ocean temperatures rise due to global warming, cyclones are becoming more intense and damaging. The IPCC reports a rise in the intensity of tropical cyclones, with an observed increase in category 4 and 5 storms in recent decades (Feng et al., 2022; NCAS, n.d.). Cyclone Nargis (Myanmar, 2008) and Hurricane Maria (Puerto Rico, 2017) are prime examples of the severe humanitarian impacts of such events, particularly in vulnerable and resource-constrained areas (Kishore et al., 2018; Lateef, 2009; Seekins, 2009; Zorrilla, 2017). Floods occur due to excessive rainfall, overflowing rivers, or coastal surges, and can lead to significant displacement and loss of life. Climate change is causing more erratic and intense rainfall patterns, resulting in more frequent and severe floods (Lateef, 2009). The 2021 IPCC report highlights that "heavy precipitation events" are likely to become more frequent and intense in many regions, particularly in Asia and Sub-Saharan Africa (Intergovernmental Panel on Climate Change (IPCC), 2023). Bangladesh has been severely affected by flooding exacerbated by rising sea levels and increased monsoon rainfall, with millions displaced over the years (UNDP, 2020).

Droughts are prolonged periods of low rainfall, often leading to water scarcity, crop failures, and food insecurity. Climate change is intensifying drought conditions in many parts of the world, particularly in already arid and semi-arid regions. According to the World Meteorological Organisation (WMO), climate change is making droughts longer and more severe, particularly in Sub-Saharan Africa, the Middle East, and parts of North America (WMO, 2021). For example, prolonged droughts in the Horn of Africa have led to mass displacement and famine conditions (UNDP, n.d.). Heatwaves are extended periods of excessively high temperatures, which can lead to health crises, especially among vulnerable populations. Climate change is

increasing both the frequency and severity of heatwaves globally. The IPCC predicts that heatwaves, especially in urban areas, will become more frequent and longer-lasting as global temperatures continue to rise (IPCC, n.d.). The 2019 European heatwave, which broke temperature records across the continent, is a prime example of this trend (World Health Organisation, 2024). Wildfires are uncontrolled fires that spread rapidly in forested, grassland, or urban-fringe areas. Rising temperatures, prolonged droughts, and changing vegetation patterns due to climate change are increasing the likelihood and severity of wildfires. In 2019 and 2020, massive wildfires in Australia and California highlighted how rising temperatures and prolonged drought conditions contribute to the frequency and severity of fire events (Millar & Stephenson, 2015; Tyukavina et al., 2022). The World Bank reports that the risk of wildfire is projected to increase by 30% globally by 2050, if current warming trends continue (UNEP, 2022).

A. Humanitarian and Environmental Impacts

Climate-related disasters have far-reaching consequences, especially in vulnerable regions. For example, tropical cyclones, floods, and rising sea levels displace millions annually, with the UN High Commissioner for Refugees (UNHCR) estimating that around 21.5 million people are displaced each year by climate-related events (UNHCR, n.d.). These disasters disrupt food and water security, increase the risk of infectious diseases, and exacerbate poverty and inequality, particularly in low-income countries. Moreover, the environmental impacts are significant, including loss of bio-diversity, degradation of ecosystems, and long-term damage to vital resources such as forests and freshwater systems. The scientific consensus is clear, climate change acts as a "risk multiplier" that exacerbates existing vulnerabilities and amplifies the intensity of natural hazards. In a world with higher temperatures, extreme weather events are expected to become more frequent, severe, and unpredictable. For regions already experiencing political instability, resource scarcity, or poverty, these climate-related disasters pose unprecedented challenges for disaster management and humanitarian relief efforts (Birkmann & von Teichman, 2010). The increasing frequency and severity of natural disasters due to climate change pose critical challenges to traditional disaster management frameworks. Climate change has amplified the risks faced by vulnerable populations, particularly in resource-limited and disaster-prone regions (IPCC, 2012). Addressing these challenges requires a re-evaluation of existing disaster management systems to ensure they integrate climate projections and humanitarian concerns effectively. This literature review explores the current frameworks and highlights the gaps, focusing on how these can be adapted to meet the growing humanitarian needs, such as food security and displacement, in light of climate change.

B. Traditional Disaster Management Frameworks and their Limitations

Traditional disaster management frameworks have been centred around risk reduction, response, and recovery, often without fully integrating long-term climate risks. These models are primarily designed to manage immediate threats rather than addressing the slow-onset and compounding effects of climate change (Birkmann et al., n.d.; Birkmann & von Teichman, 2010). As the frequency and intensity of disasters rise, there is a growing recognition that conventional models are ill-equipped to deal with the complexities of climate-related risks. Some argue that successful adaptation to climate change must occur across multiple scales, requiring an integration of both local and global perspectives (Adger et al., 2005). However, most traditional models lack this multi-scale approach, often failing to incorporate localised climate data and knowledge. These gaps in disaster management frameworks result in increased vulnerability for marginalised populations, who are less likely to benefit from standardised response measures (Boano et al., 2008).

C. The Integration of Climate Projections into Disaster Management

As climate change projections become more precise, they offer valuable insights into the future risks of extreme weather events, sea-level rise, and other hazards. Current disaster management frameworks must evolve to incorporate these projections, enabling more proactive and long-term planning. Some emphasise the importance of integrating disaster risk reduction (DRR) with climate change adaptation (CCA), noting that both fields share overlapping objectives, such as enhancing resilience and reducing vulnerabilities. Despite this alignment, challenges remain in operationalising the integration of climate adaptation into disaster management strategies (Nemakonde et al., 2021). One significant hurdle is the need for more granular climate data at the local level. Many regions still rely on broad climate models that may not capture localised risks. They suggest that enhancing preparedness will require frameworks that integrate local risk assessments and involve community engagement, ensuring that responses are tailored to specific vulnerabilities (Moser & Ekstrom, 2010).

