

Review

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Evolution of disaster risk governance and its implication to resilience building in Nepal

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Abstract

The concept of disaster risk governance has evolved in line with international trends in the face of various challenges, such as sustainable development, climate change, and urbanization. Nepal, a country prone to natural disasters, has a history of disaster risk governance. The 2015 Earthquake caused extensive damage, but disaster risk governance in Nepal was re-established as reconstruction progressed. Ratification of the Sendai Framework for Disaster Risk Reduction 2015-2030 was also adopted in 2015, and the establishment of a federal system on a new constitution was promulgated in the same year, decentralized responsibility for disaster risk management from the center to the regions. This paper attempts to identify the evolution of disaster risk governance in Nepal, considering the above background and the impact of civil society interventions and technological advances in the disaster risk reduction field.

Keywords: Disaster risk, governance, resilience building, decentralization, Nepal

INTRODUCTION

According to the United Nations Office for Disaster Risk Reduction (UNDRR), Disaster Risk Governance is defined as “the system of institutions, mechanisms, policy and legal frameworks and other arrangements to guide, coordinate and oversee DRR and related areas of policy”^[1]. People have faced the risk of exposure to natural hazards since time immemorial. Still in ancient and medieval times, natural hazards were considered



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divine will and were responded to with religious interpretations and prayers^[2]. The lack of scientific understanding and effective governance leaves societies vulnerable to such events' effects^[3]. However, these disasters also had the potential to trigger political action and create opportunities for change and response. Devastating “natural” disasters often set socio-political and cultural dynamics in motion, creating conditions in which political change can occur at the hands of a disaffected civil society. If the state fails to respond adequately to a disaster, it could become a turning point in the historical trajectory^[4].

Since the modern era, advances in science and technology have facilitated disaster risk management, which have developed more systematic and practical approaches. In the 19th and early 20th centuries, the concept of disaster risk governance developed as part of disaster mitigation measures to protect settlements from disasters such as floods and fires. Subsequently, disaster risk governance developed in the early 2000s in line with the paradigm shift in disaster risk management^[5]. Disasters are now seen as not arising from natural hazards but from the exposure of vulnerable populations to hazards. They became widely recognized as development and governance issues. The previous focus on “response and recovery” and the importance of “prevention and preparedness” has been advocated gradually each time the disaster occurred, and systematically integrated disaster risk reduction (DRR) was called for^[6]. It required the cooperation of various stakeholders, including local, national, regional and international agencies, the private sector and non-profit organizations. Technological advances have also led to the use of new technologies for effective governance in disaster risk management in recent years.

Nepal is a small country with diverse hazards sandwiched between two large countries, China and India. It is a country where disaster management policies have been promoted, driven by disaster experience and international frameworks, while receiving resources on finance and human resources from external aid agencies. This paper aims to (i) summarize and analyze the process of internalizing these policy frameworks and the many challenges Nepal has faced in implementing these policies; (ii) identify the evolution of the concepts of disaster risk management and disaster risk governance; and (iii) provide suggestions for building resilience in the Nepalese context. This study will contribute to a comparative analysis with other countries facing similar challenges. Based on this paper's discussion of disaster risk governance in local governments and communities, future work will consider analyzing the vulnerability and resilience of specific areas to disaster risk using qualitative and quantitative methods, such as interviews and field surveys.

METHODS AND MATERIALS

The paper adopts a qualitative analysis of global and national key policy documents. Three international frameworks on DRR were analyzed: the Yokohama Strategy and Action Plan of 1994, the Hyogo Framework for Action 2005-2015 (HFA) of 2005, and the Sendai Framework for Disaster Risk Reduction 2015-2030 (SFDRR) of 2015. These three frameworks are the key global frameworks of DRR, and analysis of these provides a historical evolution of DRR globally. Apart from these three disaster frameworks, Sustainable Development Goals (SDGs) and Paris Agreements were also analyzed to understand the link of disaster, climate change and development issues.

For the analysis at the national level in Nepal, three time horizons were chosen: DRR 1.0, which focuses on the phase until the 2015 Earthquake. A baseline of 1982 was used for this when the Natural Calamity Relief Act (NCR) was formed. The second time horizon was DRR 2.0 (2015 to 2019) during the immediate relief and reconstruction period and DRR 3.0 (2019 onwards), when the national DRR authority was formed and Nepal went through a decentralization process. To analyze the evolution of the three time horizons, a total of 21 national documents from 7 categories were examined: Constitution (1 document), Act (4 Acts), Policy

(3 policy documents), Strategy (2 national strategies), Plan (6 national plans), Strategic Plan (2 strategic plans) and Action Plan (3 action plans).

