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Assessment of Risks and Strategies in Disaster Risk Management in Nepal

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Abstract

This paper scrutinizes the status and impact of disaster risk management in Nepal. The country is prone to natural calamities due to complicated and fragile geographical locations and unanticipated climate change impacts. The geographical locations are highly remote and fragile often face biggest challenges to response and prepare for disasters. The article aims to assess risks and strategies formulated to reduce the disasters including floods, earthquakes, cold waves, fire, droughts, and landslides that are threatening to the human security and property protection. Nepal's geographical location and fragile ecosystem, poor infrastructure, deforestation and unplanned urbanization have been explored as the causes of disasters and its impact. Consequently, almost every part of the country is prone disaster risks. In response to such random disasters, both government and non-government agencies and organizations have endeavored to strategically address both natural and human induced disasters. The study has been accomplished based on secondary data drawn from diverse sources. Meanwhile, the approach to analyze the variables that relate to risks and strategies has been qualitative. Since the research is based on secondary data, the analysis of the themes distinctly tends to respond to the query how Nepal has been responding to such disasters and what strategies have been formulated to address the problem.

Keywords: Disaster, Risk, Strategy, Reduction, Management, Mitigation

Introduction

This article discusses myriad possibilities of natural vulnerabilities faced by Nepalese people throughout the year. Nepal is situated in a seismically active zone, positioned between the Indian and Eurasian tectonic plates, which make it highly vulnerable to earthquakes.The country has experienced several significant seismic events, notably the major earthquakes in 1934, 1988, and the devastating 2015 Gorkha Earthquake. These earthquakes shook the infrastructural foundation and resulted into numerous causalities and losses of properties. The risk of earthquakes is particularly pronounced in the Kathmandu Valley and western regions of Nepal as there is no major earthquake in western region since

long and energy has been accumulated. The anticipated risk highlights the need for preparedness and resilience in these areas.

The second most common and recurrent disaster risk that the country encounters is landslide. Landslides during the monsoon season, which spans from June to September, are usually triggered by various factors such as heavy rainfall, earthquakes, unplanned development including road construction, and deforestation. These natural disasters predominantly affect hilly and mountainous regions, where the terrain is more susceptible to destabilization due to the combination of these influences. As rain saturates the soil, it increases the likelihood of landslides, making it a critical concern for communities living in these vulnerable areas. The landslides affect the community primarily in two ways: first they lessen the size of their fertile land and secondly, they damage human settlements as well. Sometimes, the implication is human causality as well. Primarily rivers including the Koshi, Bagmati, and Narayani, regularly overflow that pose significant risks to surrounding communities. On top of that, due to the continued melting of glaciers, Glacier Lake Outburst Floods (GLOFs) are becoming an increasingly serious threat. The status of glacier change highlights the urgency of addressing the challenges posed by both seasonal flooding and the impacts of climate change on glacial environments.

Nepal has been suffering myriad disasters including both natural and human-induced incidents. A large part of the country is covered with forests and forestation and reforestation are mostly the priorities of the government, which is highly commendable and beneficial to both economic development and ecosystem, balancing. However, wildfires are undoubtedly common due to lack of awareness among people regarding the significance of wilderness and greenery. Wildfires typically occur during the dry season, which spans from February to May, and are often induced by human activities. Besides, urban fires can arise from issues such as inadequate electrical infrastructure or gas explosions, further highlighting the risks associated with fire hazards in both natural and urban environments. National Disaster Risk Reduction and Management Authority daily bulletins and period reports show these frequencies of disasters.

Irregular rainfall patterns resulting from climate change are having a significant impact on both agriculture and water supply. These unpredictable weather changes disrupt traditional farming practices, making it increasingly challenging for farmers to plan their planting and harvesting schedules. Consequently, crop yields may decline, leading to food shortages and economic instability in agricultural communities. Moreover, the variability in rainfall

affects the availability of freshwater resources, complicating water management strategies and threatening the sustainability of both urban and rural water supplies.