D. Humanitarian Needs and Vulnerability in the Context of Climate Change

Humanitarian concerns, such as food insecurity, forced displacement, and health crises, are becoming more acute due to climate change. Some discuss how environmental degradation and extreme weather events are contributing to forced migration, particularly in regions where livelihoods are closely tied to natural resources. Current disaster management frameworks often overlook these slow-onset impacts, focusing instead on sudden disasters like earthquakes or floods (Jayawardhan, 2017). However, others point out, a holistic approach to adaptation must address both immediate and long-term threats to human security. Humanitarian responses must also prioritise equity and inclusivity. Vulnerable populations, such as women, children, and the elderly, are disproportionately affected by climate change (Araos et al., 2021). Disaster management frameworks must therefore ensure that their decision-making processes include the voices of these communities through participatory planning. This not only enhances the effectiveness of response measures but also empowers at-risk populations to take a more active role in their own protection.

E. Customising Frameworks for Local Contexts through Case Studies

Case studies from various regions illustrate the importance of tailoring disaster management frameworks to the specific needs of local communities. Some highlight successful examples where local governments and NGOs have collaborated to develop more flexible and adaptive disaster management strategies. These customised frameworks prioritise community engagement, allowing for more context-specific risk assessments and solutions. Some discuss a case in which flexible planning and community participation helped a coastal community in the United States adapt to increasing flood risks. Such examples underscore the importance of integrating climate projections and local knowledge into decision-making frameworks, ensuring that disaster responses are not only timely but also equitable and sustainable. The intensification of climate change impacts calls for an urgent rethinking of disaster management decision-making frameworks. Traditional models that focus on immediate disaster responses are increasingly inadequate in addressing the long-term risks posed by climate variability. This review highlights the need for integrating climate projections, human vulnerability, and participatory planning into disaster management strategies.

F. Positioning of Current Chapter

Positioning this research within the existing body of literature involves highlighting its contributions to the field of disaster management, climate change adaptation, and humanitarian response. To contextualise it within current literature, the research builds on existing studies that critique traditional disaster management frameworks for their lack of integration with climate change adaptation. This is reflected in Table I.

Table I. Literature Review Summary

Source	Key Theme	Contribution	Identified Gaps	Opportunities for Future Research
(Adger et al., 2005)	Adaptation across scales	Provides insights into how adaptation to climate change can be successful across different scales, emphasising the importance of multi-level governance.	Lack of specific focus on humanitarian concerns such as forced displacement and food security.	Investigating how multi-scale adaptation can be applied specifically to vulnerable populations facing displacement and food insecurity due to climate change.
(Birkmann et al., n.d.)	Integrating DRR and CCA	Highlights the need to integrate Disaster Risk Reduction (DRR) with Climate Change Adaptation (CCA) for more comprehensive resilience strategies.	Limited operational guidelines for integrating DRR and CCA in local contexts.	Developing frameworks for integrating DRR and CCA with specific local case studies, focusing on community engagement and contextualising global models to local vulnerabilities.

(Boano et al., 2008)	Environmentally displaced people	Examines the linkages between environmental degradation and forced migration, emphasising the need to address these factors in disaster management.	Insufficient emphasis on integrating climate projections with long-term migration patterns and resource scarcity.	Exploring how climate projections can be used to predict and manage future patterns of forced displacement, especially in resource-limited regions prone to climate impacts.
(IPCC, n.d.)	Climate change and extreme weather events	Offers up-to-date projections of climate change's impacts, particularly regarding the increasing frequency and intensity of extreme weather events.	Lack of focus on translating these projections into practical disaster management strategies for humanitarian contexts.	Utilising IPCC data to enhance disaster management frameworks that are proactive in nature, allowing for climate projections to inform local response and preparedness efforts.
(Moser & Ekstrom, 2010)	Barriers to climate change adaptation	Proposes a diagnostic framework for identifying barriers to climate change adaptation, including social, institutional, and technical obstacles.	Framework lacks specific focus on how these barriers affect disaster-prone regions with high humanitarian needs.	Expanding the framework to address barriers in high-risk areas, incorporating local knowledge and stakeholder engagement to improve adaptive capacity in disaster management.

Table I emphasises the need for these frameworks to evolve in response to the increasing frequency and intensity of climate-related disasters. It also acknowledges the growing body of literature linking climate change to humanitarian crises, especially in resource-limited regions. By focusing on the intersection of climate change and humanitarian needs, the research fills a critical gap in understanding how disaster management can better serve vulnerable populations. This leads to identification of gaps in existing literature regarding the long-term climate risks and vulnerabilities faced by marginalised communities. It highlights the inadequacies of current disaster management models that often overlook the socio-economic factors exacerbating these vulnerabilities. It also identifies the need for participatory approaches in disaster management that are informed by localised climate data, which is underrepresented in existing studies. To that end this research contributes to theoretical frameworks by proposing an integrated approach that combines disaster risk reduction with climate adaptation strategies. It suggests actionable insights that can inform future research and practice in disaster management. The focus on case studies provides practical examples of successful strategies, demonstrating the potential for adaptation and resilience in disaster-prone regions. The findings have implications for policy frameworks such as the Sendai Framework for Disaster Risk Reduction and the Paris Agreement. The research underscores the need for these policies to be translated into local action, thus contributing to ongoing discussions about effective climate adaptation and disaster response at multiple governance levels. Finally, the research opens avenues for future studies to explore the effectiveness of integrated disaster management frameworks in various contexts, particularly in low- and middle-income countries. It encourages further investigation into the role of community engagement and local knowledge in shaping disaster management strategies. In summary, this research positions itself as a critical contribution to the existing literature on disaster management and climate change by addressing the gaps in traditional models and proposing integrated frameworks that prioritise humanitarian needs. By combining theoretical insights with practical case studies, it aims to enhance understanding and inform both policy and practice in managing climate-related disasters.