INTERNATIONAL FRAMEWORK FOR DISASTER RISK REDUCTION

The paradigm shift in the concept of disaster risk governance reflects the evolution of international trends in DRR. In the 1980s, rapid urbanization and expansion in many cities worldwide led to increased population density. This increased urban vulnerability to disasters, including inappropriate land use and lack of building regulations. In urban areas, earthquakes, floods, typhoons, and fires, which cause extensive damage to buildings and infrastructure and seriously affect human lives and property, were seen as a problem. Against this background of the international community facing the severe effects of disasters, the International Decade for Natural Disaster Reduction (IDNDR) (1990-1999) was enacted by the UN General Assembly in 1987. During this period, the international society focused on natural hazards, raising awareness and encouraging measures and initiatives to reduce the vulnerability of cities and people.

The first World Conference on Disaster Reduction (WCDR) in 1994 adopted the Yokohama Strategy and Plan of Action for a Safer World. It provided a framework for the international community to reduce disaster risk and mitigate the impacts of natural disasters by setting specific action plans and targets^[7]. The Yokohama Strategy and Plan of Action emphasized improving coping mechanisms to better cope with and recover from the effects of disasters and emphasized knowledge and experience in emergency management at the local level.

The Great Hanshin-Awaji Earthquake in 1995 caused extensive damage. It drew national and international attention, and in 2005, the Second WCDR was held in Hyogo to review the lessons of the past decade, discuss progress and challenges in DRR, and consider new strategies and initiatives. The HFA was adopted as a set of principles and strategies for disaster risk governance that will strengthen international collaboration for DRR, support DRR efforts at the national and local levels, and promote efforts to build sustainable societies. Countries' efforts towards these goals were encouraged^[8].

In the 2010s, disaster risk governance was further strengthened as an integrated approach that goes beyond mere response and recovery and combines a wide range of elements, including prevention, mitigation, recovery, and sustainable development. The SFDRR succeeded the HFA, emphasized that DRR is a continuous process, and focused on the multiple factors that cause disasters. It also stressed that a comprehensive approach to risk reduction requires the participation and contribution of various stakeholders, including central governments, local governments, the private sector, civil society including vulnerable groups, and international organizations^[9].

LINKAGE WITH SDGS AND PARIS AGREEMENT: DISASTER, CLIMATE AND DEVELOPMENT NEXUS

In parallel to the WCDR trend, the SDGs and the Paris Agreement, adopted in 2015, play an essential role in how the international society views disaster risk governance. The SDGs are global goals to achieve sustainable development by 2030, including poverty eradication, elimination of hunger, promoting of health and well-being, spread of education, and promotion of gender equality. To achieve these goals, it is essential to increase resilience to disasters; in other words, building resilient societies and infrastructure is also critical to realizing the SDGs^[10].

The Paris Agreement is an international framework for combating global warming beyond 2020. It aims to pursue efforts to limit the increase in global average temperature to 1.5 °C, well below 2 °C compared to pre-industrial levels. To this end, under the Paris Agreement, the international society aims to reduce global greenhouse gas emissions to virtually zero, or “decarbonization”, in the second half of the 21st century. Furthermore, it is a comprehensive international agreement with mechanisms to strengthen adaptation measures to cope with the effects of climate change, as well as financial, technical and other support for a range of measures. All countries, whether developed or developing, must voluntarily prepare and submit reduction targets, known as Nationally Determined Contributions (NDCs), every five years, considering their national circumstances^[11].

The interlinkages between DRR, climate change, and sustainable development are crucial to achieving the goals of the Paris Agreement and the SDGs^[12,13]. These linkages are significant in addressing the impacts of climate change on the most vulnerable communities and countries and ensuring climate-related disasters do not undermine development efforts. However, there are challenges in implementing these linkages, including political, economic, and knowledge gaps and the need for improved governance and financing^[12]. Governments, businesses, and civil society must work together to maximize synergies between relevant agendas and achieve sustainable development in the face of climate change^[14].

OVERVIEW OF HAZARDS AND VULNERABILITIES IN NEPAL

Nepal is highly vulnerable to natural hazards due to its diverse and complex geographical, social, and economic background.

