

# Disaster Preparedness Strategies in the Kathmandu Valley

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## Abstract

*This paper examines the impact of the disasters including earthquake and floods on the residents of the Kathmandu Valley. This study aims to assess preparedness strategies based on the secondary data gathered from the sources including reports and studies. The Kathmandu Valley is extremely susceptible to various natural hazards, especially earthquakes, floods, and landslides. This study examines available literature, policy reports, and program assessments to combine effective disaster readiness approaches suited to the Valley's socio-economic, geographic, and administrative conditions. Employing a systematic literature review approach, the research highlights five key preparedness areas: governance and planning, land use and infrastructure informed by hazards, community-based preparedness and capacity enhancement, early warning and communication mechanisms, and simulations, drills, and logistical support. The article concludes with practical suggestions for local and regional authorities, community groups, and global partners to enhance resilience and minimize disaster risk. Besides, the role of community in getting aware and taking precautions to fight against natural hazards becomes crucial in terms of mitigating the risk and minimizes the consequences of the disasters.*

**Keywords:** Kathmandu Valley, disaster preparedness, earthquake risk, community resilience, early warning

## Introduction

The Kathmandu Valley, with a population of about 3 million, is among the most densely populated cities in South Asia and is located in a region prone to earthquakes (Kathmandu Valley Earthquake Risk Management Action Plan, 1998/2015). Swift urban growth, unregulated building practices, and intricate governance structures have heightened susceptibility to earthquakes, seasonal floods, and landslides. Recent severe weather incidents and ongoing threats highlight the critical need to enhance readiness at various levels. This study aims to compile evidence-based readiness strategies and generate actionable recommendations tailored for municipal governments, local disaster response teams, non-profits, and community participants.

Effective coordination among local, provincial, and federal governments is crucial for implementing initiatives aimed at mitigating the risks associated with disasters, such as floods and earthquakes in the Kathmandu Valley. This collaborative approach not only enhances the efficiency of response efforts but also facilitates the formation of numerous volunteer groups dedicated to rescuing victims during such emergencies. Furthermore, establishing alternative safe locations for displaced individuals during disasters is essential in ensuring their safety and well-being. To support these initiatives, it is also imperative to prioritize the storage of food items and emergency supplies, which can significantly alleviate the hardships faced by affected populations in times of crisis.

## **Literature Review**

### ***Policy and Theoretical Framework***

Nepal's framework for managing disaster risks has transitioned in recent years from reactive responses to a focus on preparedness and risk mitigation. Essential frameworks comprise the National Disaster Risk Reduction Policy and Strategic Action Plan along with associated regulations that encourage decentralized DRM planning and the development of local capacities. Global and local initiatives (e.g., the Kathmandu Valley Earthquake Risk Management Project; NSET efforts) have provided hazard mapping, school retrofitting trials, and community training schemes. Research in Kathmandu indicates that informal housing, insufficient enforcement of building regulations, and the densification of historic zones heighten earthquake vulnerability. Floods and landslides linked to the monsoon are seasonal but are becoming more severe due to changes in land use and drainage blockages in sub-urban regions (National Disaster Risk Reduction and Management Authority, 2025).

The studies have focused on two aspects: technical strategies (retrofitting, spatial planning, risk assessment, alert systems), and social strategies (community education, volunteer groups, public awareness, school readiness). The data indicate that combining both elements is essential: technical investments alone lack impact without community capability to respond; on the other hand, well-prepared communities with insufficient infrastructure still encounter devastating losses.

### ***Empirical Review***

Acharya et al. (2025, p. 131) have studied about the impact of the earthquake that significantly affected Nepal. The National Planning Commission reported that the earthquake resulted in approximately 9,000 fatalities and more than 22,000 injuries (Government of Nepal, NPC, 2015). The earthquake caused destruction or harm to more than 600,000 home and structures. The financial impact of the earthquake is projected to be in the billions of dollars. The earthquake significantly hindered Nepal's progress. The nation

was already among the least affluent globally, and the earthquake worsened existing poverty and inequality. The earthquake has adversely affected Nepal's tourism sector, a crucial revenue source for the nation.