4. Theoretical Basis

To conduct this research, theoretical frameworks were considered to provide a foundation for understanding the interplay between disaster management, climate adaptation, and humanitarian needs. The first theory to be considered was Sendai Disaster Risk Reduction (DRR) theory (UNDRR, n.d.-b). The Sendai Framework focuses on reducing vulnerabilities and risks associated with disasters through preparedness, response, and recovery strategies. It emphasises proactive measures to mitigate disaster impacts rather than merely responding after they occur. This framework is critical for understanding how to integrate climate change projections into disaster management frameworks. By adopting a Disaster Risk Reduction (DRR) perspective, this research highlights the importance of anticipating risks, enhancing community resilience, and ensuring that disaster management strategies align with long-term sustainability goals. Another relevant theory is Vulnerability Theory, which examines the factors that make individuals and communities susceptible to harm in the face of environmental hazards. It considers socioeconomic, political, and cultural dimensions that contribute to vulnerability. This research emphasises the need to address the unique vulnerabilities of marginalised populations in disaster-prone areas. By applying Vulnerability Theory, the research provides insights into how climate-related disasters disproportionately affect certain groups and advocates for more equitable disaster response mechanisms (Limongi & Galderisi, 2021; Turesson et al., 2024). Climate change adaptation frameworks were also considered as they outline strategies and processes for adapting to the impacts of climate change. They focus on improving resilience and reducing exposure to climate risks through various measures, including infrastructure development, policy reform, and community engagement (UNDP, 2024; UNFCCC, n.d.; World Bank Group, 2019). This research is rooted in the recognition that climate change poses significant challenges to disaster management. By integrating climate adaptation frameworks into disaster management decision-making, the research underscores the necessity of preparing for both immediate and long-term impacts of climate change. The suggestions provided are also based on participatory approaches which emphasise the involvement of communities in decision-making processes, ensuring that their knowledge, needs, and perspectives are taken into account. This approach aims to empower communities and enhance their agency in managing risks. The research advocates for increased community engagement in disaster management, drawing on participatory theory to propose strategies for involving local populations in resilience-building efforts. This engagement is crucial for developing tailored solutions that address the specific vulnerabilities and needs of affected communities (Collins et al., 2018; Mussehl et al., 2023). While all the mentioned theories provide valuable perspectives on integrating climate adaptation into disaster management, Disaster Risk Reduction (DRR) theory is arguably the most relevant for this research for the following reasons. First, DRR theory emphasises proactive risk reduction before disasters occur, aligning perfectly with the goal of integrating climate change projections into disaster management. By encouraging anticipation and mitigation of potential impacts, DRR moves beyond reactive measures and fosters long-term resilience. Second, DRR is inherently linked to climate adaptation strategies, as both aim to build resilience and reduce vulnerabilities. This research explores how disaster management frameworks can be modified to better incorporate climate risks, making DRR an ideal theoretical lens for this integration. Third, DRR theory promotes a comprehensive approach, encompassing preparedness, response, recovery, and mitigation. This holistic perspective is essential for effectively addressing the growing risks posed by climate change. Finally, numerous case studies and empirical evidence support the effectiveness of DRR strategies in reducing disaster impacts, reinforcing its credibility as a well-established framework in both research and practice (Dhar et al., 2023; Mysiak, 1993; UNDRR, n.d.-a).

5. METHODS

The methodology focuses on secondary data through a structured approach. First, a systematic literature review was conducted to critically examine existing disaster management frameworks, climate adaptation strategies, and humanitarian concerns. In the context of this research on disaster management frameworks and climate adaptation, the regions most vulnerable to climate change include Sub-Saharan Africa, Southeast Asia, Small Island Developing States (SIDS), and South Asia. These regions face significant climate-related challenges such as droughts, food insecurity, flooding, typhoons, sea-level rise, and displacement, making them critical case studies for analysing the integration of climate projections into disaster management strategies. The data sources for this research include Google Scholar, Scopus, Web of Science, and JSTOR, as

well as reports from the UN, World Bank, IPCC, and IFRC. To assess the volume of literature, systematic searches were conducted across these platforms, yielding approximately 15,872 articles from Google Scholar, 5,232 peer-reviewed articles from Scopus, 4,578 from Web of Science, 2,123 from JSTOR, and 1,567 from PubMed. Applying the inclusion criteria—relevance, peer-review status, geographic focus, and publication date (from 2014 onwards)—and excluding irrelevant, non-peer-reviewed, and outdated sources, narrowed down these results, providing a focused set of literature for in-depth analysis. After conducting systematic searches across several academic databases using the keywords "climate change", "disaster management", "humanitarian needs", "resilience", "community engagement" and "sustainable development" the following number of relevant works were identified for each case study in Table II.

Table II. Search Results by Database and Disaster Case Study

Disaster	Google Scholar	Scopus	Web of Science	JSTOR	PubMed
Cyclone Nargis in Myanmar (2008)	1,534	843	743	359	205
Hurricane Maria in Puerto Rico (2017)	1,398	602	578	243	152
Heatwaves and Drought in Sub-Saharan Africa	2,098	1,423	954	465	306
Flooding in Bangladesh (2007 and onward)	1,897	976	806	343	254
Wildfires in Australia (2019-2020)	1,000	523	483	204	154
Typhoon Haiyan in the Philippines (2013)	1,585	893	783	304	204

By reviewing only cases where the study extracted insights on practical framework modifications that integrate localised climate projections, community engagement, and resilience-building strategies, the search was further narrowed down to the studies on practical framework modifications integrating localised climate projections, community engagement, and resilience-building strategies, where terms like "localised climate projections," "community engagement in disaster management," and "resilience-building strategies" were used. This filtered out broader studies, leaving those that specifically address the integration of these elements into disaster management frameworks. Additionally, a policy and framework analysis evaluated disaster management and climate adaptation policies that have been proposed or implemented by governments and international organisations.

Table III. Narrowed Search Results by Case Study

Disaster Case Study	Narrowed to Practical Framework	Policy Framework & Analysis	Quantitative Data	Total
Cyclone Nargis	23	24	38	85
Hurricane Maria	15	15	29	59
Heatwaves and Drought in Sub-Saharan Africa	34	26	49	109
Flooding in Bangladesh	23	23	36	82
Wildfires in Australia	16	15	25	56
Typhoon Haiyan in the Philippines	26	26	30	82