Geographical characteristics and hazards

Nepal's diverse topography, including the high Himalayas and plains, makes the country susceptible to various hazards. Steep slopes, monsoon rainfall, and geological conditions contribute to risks such as landslides, floods, and glacial lake outburst floods (GLOF) that continue to impact local economies and societies. The terrain is divided into terai, hilly, and mountainous areas.

- Terai Region: located in the southern part of Nepal, which comprises fertile and densely populated low-lying plains. This area covers about 24% of Nepal's total land area, and about 50% of the population lives here.
- Hilly Region: between 1,000 and 4,000 meters above sea level, which provides a topographical barrier to the monsoon winds, resulting in high rainfall.
- Mountainous Region: covering about 34% of the country, the area includes the Himalayas, which range in altitude from 3,000 to 8,848 meters at the summit of Mount Everest. Glaciers and a small population characterize it.

These geographical characteristics expose the country to multiple hazards, including:

Earthquakes: Nepal is located south of the Himalayas in a seismic zone where the Indian and Eurasian plates collide. The area is seismically active and has experienced several significant earthquakes.

Slope failures and landslides in mountainous areas: Nepal is a mountainous country with steep terrain and a high rainfall climate, which causes frequent landslides, slope failures, and other landform changes. Landslides and floods are more likely to occur during the rainy season when rainfall is concentrated.

Floods: Nepal is one of the areas at high risk of flooding due to abundant rainwater from the Himalayas and the breakup of glacial lakes. Rivers are particularly prone to flooding and rising water levels during the monsoon season.

GLOF: there are many glacial lakes in Nepal and flooding due to overflowing of these glacial lakes is likely to occur. Climate change is accelerating the rate of glaciers melting, increasing the risk of glacial lake floods.

Wind damage: high winds and tornadoes can cause damage in the plains and lowlands of Nepal. Cyclones are particularly susceptible, and damage to crops and buildings has been reported.

Other hazards: other risks include thunderstorms, mudslides, avalanches, animal attack, and forest fires are likely occurred.

Social vulnerability to disasters

Nepal's susceptibility to natural hazards stems from its intricate mix of geographical, social, and economic characteristics, making it a high-risk location for such events^[15]. Social vulnerability in Nepal is associated with various issues, such as weak governance, rapid urban expansion, and environmental degradation, and is heavily influenced by multiple socioeconomic, demographic, and geological factors^[16].

The population in Nepal includes many ethnic groups and castes, and there are significant disparities in socioeconomic conditions. The caste system leads to social exclusion and discrimination, primarily in rural areas. Such exclusion affects access to resources and opportunities for the groups and increases vulnerability in times of disaster^[17,18].

Nepal's vast and diverse topography, from lowland plains to the world's highest mountains, creates a variety of social vulnerabilities. Rural areas, especially in mountainous regions, are often the most affected during disasters due to isolation, inadequate infrastructure, and limited access to emergency services^[17].

Regarding infrastructure and development, rapid urbanization without proper urban planning has led many people to live in highly hazardous areas. Many buildings have been constructed that do not comply with building standards. Poor infrastructure and lack of disaster-resistant building practices have exacerbated the effects of disasters^[17,18].

Demographics in Nepal have changed significantly in recent decades^[19]. Fertility and mortality rates have declined as the transition to urban living has accelerated. The population grew by about 31% between 2000 and 2023 (from 23,486,982 to 30,899,443)^[20]. The birth rate is below replacement level (total fertility rate 1.88) and immigration is high (the net migration rate in 2023 is -4.3). Nepal's population is relatively young, with 45.7% of the population under the age of 24^[20]; the percentage of rural population in 2020 (79%) is higher than in other South Asian countries (65%)^[21,22]. Urbanization rates are low (21% in 2022) and education levels are low (average years of schooling in 2021 was 5.1 years)^[20].

In terms of economy, Nepal is a lower-middle-income country. Most of the population is engaged in agriculture in rural areas (66%), producing one-third of the GDP. Migration is high, and private remittances account for almost a quarter of GDP, contributing significantly to the national economy. There are considerable disparities between urban and rural areas, as well as between provinces^[23]. Regarding social infrastructure, more than 90% of Nepal's population has access to telephones and sanitation facilities. However, there are significant differences between urban and rural areas regarding access to television,

computers, and the internet. Access to adequate clean water and electricity is also high (over 80%).