Human-induced disasters, such as industrial accidents, road traffic accidents, and pollution, pose significant threats to public safety and the environment. These incidents often stem from poor planning and a lack of enforcement of safety standards, which can greatly increase the risk of such disasters occurring. By failing to implement comprehensive safety measures and regulations, the likelihood of accidents and environmental degradation rises, ultimately impacting communities and ecosystems. Addressing these issues requires a commitment to better planning and stricter adherence to safety protocols to mitigate the risks associated with human-induced disasters. Due to unplanned infrastructure development and lack of risk sensitive development planning, increase in disaster frequency and impact is high these days.

Literature Review

Rodrigo Mena (2023) has analyzed the impact of impacts of disasters and processes associated with disasters in areas affected by repeated disasters and conflicts due to high exposure. His research shows that up to 81% of countries have been affected by violent conflicts also meet natural dangers and disasters during conflict. Furthermore, more than half of all deaths related to disasters in recent decades have occurred in countries affected by conflict. Disasters and conflicts have been explored as the primary causes of deaths in most of the countries (p. 15).

Mena has further explored that history of culture, corruption, people's preparation, and exposure to certain natural events can be exposed to certain people at greater risk of disaster than others. Besides, these social phenomena underlying disasters are more important than the most natural events that explain the occurrence of disasters. Despite the fact that the challenges of the concept of "natural disasters" are enormously important, it is equally important to maintain awareness of potential risks and the unwilling consequences of actions taken against them. Given the "no harm" approach, identifying and eliminating vulnerabilities in groups of stakeholders to perform conflict-sensitive analyses and using natural diplomacy possibilities in the case of disasters is one of the strategies that can be used to navigate through these complex areas. Realizing delicate analysis is a good strategy to support understanding of disasters, as it is not natural when preventing worsening conflict. It also enables an approach that "does not cause harm." Complex assessments, humanitarian and voluntary participation in entities receive ideas of Indigenous causes and conflict engines, as well as complex interactions between disaster and conflict dynamics.

This approach allows them to adapt their answers to specific contexts in the area of the subject of conflict issues, ensuring that by strengthening segregation, interventions are not affected and create additional vulnerabilities in the community (Mena, 2023, pp. 22—23)

Moljcapa (2017) has argued that the Nepal government has made efforts to develop and implement various legal and political provisions to create a favorable environment for managing the risks of natural disasters, but there has not yet been a significant reduction in the loss of natural disasters. In this context, a horrific need has been implemented to consider existing policies, programs, and institutions to manage the risk of natural disasters to determine potential areas for further improvement of these provisions. Disasters in Nepal have traditionally been specially controlled and were visited when they occurred. For the first time in 1982, the Natural Disaster Assistance Act (NDRA), also known as the Natural Disaster Supply Act (NCRA), was replaced by the 2017 Risk Reduction and Natural Disaster Risk Act. LGOAs approve the following features compared to local body DRRs (Cited in Nepal, Pashupati et. al, 2018, p. 6).

Local level policies, laws, standards, planning implementation, monitoring and assessment are related to natural disasters. Preparation, distribution and coordination of natural disaster accuracy and response planning, early alerts, research and rescue systems, and materials have been for support at the local level. Local embankments, river control and landslides, river management and evaluation have been some of the endeavors and initiatives. Images of danger and identification of facilities are under risk and transformation (Nepal, Pashupati et. al, 2018, p. 7),

Water Induced Disaster Management Policy-2006 has been formulated to mitigate water induced disasters and reduce loss of lives and property and to enhance institutional strengthening. International framework on disaster management, such as the Hyogo Framework for Action (HFA) 2005–2015 has played an important role in advancing the agenda for DRR (Djalante et al., 2012). National Strategy for Disaster Risk Management in Nepal (NSDRM), 2009 was implemented in line with the Hyogo Framework. The current Fourteenth Three Year Plan (2016/17-2018/19) has set its disaster management goal in chapter six under the section of disaster management, environment and climate change. The plan aims to reduce human, physical, economic, cultural and ecological losses due to disasters. It has made strategies for different types of disasters management, such as, earthquake, flood, landslide, epidemic and others focusing on different phases of disaster management cycles, such as, preparedness, response and rehabilitation and mitigation. It

has also emphasized on governance of disaster management at national, regional and local levels (National Planning Commission, 2017).