The idea of governance traps helps clarify how governance structures can become entrenched in ineffective or detrimental patterns. Governance traps can occur due to various reasons, including insufficient coordination among diverse actors, ambiguous roles and responsibilities, political influence, and reliance on established paths. Within disaster management, governance traps can cause various issues, including inefficient resource utilization, effort duplication, insufficient accountability, and an inability to learn from prior experiences. Several research efforts have investigated how governance traps affect disaster management in Nepal. There is a deficiency in government leadership regarding programs for reducing catastrophe risks (Acharya et al., 2025, p. 131).

Environmental issues primarily stem from shifting climate patterns, which have rendered disaster forecasting progressively more challenging. The uncertainty of weather occurrences has complicated the ability to prepare thoroughly and has frequently led to more significant effects from disasters. According to an environmental expert from an NGO, climate change complicates the use of historical data for forecasting future disasters, resulting in insufficient preparedness.” A major achievement in tackling environmental issues has been the use of technology for monitoring and predicting disasters. The incorporation of sophisticated technologies, including satellite imagery and early-warning systems, has improved the capacity to anticipate and prepare for potential disasters more efficiently. Technology has significantly transformed our methods of assessing risk and alerting communities in disaster technology integration. The individual experiences expressed by the participants illuminate the practical obstacles and achievements in disaster management in Nepal. Although operational inefficiencies and institutional bureaucracy present major challenges, leveraging local knowledge and fostering better inter-agency coordination arise as essential elements in improving disaster response efficiency. Although climate change-related environmental issues complicate disaster management, advancements in technology provide hopeful solutions (Acharya et al., 2025, p. 132).

Authorities establish legal frameworks and guidelines that form the foundation for advocating and upholding specific rights and responsibilities for individuals and groups. In the realm of DRM governance, regulations establish benchmarks and goals while designating roles and duties to various stakeholders. Regulations and codes outline particular procedures and standards and aim to promote or deter specific behaviors. This is based on the fundamental concept of permitting or forbidding actions and establishing incentives/disincentives including taxes, fines, tax reductions, subsidies, grants, etc. that

would either incentivize or penalize. The success of laws depends not only on a nation's administrative ability but also on the public's understanding and acceptance of regulations and standards (Nepal et al., 2018).

The Disaster Risk Reduction and Management Act of 2017 established the National Council for Disaster Risk Reduction and Management (NCDRRM) under the Prime Minister's leadership as a central authority for disaster risk reduction and management. To execute the policies and plans established by the council, an executive committee was formed under the Home Minister, along with a team of up to five experts from various thematic fields including geology, environment, infrastructure, and more. The National Disaster Reduction and Management Authority (NDRMA) will be established under the Ministry of Home Affairs. At the province level, there has been a Provincial Disaster Management Committee (PDMC) chaired by the chief minister. At the local level, there has been a District Disaster Management Committee (DDMC) and a Local Disaster Management Committee (LDMC) (Nepal et al., 2018, p. 13).

The establishment of a well-organized functional institutional framework from central to local levels may still require considerable time and effort to overcome the institutional inertia present at national, provincial, and local levels. The majority of policies, plans, and strategies have focused on floods and landslides, followed by earthquakes and GLOF/avalanches, addressing these issues in a centralized manner rather than locally. Many of them have focused less on rehabilitation and mitigation. Discrepancies among various Acts, including the Water Resource Act (1992) and Building Act (1998) with the Local Government Operation Act 2017, can be viewed as significant barriers to the effective execution of the disaster management act (Nepal et al., 2018, p. 18).

Maharjan and Shrestha (2017, pp. 99—100) have jointly highlighted the importance of awareness and preparedness knowledge that increased from eighty percent prior to the earthquake to ninety-two percent following it. Likewise, the perception of the vulnerability regarding human loss and physical property increased from seventy-three percent to ninety-five percent. The role of individual households and communities was recognized as crucial for reducing disaster risks and survival strategies (e.g., preparation of emergency kits), which increased from five percent to ninety-five percent following the earthquake. The research showed that individuals were knowledgeable about earthquake disasters, but preparedness strategies were not executed, and there were no disaster response plans at either the household or community level. Individuals' willingness to accept risk and their level of readiness are influenced by firsthand experiences of events rather than by their perceived risks of possible disasters. Reducing earthquake risk and executing the action plan at the community level is crucial. Media and local organizations significantly contributed to

raising awareness about preparedness, while individual households and communities have been essential for executing the strategies needed to minimize disaster loss and damage.