On the other hand, Nepal has limited funds for social infrastructure and disaster management, and funds are not used appropriately during ordinary times. Economic vulnerability affects the extent of damage and the difficulty of recovery and reconstruction in times of disaster. Socioeconomic inequality and poverty make disaster damage more severe, and the impact of disasters on vulnerable areas and groups is more significant^[24].

Furthermore, the legal and organizational structures, preparedness, and response measures to address natural disaster risks are inadequate^[25]. Also, education plays a critical role in reducing vulnerability^[26], but existing educational programs for DRR are insufficient to build a disaster-resilient society; both students and teachers lack knowledge and preparedness, and the importance of strengthening DRR education, especially in schools, is discussed to build more resilient society^[27].

EVOLUTION OF DISASTER RISK REDUCTION IN NEPAL

The evolution of disaster management and disaster risk governance in Nepal has evolved in stages through the occurrence and experience of disasters. Various factors have facilitated the evolution, including international frameworks, national policies, and local community participation. The discussion here is divided into three phases, DRR 1.0-3.0, as follows:

- DRR 1.0: From the post-enactment of the NCR 1982 to the 2015 Earthquake (1982-2015): the NCR in 1982^[28], the first law on disaster response in Nepal, was enacted in 1982. Disaster risk governance in Nepal since then is classified in this phase.

- DRR 2.0: 2015 Earthquake response and rehabilitation phase (2015 Earthquake, April 2015 onwards): to identify the evolution of disaster risk governance in the 2015 Earthquake recovery, especially in the context of the transition to federalism in accordance with the new Constitution enacted in 2015, which decentralizes the role of DRR.

- DRR 3.0: From reconstruction to resilient Nepal (after the establishment of the National Disaster Risk Reduction and Management Authority (NDRRMA) in December 2019): the National Reconstruction Authority (NRA), which has been functioning as an interim organization since the 2015 Earthquake, has completed its role and has been replaced by the NDRRMA. The evolution of disaster risk governance in the context of building a disaster-resilient nation is analyzed in this phase.

DRR 1.0: from the post-enactment of the NCR 1982 to the 2015 Earthquake (1982-2015)

Nepal is at high risk from various natural hazards such as earthquakes, floods and avalanches in mountainous areas which cause severe damage, including loss of life, collapse of buildings, and destruction of crops. The impact of these disasters on Nepal's economy and society has been significant. Systematic efforts on disaster risk management in Nepal began after 1982 when the NCR was promulgated^[28].

At the time, emergency response capacities to natural hazards were lacking, especially for the Deurali (Pokhara) landslide of 1974 and the Bajhang earthquake of 1980, which led to the enactment of the NCR 1982. Nepal was one of the first countries in South Asia to introduce a disaster risk management act, which was enacted to strengthen the country's response capacity by providing a framework for the government to respond quickly and effectively in the event of a disaster, with a primary focus on relief and response from the damage. At the same time, little emphasis was on disaster preparedness. Since then, Nepal has changed

its approach to disaster management, influenced by international trends and global perspectives^[29]. Based on the HFA adopted in 2005, Nepal developed a National DRR Plan. The following is a retrospective record of earthquakes in Nepal since 1980 and a summary of international assistance and strengthening of disaster risk governance efforts [Table 1].

In the wake of these earthquakes, Nepal has been promoting DRR efforts with international assistance.

DRR 2.0: 2015 Earthquake response and rehabilitation phase (April 2015 onwards)

With significant support from the international society, the Government of Nepal (GoN) has strengthened its disaster management and DRR efforts since the 2015 Earthquake, introducing updated provisions in government laws and policies, and transforming Nepal's approach to earthquake risk reduction^[39]. The country has promoted the development of laws, institutional arrangements, and operational mechanisms to ensure constitutional disaster resilience to facilitate inclusive disaster governance through federalization. Nepal's Disaster Risk Reduction and Management (DRRM) Act 2017 mandates intergovernmental cooperation across federal, provincial, and local levels. Nepal has also integrated the core tenets of the SFDRR into the National Disaster Risk Reduction Strategic Action Plan 2018-2030, highlighting its commitment to DRR.

Several departments have been established under each ministry in the federal government to strengthen response, preparedness and risk reduction capacity. The provincial government coordinates between the federal and local governments. Local governments work directly with communities at all points in the disaster management cycle, from disaster mitigation to resettlement, as mandated by the Local Government Operation Act 2017. The Act also mandates establishing and operating a disaster management fund and resource mobilization. The DRRM Act 2017 mandates the establishment of a National Council, Executive Committee and Authority (establishment of an NDRRMA) and clarifies disaster management roles, responsibilities, and accountability^[40]. The NDRRMA coordinates and facilitates cooperation within this new disaster governance framework.