Coordination with the private sector and the coordination of federal, provincial and local public institutions at the local level to manage natural disasters have been found one of the indispensable factors in disaster risk management. Creating funds and using disaster management and resources is a crucial initiative. Formulation, implementation, monitoring and evaluation to reduce the risk of natural disasters can help to bring fruitful results. Coordination will also generate resources for disaster response and make assessment, relief and response better.

Reinstallation and rehabilitation after a disaster have commenced slowly. Data management, research and research at the local level can help to translate the dream into reality in terms of disaster risk reduction and management. Water-induced disaster management policies have been developed to mitigate natural water disasters, reduce the loss of life and goods, and strengthen the strengthening of the institution. International plan and framework on disaster management structures such as the Hyogo Framework for Action (HFA) 2005-2015 played an important role in promoting the DRR agenda in globally and in Nepal. In 2009, Nepal Strategy on Disaster Risk Management (NSDRM) was implemented in accordance with the HYOGO Framework. The 14th National Plan for the 14th year (2016/17/2018/19) established the goals in the fight against natural disasters in chapter 6 of the "Natural Disaster Management, Environment and Climate Change" section. The plan is intended to reduce human, physical, economic, cultural and environmental losses in disasters. This has developed strategies for different types of disasters, including earthquakes, floods, landslides, and epidemics, and is concentrated in different stages of the natural disaster management cycle, including preparation, response, rehabilitation, and recovery. This plan also highlighted the management of natural disasters at the national, regional and local levels (National Planning Commission, 2017).

Ismayilzada, M. et al (2023) have highlighted that climate change has negatively impacted the agricultural sector, with determinants not only being an increase in mean annual temperatures, but also being a direct result of the process, as well as violations of the period of vegetation period, frequency of jelly, and increased frequency of extreme weather conditions. The conditions including pest frequency and damage are significantly increased as increased temperature indicators reduce active immunity, generally blocking the spread of plant pathogens and stimulating the perspiration process (p. 20).

Of all natural disasters, droughts and floods have the most negative impact on agriculture in Nepal. Due to natural and climate abnormalities caused by droughts, 83% of the damage caused by the sector will suffer from losses in harvests and livestock. Climate change trends require revisions to traditional plant protection technologies in favor of an increase in the frequency of plant protection products by adapting time for agricultural operations. As a result, an increase in the concentration of chemical treatments of crops should be avoided. This can lead to resistance to pathogens, and new protective measures must be developed to increase the cost of agricultural products. The major impact of climate change on the agricultural economy requires great effort to minimize exposure, level down negative outcomes, and foresee in time (Ismayilzada, M. et al, 2023, p. 20).

The need to improve existing approaches to effective and reliable assessment of natural disaster costs in the study area is identified. Main reserve conditions and factors are also highlighted, contributing to the effective implementation of risk management systems related to adverse weather conditions and climate trends. Among these factors are the introduction of early forecasting and crisis management systems, the organization of economic stamps and insurance for weather conditions, and the impact on unpredictable climate. Priority vectors for research into the impact of climate change on agricultural economic processes and the need to organize and systematize research. The importance of new research is particularly highlighted in the use of modern tools, particularly the latest tools for risk transfer that is insurance, crisis management, forecasting and adaptive modeling (Ismayilzada, M. et al, 2023, p. 23).

Dilip Karki et al. (2024) have claimed that Nepal is one of the most vulnerable countries of natural disasters in the world. Hence, natural calamities refer to major disasters which adversely affect human lives. Most Nepali people are at risk of disasters, including earthquakes, droughts, landslides, extreme weather conditions and lake glacial explosions. The current management system for natural disasters in Nepal is the various state organizations and their plans, political and strategies. There are national and international non-governmental development agencies, UN government agencies, bilateral and multilateral agencies that have contributed to the management of disasters in Nepal.