The key policy documents reviewed in this study include six frameworks and reports addressing climate change, disaster risk reduction, and resilience. These include the Adaptation and Resilience in ASEAN: Managing Disaster Risks from Natural Hazards report by GOV.UK, which outlines strategies for managing disaster risks in the ASEAN region. The UNDRR's Climate Action and Disaster Risk Reduction document highlights the integration of climate change and disaster management strategies. Additionally, the Sendai Framework for Disaster Risk Reduction and the World Bank's Action Plan on Climate Change Adaptation and Resilience provide global guidelines for reducing disaster risks and improving resilience to climate impacts. Other significant resources include the World Health Organisation's report on Heat and Health, the UNFCCC's Adaptation and Resilience overview, and the IPCC's Managing Risks of Extreme Events and Disasters to Advance Climate Change Adaptation, all of which emphasise the need for comprehensive climate

adaptation strategies and resilience-building in the face of increasing climate-related risks. These documents provide a critical foundation for analysing the intersection of climate risks and humanitarian needs, informing the development of effective disaster management frameworks. This analysis focused on identifying the strengths and limitations of current policies, particularly regarding the inclusion of climate data and localised risks. Lastly, existing quantitative data from publicly available sources, such as the World Bank, UNHCR, and IPCC, is used to complement the qualitative findings. Statistical data on disaster occurrence, climate change impacts, and humanitarian crises will be analysed to provide empirical support for the research. The study will then synthesise these findings to develop a conceptual framework that integrates climate change projections with disaster management and humanitarian needs, using secondary data to ensure that it aligns with best practices.

A. Data

First case is Cyclone Nargis in Myanmar (2008) through UN OCHA and reports from the Red Cross examines disaster preparedness, community response, and the role of international aid in a resource-limited country, with an emphasis on forced displacement and food insecurity (Lateef, 2009; Seekins, 2009). Second case focuses on Hurricane Maria in Puerto Rico (2017) through U.S. Federal Emergency Management Agency (FEMA) reports and academic studies on climate resilience to focus on how a developed region faced disaster with limited preparedness, and the long-term impacts on food security, infrastructure, and forced migration due to climate change (Kishore et al., 2018; Zorrilla, 2017). The third case is heatwaves and Drought in Sub-Saharan Africa through Reports from the World Bank and UNHCR, examining how climate-driven events lead to forced displacement (UNDP, n.d.). This case emphasises how localised climate impacts, such as drought, intersect with food security and displacement, offering a practical look at climate adaptation strategies. The fourth case is flooding in Bangladesh (2007 and onward) through academic literature, UNDP reports, and World Bank documentation (UNDP, 2020). Bangladesh's experience in integrating disaster risk reduction with climate change adaptation, particularly focusing on community-based early warning systems and localised climate projections. Fifth case is a set of Wildfires in Australia (2019-2020) is examined through reports from Australian government agencies and international humanitarian organisations like the International Federation of Red Cross and Red Crescent Societies (IFRC) (du Parc, 2020; International Federation of Red Cross and Red Crescent Societies, 2010). This case demonstrates how a country with relatively strong infrastructure still faced significant humanitarian challenges, including forced displacement and long-term recovery needs exacerbated by climate change. And finally typhoon Haiyan in the Philippines (2013) through UN OCHA, World Bank reports, and academic studies on recovery and adaptation (Santos et al., 2015; OXFAM, 2013; Bowen, T., 2015; WorldBank, 2013). This is a case of extreme weather compounded by climate change, with a focus on humanitarian assistance, recovery, and integration of climate projections into rebuilding efforts.

B. Policy Documents

Another set of policy documents under review includes the Sendai Framework for Disaster Risk Reduction (2015-2030) from the UN Office for Disaster Risk Reduction (UNDRR). This global framework emphasises resilience and preparedness, particularly in developing countries vulnerable to climate change. Another key document is the Paris Agreement (2015) from the United Nations Framework Convention on Climate Change (UNFCCC). As the cornerstone of global climate policy, it provides critical context for how countries are mandated to integrate climate adaptation into their disaster management strategies. The Intergovernmental Panel on Climate Change (IPCC) reports (2023 update) from the IPCC Working Groups present the latest scientific data on climate change projections, the impacts of extreme weather events, and adaptation strategies that must be incorporated into disaster management. The UNHCR Policy on Climate Change and Displacement (2019) focuses on how climate change contributes to forced migration and how disaster management frameworks can be adapted to anticipate and respond to displacement caused by environmental factors. The World Bank's Climate Change Action Plan (2021-2025) is a policy document outlining how climate finance can support resilience-building in vulnerable regions, with a specific focus on disaster management and humanitarian response. The National Climate Change Action Plan (Kenya, 2018-2022) from the Government of Kenya is a country-specific policy that integrates climate adaptation strategies into disaster risk management, emphasising food security and displacement risks in drought-prone areas.

Another country-specific document is the FEMA National Response Framework (2020 update) from the U.S. Federal Emergency Management Agency (FEMA), which provides insights into how the U.S. government integrates climate change projections into disaster preparedness and emergency response efforts. At a continental level, the African Union's Agenda 2063 (Climate and Disaster Risk Management) outlines long-term strategies for climate adaptation and disaster risk reduction, with a focus on resource-limited regions. Finally, the Global Humanitarian Response Plan (COVID-19, 2020) by UN OCHA and various international NGOs offers insights into large-scale humanitarian responses during global crises, drawing parallels with disaster management strategies in the context of climate change.