The studies indicate that significant earthquakes in the Kathmandu Valley have been documented since 1255 AD, and again in 1934 AD that resulted in extensive damage, with the most recent earthquake in 2015 AD. The latest earthquake caused 8,019 deaths and the destruction of thousands of residential, institutional, and cultural structures. Nepal was positioned eleventh globally regarding earthquake vulnerability. The Kathmandu Valley was recognized as one of the most at-risk cities (UNDP/ERRRP, 2009). Even though the Kathmandu Valley is particularly susceptible to earthquakes and residents recognize the dangers of a possible quake, there have been very few efforts toward preparedness. The government has established disaster risk reduction acts, plans, and programs over the last 20 years; however, the current disaster management efforts have proven ineffective. In this scenario, individuals' understanding, consciousness, and readiness are essential for decreasing earthquake susceptibility (Maharjan and Shrestha, 2017, p.100).

The proportion of households with life insurance rose from 84 to 86 following the earthquake, while the percentage of households with savings grew from 31 to 51 percent. The change indicates that individuals are transitioning from conventional to contemporary methods of readiness. The research shows that individuals may understand and be equipped for the harm and loss via education and media without having experienced the disaster as well. However, awareness does not indicate taking steps for preparedness (Maharjan and Shrestha, 2017, p. 104).

A recent study by Shrestha and Maharjan (2016) presented a significant number of sources located at distances of 100 m, 200 m, and 300 m from the IDP sites. The 1934 earthquake had temporarily ruined the majority of the shallow dug wells and *dhunge dhatas* in the valley. The majority of shallow sources were compromised because of liquefaction and sand boils. This eliminated the presence of many shallow groundwater sources. Evidence from various countries indicates that deep wells have a strong likelihood of enduring earthquakes. Therefore, only deep wells (> 50m depth) would continue to operate as long as they have been correctly constructed. Only these resources were taken into account regarding possible water sources. Eight IDP locations have over 10 deep wells in their vicinity.

The majority of these IDP locations are situated in the central area of Kathmandu Municipality. The majority of these sites fall under the small size category. Twenty-nine IDP locations have improved conditions with operational wells, reserve tanks, treatment facilities, backup power, etc. The majority of these are found in hotels, apartments, and residential complexes. Many of them possess backup power. Nevertheless, sharing these

resources during a disaster would lead to issues causing social conflicts. The water supply system and distribution have been planned for IDP camps considering the camps' population capacity. Nevertheless, how would water supply be handled if individuals not living in the camps came to access it? This is particularly critical since the camps are close to the central urban areas. The outcome would be disorder and disputes (Shrestha and Maharjan, 2016, p.58).

Khanal, Beda Nidhi (2020, January). Nepal: A Brief Country Profile on Disaster Risk Reduction and Management. Ministry of Home Affairs, Nepal.

Climate conditions in Nepal change over short distances mainly because of the differences in elevation and diverse topography, as well as the distances to its extremities. The differences in climate have led to diverse habitats, plant life, vegetation, and wildlife. The typical yearly rainfall is roughly 1,600 mm (mean annual precipitation ranges from over 4,000 mm on the southern slopes of the Annapurna Himalayan range to under 250 mm in the rain-shadow zones near the Tibetan plateau, with approximately 80% occurring from June to September as summer monsoon. The east part of Nepal receives significantly more rainfall than the west part, yet the west can experience sudden and intense rain (Khanal, 2020).