Nepal has also demonstrated its commitment to DRR by including crucial provisions of the SFDRR in the Disaster Risk Reduction National Strategic Plan of Action 2018-2030, which calls for a more comprehensive and sustainable approach that emphasizes cooperation and coordination between national and international stakeholders. On the other hand, rapid legislative changes to facilitate this transition have created confusion between government and disaster management agencies, affecting coordination mechanisms for effective risk governance and disaster management.

DRR 3.0: from reconstruction to resilient Nepal (after the establishment of the NDRRMA, December 2019)

At the end of 2019, the NDRRMA was established under the DRRM Act 2017. Nepal aims to become a disaster-resilient nation and ensure a resilient society. It requires DRR to strengthen disaster management, community participation, and capacity building. NDRRMA is one of the leading disaster management agencies of the GoN, which coordinates and implements disaster-related activities. Its specific roles are defined as follows;

- Developing and implementing DRR policies, strategies, and plans
- Conducting disaster risk mapping and vulnerability assessments

Table 1. Earthquake in Nepal and strengthening international assistance and DRR efforts

Earthquake	Summary	International support and measures to strengthen DRR efforts
1980 Earthquake ^[30,31]	July 29, 1980 Magnitude (Mw): 6.6 Epicenter: Northwest of Khaptad National Park, Nepal-India border area Impact: At least 200 people lost their lives Many buildings around Bhajan, western Nepal, were damaged	Beginning of international cooperation: Nepal received assistance from the international society for the first time in its reconstruction efforts after the earthquake. This became the foundation for later international aid Laying the groundwork for disaster management: With the support of international organizations, a basic framework for disaster management was established. This has led to the formulation of basic policies for DRR
1988 Earthquake ^[32-34]	August 20, 1988 Magnitude: 6.9 Epicenter: Kathmandu, Nepal Impact: Over 1,000 fatalities and thousands injured	Initial response and recovery support: The United Nations Development Program (UNDP) and the International Committee of the Red Cross (ICRC) provided emergency assistance and supported recovery efforts in the affected areas Initiation of DRR education: After the earthquake, with the support of UNDP, a DRR education program was introduced in schools to teach students and teachers the importance of DRR Review of building codes: The 1988 earthquake prompted the reviewing and strengthening of earthquake resistance standards for buildings
2011 Earthquake ^[35,36]	September 18, 2011, Magnitude: 6.9 Epicenter: Sikkim (India-Nepal border area) Impact: 111 deaths	Enhanced emergency response training: With the support of international organizations, disaster response training was conducted nationally. This has improved skills in rescue operations and evacuation guidance Local community education: An educational program on earthquake safety and evacuation procedures was introduced for local residents
2015 Earthquake ^[37,38]	April 25, 2015 Magnitude: 7.8 Epicenter: approx. 77 km northwest of Kathmandu Death toll: 8,964 Total economic loss: around \$5 billion	UN and International NGO intervention: The UN and several international NGOs immediately stepped in to help, providing relief supplies, setting up shelters, and providing medical assistance Financing for reconstruction: Infrastructure reconstruction and rebuilding was carried out with significant financial support from the World Bank and the Asian Development Bank Reinforced earthquake-resistant design: Building codes were revised to promote the introduction of more earthquake-resistant construction techniques. Seismic design was mandated for post-earthquake reconstruction DRR program implementation: The GoN, with international assistance, established the NDRRMA to improve disaster response capacity

- Coordinating emergency response and relief operations during disasters

- Strengthening local capacities and disaster awareness

The DRRM Act 2017 provides for more extraordinary powers for NDRRMA. Still, there is confusion, including reliance on the Ministry of Home Affairs for cabinet decisions, restrictions on financial decision-making, little control over security mobilization in humanitarian crises, constraints on recruitment and mobilization, and decision-making for foreign aid mobilization. The country still faces many challenges.

ENABLING POLICY ENVIRONMENT IN NEPAL

Decentralization

Nepal, led by the 2015 Constitution, has begun to steer towards decentralization, while neighboring large countries such as China and India tend to have a more centralized approach. The most important aspect of decentralization in disaster risk management is the disaster response system at the local level. Local governments and communities must be able to act quickly and manage their response to disasters effectively. Their skills are essential to protect lives and property in a disaster. However, vital and first responders at the local level often lack the skills, knowledge, and resources needed to prepare for and manage a disaster response^[41].