The study by Blackburn, Christine Crudo et al. (2024) has contained 7 subsections related to statistic characteristics displayed by common calamities, states of mind toward readiness, behavioral eagerly amid fiasco reaction, subjective standards, seen behavioral control, and believe in fiasco reaction help among respondents. More particularly, they have inquired whether the respondents (1) had a individual or family departure arrange in case of a

characteristic catastrophe, (2) had an crisis unit in their domestic, (3) felt that they knew where to induce crisis data in case of a common fiasco, (4) felt that they had the supplies they required in case they were to be influenced by a characteristic fiasco, (5) felt sure that they knew how to ensure themselves amid a normal catastrophe, and (6) felt that they seem depend on their neighbors, their nearby government, the National Watch, or the government for help amid or after a characteristic catastrophe (p. 2).

Since climate alter is credited as one of the reasons for the expanding calamity slant (i.e., rising temperature increments the dampness the environment can hold, coming about in more storms and overwhelming downpours), this Databook too looks at the slant of climate-related calamities, especially dry season, storm, surge, and extraordinary temperature. In 2023, worldwide temperature come to outstandingly tall, near to 1.50C constrain. In specific, temperatures from June onwards made 2023 the hottest year on record, surpassing by a expansive edge 2016, the past hottest year. All inclusive, climate-related catastrophes in 2023 recorded 322 occasions, which is higher than the yearly normal of the final 30 a long time (1993-2022) of 286/year (Asian Disaster Reduction Center, 2023, p. 5). These studies demonstrate the disaster risks and their pervasiveness across the country in different forms including floods, landslides, earthquakes, wildfires, droughts, fire, etc. however, none of the researchers has holistically discussed the disaster risks and strategies together in the context of Nepal.

Methods and Materials

The research employs a qualitative approach, utilizing secondary materials as its primary source of data. This research is designed to uncover insights and deepen understanding by analyzing existing information rather than collecting new data. By focusing on secondary sources, the study aims to provide a comprehensive examination of the topic at hand, allowing for a nuanced interpretation of the findings. The purpose of exploratory research is to delve deeply into a problem or phenomenon, allowing for a comprehensive understanding of the subject at hand. This clarifies the concepts including disaster, risk, and strategies used to mitigate the impact of natural calamities. By gathering valuable insights that can lead to the uncovering of potential causes, relationships, or solutions that have not been identified, the paper has endeavored to unfold the realities in terms of disaster risk strategies. Exploratory research serves as a foundational step in guiding the development of hypotheses for future studies, ensuring that subsequent research is well-informed and targeted.