Nepal features five climatic zones, ranging from subtropical to arctic, which generally align with the varying altitudes. The tropical and subtropical region extends up to 1200 meters, the temperate region from 1200 to 2400 meters, the cold region from 2400 to 3600 meters, the subarctic region from 3600 to 4400 meters, and the arctic region above 4400 meters. Nepal experiences four primary seasons which include winter (December-February), spring (March-May), summer (June-August), and autumn (September-November). The Terai and Siwalik hill range features a sub-tropical climate, while the northern mountainous areas experience a cold, dry continental and alpine winter climate. Temperatures in late spring and summer vary from approximately 28°C in the mountainous area to over 40°C in the Terai. During winter, typical maximum and minimum temperatures in the Terai fluctuate between a cool 7°C and a gentle 23°C respectively. The major valleys frequently endure a minimum temperature that drops below freezing. Significantly lower temperatures dominate at elevated altitudes (Khanal, 2020, p. 7).

The flooding in Nepal is primarily caused by its topographical characteristics. Flooding occurs due to intense rainfall, which can happen in any location except the high Himalayan area during the monsoon season. Flooding along the river banks and soil erosion result in losses by harming irrigation and communication infrastructures as well as fertile areas near or alongside the river banks. This phenomenon has resulted in the loss of 79 lives and significant property damage in the mountainous regions of Nepal annually (MoHA,

2020). It also presents significant risks to physical structures such as roads and bridges. Flooding has hindered the social and economic progress of numerous areas in the country's terrain region. The catastrophic floods in Nepal occurred in August 2008 in the Koshi river, September 2008 in Western Nepal, and July and August 1993 in the Bagmati and other rivers. Nepal has experienced both Monsoon flooding and Flash flooding. Variability in rainfall (uneven distribution over time and space), topography (rugged mountains and flat Tarai), and deforestation (reduction in plant cover) are the primary causes of flooding in Nepal. Likewise, flooding and intense rainfall lead to significant and regular disasters in Nepal. On average, nine lives are lost (MoHA, 2020), causing significant damage and losses to crops and settlements in flat regions nearly every year.

### **Methodological Approach**

This research employs a systematic review of the existing data on disasters and preparedness efforts and their implications in the lives of the residents of the Kathmandu Valley. The paper has been based on the secondary sources of information drawn from diverse electronic and print versions. The study has been analytical and exploratory. The method of the study is mixed approach that undertakes both qualitative and quantitative data. Materials were obtained from government policy papers, reports from international organizations, peer-reviewed studies (2010–2025), and NGO program assessments related to the Kathmandu Valley and Nepal in a wider context. Focus was directed on documents that outline executed preparedness measures or offer assessments or insights gained.

### **Results**

In the Kathmandu Valley, effective preparedness strategies are essential to mitigate the risks associated with natural disasters. A comprehensive analysis of the current landscape has led to the identification of five key strategy areas, accompanied by specific actions. Firstly, there is a pressing need for enhanced disaster preparedness and response plans at both metropolitan and municipal levels, which should align with the National Disaster Risk Reduction (DRR) frameworks. These plans must clearly delineate the responsibilities of local officials, law enforcement, healthcare facilities, and volunteer organizations to ensure a coordinated response. Secondly, establishing a coordination system to manage multi-municipality hazards, particularly earthquakes and widespread flooding, is critical. This system should emphasize resource allocation, evacuation procedures, and mass-casualty preparedness. Additionally, enforcing construction regulations and integrating disaster risk reduction into urban planning permits and land-use strategies will contribute to more resilient infrastructure. Finally, thorough risk assessments, updated zoning regulations, and the development of durable infrastructure are vital components that must be prioritized to enhance overall preparedness in the region.

To enhance community resilience against natural disasters, it is essential to revise multi-hazard maps for earthquakes, landslides, and floods using Geographic Information Systems (GIS) and ensure their public accessibility to facilitate effective planning and readiness. A concentrated effort should be made to improve critical public infrastructure, including hospitals, schools, emergency shelters, and water and power substations, while also promoting seismic retrofitting of private buildings through financial incentives or tax reductions. Additionally, the identification and protection of open spaces and evacuation routes, such as parks and athletic fields, must be prioritized to establish recognized safe assembly areas within neighborhoods. Community-oriented preparedness should be fostered through skill development initiatives aimed at enhancing the capabilities of ward-level disaster preparedness committees, Community Emergency Response Teams (CERTs), and local volunteers in areas like first aid, search and rescue, and debris removal. Furthermore, implementing school-focused preparedness programs that incorporate drills, emergency exit plans, and effective communication strategies with caregivers is vital. Finally, preparedness strategies must be developed with a focus on inclusivity, addressing the needs of gender and disability to ensure that at-risk groups are adequately considered in evacuation and support processes.