C. Descriptions

Cyclone Nargis in Myanmar (2008) was one of the deadliest tropical cyclones ever recorded, devastating Myanmar in May 2008. It led to nearly 140,000 deaths and displaced millions, mainly in the Irrawaddy Delta region, where the storm surge flooded vast areas of farmland and villages. The disaster exposed significant gaps in Myanmar's disaster preparedness and response capacity, particularly in a resource-constrained setting. International organisations like the UN OCHA and the Red Cross played a critical role in the humanitarian response, providing food, shelter, and medical assistance in the aftermath (Lateef, 2009; NASA Earth Observatory, 2008; Seekins, 2009). Hurricane Maria in Puerto Rico (2017), a Category 5 storm, caused widespread devastation in Puerto Rico, particularly impacting infrastructure, electricity, and water systems. The hurricane left over 3,000 people dead and led to a humanitarian crisis, with delays in response and recovery efforts highlighting vulnerabilities in disaster preparedness. Climate change is believed to have intensified the storm, as rising sea surface temperatures contributed to its rapid intensification. Reports from FEMA and other organisations emphasised the need for stronger climate adaptation measures and disaster risk reduction frameworks (Kishore et al., 2018; Zorrilla, 2017). Heatwaves and Drought in Sub-Saharan Africa (2010s) affected Sub-Saharan Africa which has been increasingly affected by prolonged droughts and heatwaves, exacerbated by climate change. These events have contributed to widespread food insecurity, water scarcity, and forced migration, particularly in regions like the Sahel. Drought conditions in the Horn of Africa during the 2010s led to famine-like conditions and displaced millions, with humanitarian organisations like the UNHCR providing aid to affected populations. These events have underscored the need for integrating climate adaptation strategies into disaster management frameworks (UNDP, n.d.). Flooding in Bangladesh (2007 and onward), one of the most flood-prone countries in the world, has experienced increasingly severe flooding due to climate change. Rising sea levels, more intense monsoon rains, and upstream river flow have caused devastating floods that displace millions annually, disrupt agriculture, and threaten food security. The floods of 2007 were particularly catastrophic, prompting large-scale responses from international organisations such as UNDP and the World Bank. These floods have pushed the government to integrate climate projections into disaster risk reduction plans and early warning systems (Foo et al., 2023; UNDP, 2020). Wildfires in Australia (2019-2020) were some of the worst in the country's history, burning over 18 million hectares of land and causing massive environmental and economic damage. The fires were driven by extreme heat and prolonged drought, both exacerbated by climate change. Thousands of homes were destroyed, and 33 people lost their lives, while millions of animals were killed or displaced. The event highlighted the urgent need for comprehensive fire management strategies that incorporate climate projections, as well as improved community preparedness (Tyukavina et al., 2022). Typhoon Haiyan in the Philippines (2013) mostly named as Yolanda was one of the strongest tropical storms ever recorded, struck the Philippines in November 2013, causing widespread destruction and killing over 6,000 people. The storm displaced millions and severely impacted livelihoods, particularly in coastal areas. The scale of the disaster and the rapid intensification of the typhoon have been linked to rising ocean temperatures due to climate change. The response from the international community, including UN OCHA and the World Bank, emphasised the need for integrating climate resilience into disaster recovery and rebuilding efforts. A summary of these cases can be found in Table IV.

Table IV. Summary of Disaster Case Studies

Disaster Case Study	Death Toll	Main Impact	Key Humanitarian Response
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Cyclone Nargis in Myanmar (2008)	140,000+	Flooding, farmland destruction, gaps in disaster preparedness	UN OCHA, Red Cross: Food, shelter, and medical assistance
Hurricane Maria in Puerto Rico (2017)	3,000+	Infrastructure damage, humanitarian crisis, intensification from climate change	FEMA: Need for stronger adaptation measures and risk reduction frameworks
Heatwaves and Drought in Sub-Saharan Africa (2010s)	Thousands displaced	Food insecurity, water scarcity, forced migration, droughts	UNHCR: Aid for affected populations, need for climate adaptation in disaster management
Flooding in Bangladesh (2007 and onward)	Millions displaced	Severe flooding, disruption of agriculture, food security threatened	UNDP, World Bank: Integration of climate projections into risk reduction plans
Wildfires in Australia (2019-2020)	33 dead, millions displaced	Massive wildfires, environmental and economic damage, loss of homes	International response: Comprehensive fire management and community preparedness
Typhoon Haiyan in the Philippines (2013)	6,000+ dead	Severe destruction, coastal area damage, rapid intensification linked to climate change	UN OCHA, World Bank: Emphasising climate resilience in recovery efforts

On the Policy side, The Sendai Framework emphasises disaster risk reduction (DRR) by integrating climate adaptation, reducing vulnerability, enhancing preparedness, promoting local engagement, and utilizing climate data for informed policy-making to strengthen global resilience against disasters (UNDRR, n.d.-b). The Paris Agreement aims to limit global warming below 2°C, requiring nations to integrate climate adaptation into development, enhance resilience, and finance adaptation efforts, especially for vulnerable countries and communities (UNFCCC, n.d.). The 2023 IPCC report warns of rising climate disasters like cyclones, floods, and wildfires, emphasising the need to integrate climate projections into disaster management to mitigate future risks (IPCC, n.d.). The UNHCR policy addresses climate-induced displacement, emphasising protection, adaptation, and collaboration with governments and organisations to tackle root causes and integrate climate strategies into humanitarian responses (UNHCR, n.d., 2019, 2022). The World Bank's Climate Change Action Plan supports climate resilience by investing in infrastructure, early warning systems, and social protection, prioritizing disaster-prone regions and climate-vulnerable populations.

6. Analysis

The analysis of climate-related disasters reveals key lessons for improving disaster management strategies. Cyclone Nargis (2008) and Hurricane Maria (2017) highlighted the need for better early warning systems, resilient infrastructure, and rapid responses. Both cases exposed gaps in integrating climate projections into disaster preparedness, particularly affecting vulnerable populations (Lateef, 2009; Seekins, 2009). Sub-Saharan Africa's droughts and heatwaves show how climate change worsens food insecurity and migration, underscoring the need for climate resilience in socio-economic planning (UNDP, 2024). Bangladesh's progress in flood management is a model, but increasing flood intensity challenges its resources, demonstrating the need for international support (Foo et al., 2023; UNDP, 2020). The 2019-2020 Australian wildfires revealed gaps in fire management, emphasising the importance of integrating climate data into strategies (Tyukavina et al., 2022). Typhoon Haiyan (2013) exposed the vulnerability of coastal communities to severe storms, stressing the need for climate risk assessments in rebuilding (Santos et al., 2015; World Bank, 2013). These case studies underscore the necessity of incorporating climate projections into disaster management frameworks. The analysis of these case studies and policy documents reveals the complex relationship between climate-related disasters and existing disaster management frameworks.