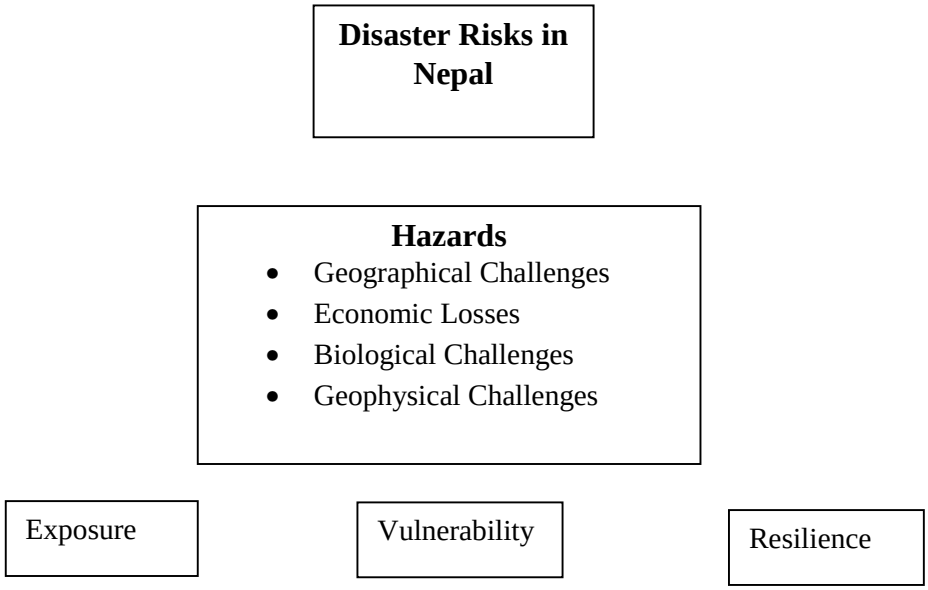
Discussion

Disaster Risks in Nepal

Nepal is highly disaster-prone due to its unique geography, climate, geology, and socio-economic factors. The main disaster risks include seismic activity, with earthquakes posing significant threats to the population and infrastructure. Landslides frequently block roads, destroy settlements, and lead to fatalities. Heavy rainfall and extreme weather events result in intensified rainfall, causing washouts, floods, and landslides, while storms, hailstorms, thunderstorms, and lightning strikes further exacerbate the situation. In the high-altitude mountainous regions of the Himalayas, avalanches, snowstorms, and ice hazards are recurring risks. Additionally, drought affects agricultural productivity and water supply, particularly in arid or rain-deficient areas. Forest fires, especially during drier months, alongside environmental degradation such as deforestation and soil erosion, worsen the impacts of landslides and floods.

Extreme temperature events, including severe cold waves in high-altitude zones and heat waves in lowlands, are also prevalent. The high population density, poor infrastructure, and inadequate healthcare access mean that disasters can trigger or worsen epidemics. Furthermore, human and technological disasters, such as fires in densely populated urban areas and industrial accidents, add another layer of risk to the already vulnerable nation.

A Conceptual Framework of Disaster Risks in Nepal



Hazards present a multitude of challenges that can significantly impact various aspects of life. Geographical challenges arise from the physical features of the land, which can complicate infrastructure development and disaster response. Economic losses often accompany these hazards, affecting businesses and communities, leading to long-term financial repercussions. Besides, biological challenges, such as the spread of diseases or disruptions to ecosystems, pose risks to public health and biodiversity. Finally, geophysical challenges, including earthquakes and volcanic activity, can cause devastating damage to both human settlements and natural environments, highlighting the need for preparedness and resilience in the face of such threats.

Strategies to Mitigate Disaster Risks in Nepal

Nepal has been actively working on Disaster Risk Reduction (DRR), particularly after the 2015 earthquake. The key strategies formulated by the government of Nepal can be elaborated. The Disaster Risk Reduction and Management Act of 2017 replaced the outdated Natural Calamity Act, marking a significant shift in the approach to disaster management. To effectively coordinate disaster risk reduction efforts, the National Disaster Risk Reduction and Management Authority (NDRRMA) was established. Additionally, Local Disaster and Climate Resilience Plans (LDCRP) have been developed at the municipal levels, ensuring that local governments are equipped to address and manage disaster risks in their respective areas.

Early warning systems are crucial for disaster preparedness, particularly in major river basins where flood risks are prevalent. Implementing flood early warning systems can significantly enhance community safety and response times. Besides, promoting earthquake awareness through educational initiatives and conducting mock drills can better equip individuals and communities to handle seismic events. Furthermore, establishing partnerships with telecom companies to provide SMS alerts for various disasters will ensure timely communication and updates, ultimately contributing to a more resilient society.

Community-Based Disaster Risk Management (CBDRM) emphasizes the importance of local training and awareness programs to equip individuals with the necessary skills to respond effectively during emergencies. A key component of this approach is the establishment of Community Emergency Response Teams (CERTs) and local responder, which are composed of volunteers from within the community who are trained to assist in disaster situations. Furthermore, CBDRM prioritizes the inclusion of vulnerable populations, focusing specifically on women, the elderly, children, and marginalized groups to ensure that their unique needs and perspectives are addressed in disaster preparedness

and response efforts. This holistic approach fosters resilience and empowers communities to take charge of their safety and well-being in the face of potential disasters.