Developing a robust multi-channel, multilingual public alert system that utilizes SMS, FM radio, social media, and loudspeakers is essential for timely notifications during flash floods and landslides while minimizing false alarms. To effectively reach populations in informal areas with unreliable digital connectivity, engaging local volunteers and community representatives is crucial for disseminating these notifications. Additionally, maintaining updated public guidance on local government websites and community message boards regarding actions to take before, during, and after such events is vital for public preparedness. Consistent multi-stakeholder exercises, including tabletop and practical simulations replicating earthquake and flood scenarios, should be conducted with hospitals, police, fire departments, NGOs, and community organizations to enhance collaborative response efforts. It is also important to position emergency reserves—such as food, water, medical supplies, and temporary shelter materials—at the municipal or ward level, accompanied by clear inventory management systems to ensure accessibility during crises. Furthermore, enhancing rapid damage and needs evaluation capabilities post-event can be achieved by training local teams and implementing straightforward digital forms for swift reporting, thereby improving overall disaster response effectiveness.

## **Discussion**

The evidence from Kathmandu and greater Nepal shows that preparedness is most effective when technical, institutional, and social approaches are combined. For instance,

upgrading schools lowers structural risk but is most effective when paired with trained personnel and practiced evacuation plans. Collaboration among municipalities in the Valley is essential as hazards such as earthquakes cross administrative boundaries and necessitates shared resources and consistent communication. Challenges consist of restricted municipal budgets, political changes, enforcement gaps in building regulations, and the unofficial characteristics of a significant portion of housing. Global warming and rising urban development will persist in altering risk patterns, necessitating ongoing and adaptable readiness strategies.

Successful disaster management necessitates a holistic strategy that includes local policies, laws, and standards, implementation of plans, and thorough monitoring and assessment. Central to this strategy is the creation of a disaster readiness and response plan, incorporating an early warning system, search and rescue efforts, and the upkeep of a reserve supply of relief materials to guarantee prompt distribution and coordination within the community. Moreover, local efforts like embankment work, managing rivers and landslides, alongside river assessment and oversight, are vital for reducing risks. Hazard mapping and identifying at-risk settlements enable a shift in community planning, while promoting collaboration among federal, state, and local entities, as well as community organizations and the private sector, is crucial for successful disaster management. The creation of a disaster management fund supports the operation and use of resources essential for planning, executing, monitoring, and assessing efforts directed at reducing disaster risks. Post-disaster activities like resettlement and rehabilitation are essential for recovery, as well as data management and studies centered on local disaster dynamics.

## Conclusion

The paper has explored that the Kathmandu Valley encounters ongoing and interconnected disaster hazards. Strategies for preparedness that integrate governance reforms, technological investments, community capacity enhancement, early-warning systems, and frequent drills are the most effective in minimizing loss of life and accelerating recovery. Carrying out the prioritized suggestions will demand political will, reliable funding, and ongoing involvement with communities. Creating a local emergency work operation system and applying community-based disaster management approaches improve resilience and readiness in communities, resulting in a stronger disaster response framework.

The concerned authorities ought to create a permanent Kathmandu Valley Preparedness Council (made up of municipal representatives, NDRRMA liaison, civil society, and technical partners) to oversee planning, collaborative drills, and shared resources. A prioritized retrofitting initiative for hospitals, schools, and municipal buildings

should be established with clear criteria and oversight. It should designate a consistent portion of municipal budgets for ward-level readiness (training, stockpiling, and signage for evacuation paths). The government must initiate inventory and protection of open spaces. It should identify and legally designate essential open areas in densely populated wards and safeguard them from transformation. This paper serves as a synthesis of existing literature and does not incorporate original fieldwork or novel quantitative risk modeling. Local specifics (e.g., precise budget amounts, current city plans) have been updated and need to be confirmed with municipal officials when carrying out recommendations.

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