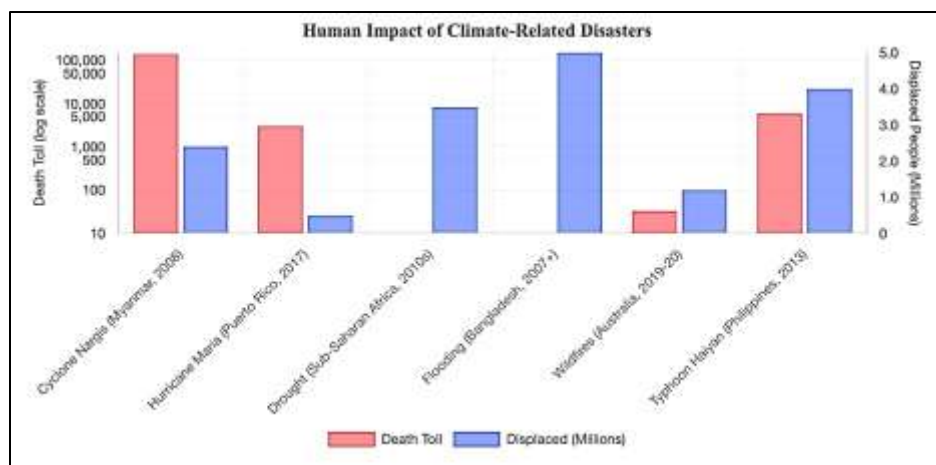


Fig. 1 Impact of Climate-Related Disasters Across Case Studies

The increasing frequency and intensity of extreme weather events underscore the urgency of integrating climate projections and adaptation strategies into disaster risk reduction plans (IPCC, n.d.; UNDRR, n.d.-a). Vulnerable regions such as Sub-Saharan Africa, Bangladesh, and island nations like the Philippines and Puerto Rico face significant challenges in managing these disasters, often due to inadequate infrastructure, governance issues, and limited financial resources (Adger et al., 2005; UNDRR, n.d.-b). Policy documents such as the Sendai Framework and the Paris Agreement provide a strong foundation for integrating climate adaptation into disaster management, but their implementation remains uneven across regions (Birkmann et al., n.d.). Case studies highlight that, while progress has been made in some areas (e.g., flood management in Bangladesh), significant gaps remain in preparedness, early warning systems, and equitable disaster responses. Effective disaster management in the face of climate change requires a shift towards more localised, participatory approaches that account for long-term climate risks and the unique vulnerabilities of at-risk populations (Araos et al., 2021; Moser & Ekstrom, 2010). Additionally, international support in the form of financing, technological assistance, and capacity-building is crucial for countries that are on the frontlines of climate-related disasters (UNDP, 2024; World Bank Group, 2019). The analysis of case studies and policy documents provides valuable insights into the management of climate-related disasters and the effectiveness of existing frameworks as demonstrated in Table V.

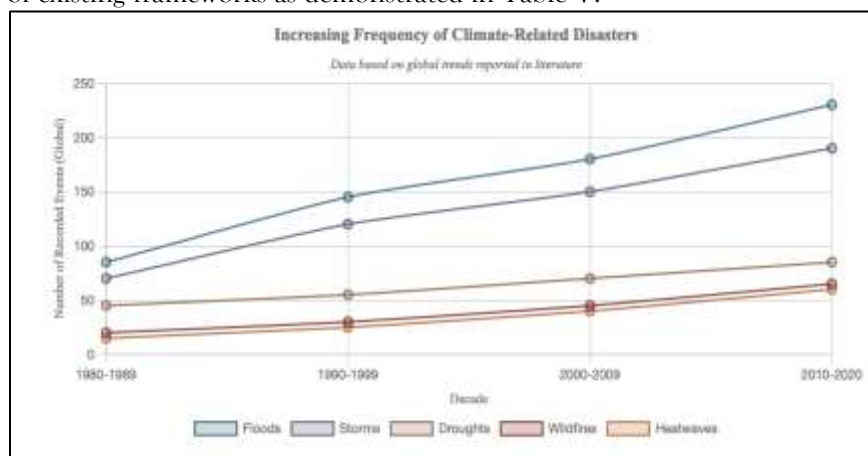


Fig. 2 Global Trends in Climate-Related Disasters (1980-2020)

Figure 2 illustrates the global trends in climate-related disasters from 1980 to 2020, broken down into four decade intervals. The line graph tracks five major categories of disasters—floods, storms, droughts, wildfires, and heatwaves—all showing significant upward trajectories over the 40-year period. Floods demonstrate the most dramatic increase, rising from approximately 85 recorded events in 1980-1989 to 230 in 2010-2020, followed closely by storms which increased from 70 to 190 events. Droughts, wildfires, and heatwaves, while starting from lower baselines, show proportionally similar upward trends. This visualization provides empirical support for the paper's central premise that climate change is driving an escalation in both frequency

and intensity of extreme weather events, underscoring the urgent need for disaster management frameworks to evolve beyond reactive approaches toward proactive, climate-informed strategies.

The key findings from assessing the case studies are six fold. First are common themes across the case studies. For example significant impact of climate-related disasters on vulnerable populations, exacerbated by inadequate preparedness and response mechanisms. Events such as Cyclone Nargis and Hurricane Maria illustrate that both local and international responses can be hampered by a lack of effective early warning systems and coordination. Similarly, heatwaves and droughts in Sub-Saharan Africa highlight the urgent need for comprehensive climate adaptation strategies to mitigate food insecurity and displacement (Boano et al., 2008). Also the analysis reveals notable gaps in existing disaster management frameworks, particularly in their ability to incorporate long-term climate projections and local data. For instance, while Bangladesh has made strides in flood management, its adaptation measures still fall short in addressing future climate risks, such as rising sea levels (UNFCCC, n.d.). In Australia, the wildfires of 2019-2020 exposed the deficiencies in traditional fire management practices, emphasising the need for adaptive strategies informed by current climate data (Zscheischler et al., 2018). The case studies also demonstrate that marginalised communities often bear the brunt of climate-related disasters. In regions like Puerto Rico and the Philippines, socio-economic factors, such as poverty and political barriers, hinder effective disaster response (McMichael et al., 2012). This pattern highlights the necessity for equitable disaster management approaches that prioritise the needs of vulnerable populations and ensure inclusive participation in planning processes (Collins et al., 2018). The analysis of policy documents, such as the Sendai Framework and the Paris Agreement, indicates that while these frameworks set ambitious goals for disaster risk reduction and climate adaptation, their implementation remains inconsistent. The challenges faced by developing nations in accessing financial resources and technical support impede the effectiveness of these policies. Furthermore, the IPCC reports emphasise the critical need for local governments to translate scientific data into actionable policies, a task that many still struggle with (IPCC, 2012). To improve disaster management in the context of climate change, it is essential to adopt a more localised and participatory approach. This includes integrating community knowledge and localised climate data into disaster risk reduction frameworks (Birkmann et al., n.d.). Building resilience requires not only robust infrastructure and early warning systems but also comprehensive policies that address underlying socio-economic vulnerabilities (Moser & Ekstrom, 2010). The findings underscore the importance of international support for vulnerable nations. Capacity-building initiatives, funding for climate adaptation projects, and technical assistance are crucial for empowering these countries to respond effectively to climate-related disasters (World Bank Group, 2019). The analysis reveals a pressing need to reevaluate and strengthen disaster management frameworks in light of climate change.