Building codes play a critical role in ensuring infrastructure resilience, particularly through the implementation of the National Building Code, which is mandatory in municipalities across the country. This code sets essential standards for construction and renovation practices, particularly in retrofitting vital facilities such as schools, hospitals, and government buildings to withstand potential disasters. Besides, promoting earthquake-resistant construction is a key focus, aimed at safeguarding lives and minimizing damage during seismic events. By adhering to these building codes and prioritizing infrastructure resilience, communities can better prepare for and respond to natural disasters.

Education and awareness are crucial components of disaster risk reduction (DRR), which is why it is essential to incorporate DRR into the school curriculum. By doing so, students will gain a foundational understanding of the risks associated with disasters and the measures they can take to mitigate these risks. Additionally, implementing nationwide drills and awareness campaigns will further reinforce this knowledge, ensuring that communities are better prepared to respond effectively in the event of a disaster. Together, these initiatives will foster a culture of safety and resilience across the nation.

The integration of Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) in planning is essential for effectively addressing the challenges posed by climate change. By combining these approaches, we can develop more resilient communities and ecosystems. Key initiatives such as reforestation, water management, and the promotion of renewable energy play a crucial role in this integration. These projects not only mitigate the impacts of climate change but also enhance the overall sustainability and health of our environment, ensuring a better future for all. International cooperation plays a crucial role in addressing global challenges, and our collaboration with organizations such as the United Nations, the Red Cross, the World Bank, and JICA is vital in this endeavor. By working together with these institutions, we enhance our capacity to respond to crises and implement effective solutions. Our participation in the Sendai Framework for Disaster Risk Reduction (2015–2030) further exemplifies Nepalese commitment to building resilience against disasters and promoting sustainable development. Through these partnerships and frameworks, Nepal has aimed to foster a safer, more prepared world for all.

The prevention and mitigation of disasters is a critical focus in Nepal, emphasizing the integration of mitigation measures into planning processes. This approach is essential for enhancing preparedness and building capacity within the country. The National Disaster

Relief Fund and Government of Nepal annual budget play a pivotal role in mitigating disaster risks, providing necessary resources for effective disaster management strategies. Additionally, the establishment of response funds and disaster mitigation funds at local, provincial, and federal levels ensures a comprehensive framework for addressing disaster-related challenges and improving overall resilience against potential threats.

Conclusion

To enhance Disaster Risk Reduction and Management (DRRM) implementation in Nepal, it is indispensable to strengthen local government capacity ensuring that they are equipped to effectively manage and respond to disasters. A critical step in this process is the strict enforcement of building codes throughout the country, which can help create safer structures and communities. Besides, expanding early warning systems across various hazard types is vital for timely alerts and preparedness. Increasing investment in risk-resilient infrastructure may reinforce community safety and sustainability. Finally, improving data collection and hazard mapping is necessary for informed decision-making and planning that enables a more proactive approach to disaster risk management.

To mitigate natural disaster risk in Nepal, a comprehensive approach is essential, beginning with hazard and risk assessments that involve mapping hazard-prone areas such as landslides, flood plains, fault lines, and glacial lakes. Identifying vulnerable populations and critical infrastructure, including schools, hospitals, and roads, is crucial, particularly in light of climate projections indicating increased risks due to factors like heavier rainfall and glacial melt. Early Warning Systems (EWS) play a vital role in this strategy by enhancing weather forecasting capabilities, installing rainfall gauges, and establishing community-level alert systems through SMS alerts and local volunteers. Effective risk sensitive land use planning and regulation are necessary to avoid development in high-hazard zones while enforcing building codes that prioritize earthquake-resistant designs, exemplified by the push for multi-hazard resistant houses following the 2015 earthquake.

Institutional and policy measures must ensure robust governance, clear responsibilities for disaster management, and integrated planning that considers hazard risks in development projects. Investment in resilient infrastructure, such as earthquake-resilience infrastructure for hospitals, schools and other public facilities, is critical, alongside social protection mechanisms that provide support before and after disasters. Public awareness campaigns, active community participation, and ongoing research utilizing geospatial tools and technology are also integral to this multi-faceted approach. Finally, securing dedicated

budgets, risk transfer tool such as increasing coverage of insurance, and international partnerships is vital to bolster Nepal's disaster risk reduction efforts.

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