In Nepal, security agencies play a central role in disaster response. The DRRM Act 2017 mandates the deployment of security forces during disasters. However, security agencies cite the need for better-equipped and trained personnel. Frequent turnover in leadership and a lack of clarity in the response mandate of various agencies pose additional challenges to effective disaster management. Clarifying the division of duties, such as Nepal Police for community awareness, Armed Police for small-scale disaster response management, and Nepal Army for large-scale disaster management, would increase efficiency and accountability.

Different DRR-related policies and plans

Various policies, plans and initiatives regarding DRR in Nepal have been implemented. The Nepal Constitution of 2015 and the DRRM Act of 2017 provide that disaster risk management responsibilities are given to all three levels of government - federal, provincial, and local- and that all of them must share responsibility for DRRM. Schedule 7 of the Constitution provides that federal and provincial governments are responsible for disaster preparedness, rescue, relief, and recovery. Schedule 8 leaves disaster management at the local level solely to the provincial governments. Schedule 9 states that disaster management is the joint responsibility of the federal, provincial, and local governments^[42]. The critical legal frameworks for DRR since the enactment of the 2015 Constitution are listed in [Table 2](#). Among them, the DRRM Act 2017 and the Local Government Operation Act 2017 are critical^[43].

The following provisions regarding disaster management are in Nepal's decentralization context.

1. Strengthened powers of local authorities: responsibilities for disaster management and disaster risk management by local authorities are strengthened, emphasizing the formulation, implementation, and monitoring of disaster management plans at the local level.
2. Local authority disaster management plans: each local authority must develop a plan based on regional characteristics and risks. This includes emergency response plans and long-term risk management strategies for natural hazards such as earthquakes, floods, and landslides.
3. Risk assessment and mapping: local authorities conduct risk assessments and disaster risk mapping to collect data to understand local vulnerabilities and seismic risks and take appropriate measures accordingly.
4. National disaster risk management strategy: the GoN has developed the DRR National Strategic Plan of Action. The strategy aims to support local government initiatives in response to local needs and risks and to improve disaster management capacity within the decentralized framework.
5. Funding allocation and technical assistance: the GoN has set out funding and technical assistance for local authorities to support disaster management activities. This includes training programs and technical assistance tailored to local characteristics^[40,44].

The above policies and plans provide an essential framework for local authorities to improve local disaster management capacity and resilience to disasters. Nepal aims to build a robust disaster management system under decentralization and promote community safety and well-being through these initiatives. On the other hand, despite the legal framework and policies in place, there are a lot of difficulties and challenges in implementation, and the effectiveness and sustainability of DRR in Nepal remains a concern, particularly in the context of the SFDRR^[45]. While the UN framework has mainly influenced this shift toward disaster preparedness and risk reduction, some points have been raised that have been challenging to implement in line with the Nepali context and may not address the root causes of disasters^[46].

Table 2. Legal framework for disasters in Nepal

Category	Item	Year
Constitution	Constitution of Nepal 2015	2015
Act	Disaster risk reduction and management act 2017	2017
	Natural calamity relief act	1982
	Local governance operation act 2017	2017
	The environment protection act 2019	2019
Policy	National policy for DRR 2018	2018
	Climate change policy	2011
	National forest policy 2019	2019
Strategy	Forestry sector strategy 2016-2025	2016
	National REDD + strategy	2018
Plan	National plan	
	Fifteenth periodic plan 2018/19-2023/24	2018
	Fourteenth periodic plan 2016/17-2018/19	2016
	Thirteenth periodic plan 2013/14-2016/17	2013
	Twelfth periodic plan 2010/11-2013/14	2010
	Eleventh plan 2007/08-2010/11	2007
	Tenth plan 2002-2007	2002
Strategic plan	DRR national strategic plan of action 2018-2030	2018
	National strategic action plan for search and rescue 2013	2013
Action plan	National framework on adaptation plans for action (NAPA)	2010
	Local framework on adaptation plans for action (LAPA)	2011