Table V. Key Findings from Case Studies

Key Findings	Details
Common Themes	Climate-related disasters significantly impact vulnerable populations, often due to inadequate preparedness and response mechanisms.
Identified Gaps	Existing disaster management frameworks struggle to incorporate long-term climate projections and local data.
Patterns of Vulnerability	Marginalised communities bear the brunt of disasters, with socio-economic factors hindering effective disaster response and recovery efforts.
Policy Effectiveness	While frameworks like the Sendai Framework and Paris Agreement set ambitious goals, their implementation is inconsistent and often lacks local actionability.
Recommendations for Integration	A localised and participatory approach is essential, incorporating community knowledge and climate data into disaster risk reduction strategies.
Call for International Support	International support is crucial for vulnerable nations through capacity-building, funding, and technical assistance to enhance their disaster response efforts.

Table V synthesises the critical findings from six climate-related disaster case studies, organising insights into six categories: common themes, identified gaps, vulnerability patterns, policy effectiveness, integration

recommendations, and international support needs. The table reveals how climate disasters disproportionately impact vulnerable populations due to inadequate preparedness mechanisms, highlights the struggle of existing frameworks to incorporate long-term climate projections, and demonstrates how socio-economic factors hinder effective disaster response in marginalised communities. It contrasts ambitious policy goals with inconsistent implementation and advocates for localised, participatory approaches that integrate community knowledge with climate data. This structured summary provides a comprehensive overview of the research findings that inform the paper's recommendations for reimagining disaster management in a changing climate. By addressing the identified gaps and integrating effective strategies from successful case studies, policymakers can enhance resilience and preparedness in disaster-prone regions. The collaborative efforts of local communities, governments, NGOs, and international organisations are essential to protect vulnerable populations and ensure equitable disaster responses in the face of an increasingly unpredictable climate.

7. DISCUSSION

The findings from the research directly address the five objectives outlined in the study as demonstrated in Table VI.

Table VI. Alignment of Findings with Research Questions

Research Questions	Findings
1. What are the key strengths and weaknesses of existing disaster management frameworks in addressing climate change risks and humanitarian needs?	Existing frameworks often struggle to incorporate long-term climate projections and local data, with significant gaps in preparedness and response mechanisms identified in case studies.
2. How have specific case studies of climate-related disasters demonstrated successful strategies for improving resilience and disaster response?	Case studies (e.g., Bangladesh's flood management and Australia's wildfire response) reveal successful strategies such as community engagement and early warning systems, but implementation varies.
3. What gaps exist in traditional disaster management models regarding long-term climate risks and the vulnerabilities of affected populations?	Notable gaps include inadequate adaptation strategies for rising sea levels and extreme weather events, as well as socio-economic factors hindering effective responses in marginalised communities.
4. What strategies can be implemented to effectively integrate localised climate data and community engagement into disaster management frameworks?	Recommendations emphasise a localised and participatory approach, advocating for the integration of community knowledge and climate data into disaster risk reduction strategies.
5. How can findings from this research contribute to the development of more effective policies and frameworks that address the intersection of climate change and humanitarian needs?	Insights gained from the analysis can inform policy documents at various levels, promoting the integration of climate adaptation into disaster risk reduction frameworks, thus enhancing resilience and preparedness.

Research Question 1, which examines the key strengths and weaknesses of existing disaster management frameworks, highlights gaps in incorporating long-term climate projections and local data. This finding addresses Objective 1, focusing on the strengths and weaknesses of current disaster management frameworks in addressing climate change risks and humanitarian needs. Research Question 2 explores how case studies of climate-related disasters have demonstrated successful strategies for improving resilience. The finding points to successful strategies such as community engagement and early warning systems, particularly in Bangladesh and Australia, addressing Objective 2, which focuses on successful strategies for improving resilience and disaster response. Research Question 3 investigates gaps in traditional disaster management models regarding long-term climate risks and vulnerabilities. The finding identifies gaps, such as inadequate adaptation strategies and socio-economic barriers, addressing Objective 3, which examines the gaps in existing disaster management models. Research Question 4 looks at strategies to integrate localised climate data and

community engagement into disaster management frameworks. The finding emphasises the importance of a localised, participatory approach, aligning with Objective 4, which focuses on strategies to effectively integrate these elements. Finally, Research Question 5 examines how the findings contribute to policy development. The insights gained can inform the creation of more effective policies, addressing Objective 5, which focuses on developing policies and frameworks to address the intersection of climate change and humanitarian needs.

8. CONCLUSIONS

The findings of this research successfully address all the objectives outlined, offering valuable practical contributions for policymakers, NGOs, and local governments involved in disaster management and climate adaptation. By identifying gaps in existing frameworks, the research advocates for the integration of climate data and projections to enable disaster management authorities to better anticipate and respond to the increasing frequency and severity of climate-related disasters. The focus on localised approaches ensures tailored responses that address the specific vulnerabilities of affected communities. The findings emphasise the importance of involving local communities in disaster management, advocating for participatory approaches that empower communities to play an active role in resilience-building efforts. This engagement not only improves disaster response effectiveness but also ensures the inclusion of marginalised populations' perspectives. Additionally, the research underscores the need for capacity building among local governments and NGOs, providing recommendations for training and resource allocation to strengthen disaster management capabilities. Concrete policy recommendations are made for integrating climate adaptation into disaster risk reduction frameworks, guiding the development of flexible and robust policies that prioritise humanitarian concerns in the face of climate change. By aligning disaster management with the broader SDGs, the research supports the creation of more resilient communities and sustainable development pathways, addressing both immediate needs and long-term development goals. The theoretical contributions of this research extend the existing body of knowledge on disaster management and climate adaptation by providing a comprehensive analysis of the interplay between these fields. This research advances the theoretical understanding of how climate change impacts humanitarian needs and disaster management. By emphasising the importance of integrating climate adaptation strategies into disaster management frameworks, it highlights the interconnectedness of these domains and the need for a more unified approach. The chapter proposes a conceptual framework for integrating climate projections into disaster management decision-making processes.

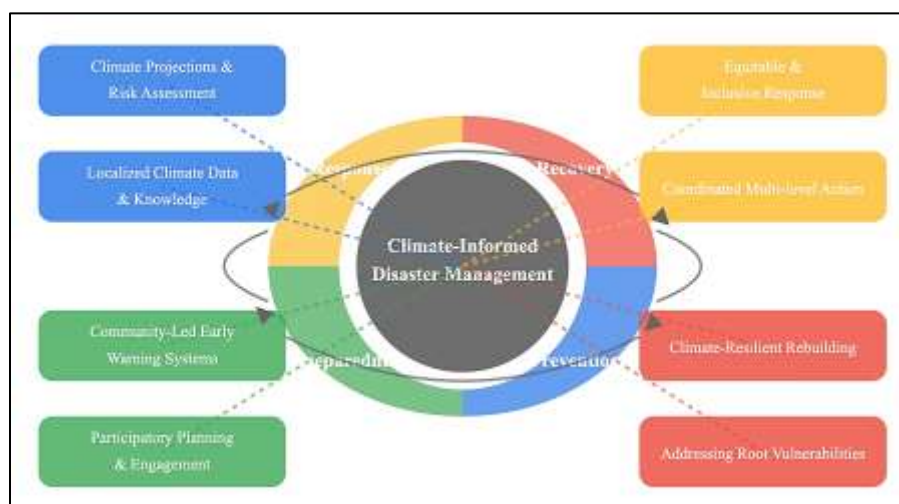


Fig. 3 Conceptual Framework for Climate-Informed Disaster Management

This framework highlights six main elements used in this research: Disaster Risk Reduction (DRR) Framework, Climate Change Projections, Community Engagement, Resilience Building, Vulnerable Populations, and Disaster Preparedness and Response Systems. The focus is on addressing the vulnerabilities of affected populations, integrating climate projections, and building resilience through community engagement and preparedness systems. The framework underlines the necessity of addressing the unique

vulnerabilities of populations and the importance of robust systems for disaster preparedness and response to effectively manage climate-related risks. The theoretical contribution to the existing body of knowledge on disaster management and climate adaptation includes analysis of the relationship between how climate change affects humanitarian needs and disaster management and emphasising the importance of integrating climate adaptation strategies into disaster management frameworks. The proposed framework provides a valuable theoretical model to understand how climate data can inform disaster response and resilience-building strategies. The case study analysis reveals the vulnerabilities faced by different populations during climate-related disasters including socio-economic, political, and environmental factors that impact community resilience. By critiquing traditional disaster management models, the research contributes to ongoing discussions about the limitations of existing frameworks in addressing long-term climate risks. The findings contribute to several United Nations Sustainable Development Goals (SDGs), particularly those aimed at fostering resilience and addressing the challenges posed by climate change. The integration of climate adaptation strategies into disaster management frameworks directly supports the following SDGs. The research emphasises the urgent need for effective climate adaptation measures within disaster management systems. By advocating for the incorporation of climate projections and localised data, the chapter supports efforts to strengthen resilience against climate-related disasters, ultimately contributing to global efforts to combat climate change (SDG 13: Climate Action). The focus on enhancing community engagement and participatory planning in disaster management aligns with the goal of making cities and human settlements inclusive, safe, resilient, and sustainable. By prioritizing the needs of vulnerable populations in disaster-prone areas, this research promotes the development of resilient urban environments that can better withstand climate impacts (SDG 11: Sustainable Cities and Communities). The paper highlights the disproportionate effects of climate-related disasters on marginalised communities, emphasising the need for equitable disaster response mechanisms. By integrating humanitarian needs into disaster management frameworks, the research advocates for strategies that address the root causes of poverty and vulnerability, thereby contributing to poverty alleviation (SDG 1: No Poverty). By addressing the vulnerabilities faced by marginalised groups during climate-related disasters, this research promotes strategies that ensure fair and equitable access to resources and support. This alignment with SDG 10 underscores the importance of inclusive decision-making processes in disaster management (SDG 10: Reduced Inequalities). The findings stress the importance of collaboration among various stakeholders, including governments, NGOs, and local communities. By fostering multi-level partnerships, the research supports the achievement of SDG 17, which aims to revitalize the global partnership for sustainable development. The research highlights gaps in current models, particularly the failure to adequately account for long-term climate risks given the increasing severity of extreme weather events. By analysing successful case studies, the research demonstrates that integrating localised climate data and community engagement enhances disaster resilience. The findings also underscore the disproportionate impact of climate-related disasters on marginalised populations, who often face vulnerabilities due to socio-economic factors and inadequate infrastructure. The research extends its implications to policy frameworks at local, national, and global levels, referencing key documents like the Sendai Framework and the Paris Agreement. While these frameworks highlight the importance of collaborative efforts, the study reveals inconsistencies in their implementation, particularly in developing nations. Furthermore, the research emphasises the necessity of community engagement, as local populations possess critical knowledge of their vulnerabilities and resources. Integrating local perspectives into disaster planning leads to more effective, sustainable solutions, fostering a sense of ownership and empowering communities to better respond to future challenges. While the research offers substantial insights, several limitations must be noted. The reliance on secondary data restricts the analysis to the availability and quality of existing literature, which may not capture local nuances. Additionally, the dynamic and evolving nature of climate change and disaster management practices may require continual adaptation of the strategies discussed. Furthermore, the specific focus on case studies limits the generalizability of the findings, and future studies should consider more interdisciplinary approaches that explore the intersections of socio-economic, political, and environmental factors. Despite these limitations, this research provides a valuable foundation for integrating climate adaptation into disaster management frameworks, but further empirical validation is necessary to ensure its effectiveness across diverse contexts.

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