TOWARDS DEVELOPMENT OF RESILIENT COMMUNITIES AND GOVERNMENT

Building resilience

Disaster-resilient communities and governments are crucial to building resilience and achieving sustainable development. Understanding local vulnerability, leadership development, and improving disaster preparedness are essential at the community level. At the government level, the development of legal frameworks, policy formulation and implementation, and allocation of resources are necessary. Collaboration among local governments is also an effective way forward in disaster risk management, which is led by the response area, as a way of resolving the issues of experienced and skilled human resource shortages and reduced administrative functions and to enable cooperation with neighboring local governments in the event of a large-scale disaster that a single municipality cannot handle. This will be an effective method in disaster risk management led by the responding community. Building resilience requires a multifaceted approach that includes understanding and assessing disaster risk, managing appropriate infrastructure and resources, community participation and cooperation, and education and awareness raising. Integrated long-term and short-term strategies may help promote effective disaster risk management and sustainable development.

In the short term, these include strengthening disaster emergency response, recovery, and early warning systems and organizing campaigns and training for the communities to increase awareness and understanding of disaster risks. On the other hand, infrastructure development, institutional strengthening of government agencies, and human resource development are long-term initiatives that need to be integrated into short-term efforts. Utilizing international frameworks such as the SDGs and the SFDRR is also essential. In addition, community-government partnerships, cooperation with the private sector, and linkages to international assistance will also play a crucial role in building resilience.

Lessons from the cases of other countries

There are many examples of successful resilience-building efforts that have adopted a comprehensive approach that is tailored to local characteristics and risks. Recognition of the importance of disaster preparedness and response, and working collaboratively throughout the community is the key to resilience.

Earthquake preparedness in Japan: Japan has excellent earthquake preparedness despite being earthquake-prone. These include the implementation of disaster drills and simulations, adherence to earthquake-resistant building codes, and introduction of an earthquake early warning system. Furthermore, based on the experiences of past earthquakes, efforts are being made to enhance the disaster preparedness of local communities, strengthen cooperation with local governments, and proactively develop disaster management plans for local communities and local authorities.

Flood control in the Netherlands: Comprehensive flood risk management is in place, including river management, levee maintenance, and the establishment of inundation zones. Educational programs and simulations are also conducted to improve the flood response capacity of citizens.

Proactive promotion of community-based disaster management (CBDM) in Indonesia: Local communities are aware of their own risks and are developing disaster response plans under local leadership to reduce disaster risks at the community level. The Government of Indonesia is also working to improve disaster preparedness and response capacity, conducting training and exercises for disaster response and building the capacity of local rescue teams and volunteers.

Application to Nepal: The above examples from other countries provide valuable suggestions for enhancing disaster resilience in Nepal. Assigning responsibilities and resources for disaster management to local governments and communities; conducting regular drills and simulations to ensure preparedness; introducing early warning systems that combine modern technology with traditional means of communication; and developing infrastructure such as multipurpose shelters that provide safe refuge in the event of a disaster, educational programs that foster a culture of disaster preparedness from an early age are some of the areas that could be considered for building resilience in Nepal.

National and local governance

Nepal adopted a new constitution in 2015 and transitioned to a federal system. This restructured the relationship between three layers of governance and strengthened the powers and responsibilities of local governments by devolving authorities to the local level. Specifically, the new Constitution introduced a federal system divided into seven provinces, each devolving some of its powers and finances. Local governments were also established under the provinces, strengthening government functions at the local level. This reorganized the distribution of authority, financial resources, and policy-making processes between the federal and the provinces.

At the same time, the relationship between the three layers of government in Nepal remains a challenge, with issues such as inadequate laws and policies, poor coordination, and leadership effectiveness still hindering the efficacy^[47]. Local authorities also need adequate resources and technical assistance to fulfill their new responsibilities. Problems with decision-making and resource allocation between the three layers of government also remain. Cooperation and coordination between the three layers of government are essential to strengthen the relationship between the state and local government in Nepal. Local

governments' decision-making capacity and financial sustainability must be strengthened, and policies and programs responsive to local needs must be developed. Enhancing information sharing and cooperation between the three government layers will also be essential to establish a sustainable development and prosperity framework.

Coordination among local governments also needs to be discussed. While local plans, the cornerstone of municipal disaster risk management, are to be developed by each municipality, the federal government must ensure that these plans do not vary significantly and that measures are leveled to facilitate coordination^[48].

Urban and rural connections

The discussion on urban-rural linkages concerning disaster risk highlights the importance of infrastructure connectivity and risk management linkages.

Urban-rural connections between road and transport infrastructure, as well as communication infrastructure, are crucial. Rapid transport of goods and aid is essential in times of disaster, and adequate infrastructure is vital. Access to rural communities is complicated, especially in Nepal's hilly terrain, and the 2015 Earthquake exposed gaps in disaster preparedness, especially in rural areas^[49]. Nepal is heavily dependent on India's crucial imports, including fuel and essential primary transport and logistics networks, especially in rural areas, further complicating disaster response and recovery efforts^[50].

In addition, the development of telecommunications infrastructure linking urban and rural areas is essential as an effective means of communication for early warning systems and rapid response to emergencies^[40]. Telecommunication operators in Nepal have set up telecommunication towers in remote and hilly areas to expand mobile networks and encourage the use of mobile phones and the internet, online information access, education, and business opportunities in areas where communication has been limited in the past. The GoN focuses on developing telecommunications infrastructure, including implementing digital inclusion initiatives. There are also examples of collaboration between local police and private telecommunications providers to improve emergency call systems and conduct training on the use of telecommunications equipment and emergency response, thereby improving police emergency response capabilities and enhancing community safety.

Urban-local partnerships in managing these initiatives require capacity building and technical support for local authorities, including knowledge sharing on formulating and implementing disaster management plans from ordinary times and creating relationships for information sharing and cooperation.

In Nepal, there are constraints on infrastructure installation and maintenance due to the harshness of the terrain, and the high cost of infrastructure development in remote areas makes it necessary to build a sustainable management model. Furthermore, ongoing education and support for rural residents to effectively use new technologies is a challenge in connecting urban and rural areas. It has been noted that isolation of rural areas is a significant problem, especially during a disaster, making it difficult to respond quickly^[40].

Academic institutions

Two major universities in Nepal, Tribhuvan University (national university) and Kathmandu University (private university), train students in earthquake engineering and medical response and play an essential role in human resource development to strengthen national disaster preparedness and response capacity.

Tribhuvan University:

- Faculty of Engineering: It offers a master's program in earthquake engineering, including courses on structural dynamics, seismic hazard analysis, and seismic design of structures. The program prepares students to handle and mitigate seismic risks through advanced engineering techniques^[51].

- Faculty of Medicine (IOM): Nepal's premier medical education center offers a range of postgraduate and master's programs. The campus focuses on training medical professionals to respond to emergencies during disasters. Specialist programs in anesthesiology, clinical biochemistry, clinical pharmacology, and clinical physiology (MMCIOM) are also offered^[52].

Kathmandu University (KU):

- Department of Civil Engineering: It offers MSc programs, including courses on earthquake hazard management. These courses cover seismic hazard analysis, design, and advanced structural engineering techniques^[53].

These programs aim to equip students with the necessary skills to contribute effectively to DRR and management efforts in Nepal. By integrating academic training with practical application, both universities aim to produce professionals who can deal with the challenges of natural disasters such as earthquakes. In addition, both universities have established partnerships with international organizations to facilitate knowledge exchange and advanced training. Workshops, conferences, and on-the-job training sessions are regularly organized to enhance students' practical skills in earthquake engineering and medical response.

Community and volunteer activities

Disaster risk governance in the UNDRR definition mentioned at the beginning of this paper covers government-led governance and local governance, including communities. Community disaster management is using social capital to ensure that communities can respond on time as first responders in the event of a disaster, including disaster preparedness, understanding community risks from a DRR perspective, and using early warning systems and training for different types of disasters. Nepal has traditionally had strong social cohesion, with community volunteers playing an active role in the immediate relief efforts, such as communities willingly preparing food and supplying water for rehabilitation and reconstruction efforts after the 2015 Earthquake, and locally available materials were used to construct temporary shelters. Thus, the strength of community ties has played an essential role in past disasters. This is believed to be because daily neighborhood interaction and local festivals significantly strengthen social bonds^[54].

Nepal places more emphasis on community-based disaster risk management than its neighboring countries. Nepal has policies in place to support community engagement; however, there are challenges in their implementation and in recognizing the full potential of these community-led initiatives within the policy framework^[55]. In addition, when promoting active community engagement, consideration must be given to including vulnerable groups in line with the local context^[56]. Currently, Ministry of Federal Affairs and General Administration (MoFAGA) is taking the leadership on the GoN side and humanitarian and development partners are working together to implement the DRRM Act 2017, SFDRR, National DRR Policy 2018, and the DRR National Strategic Plan of Action 2018-30, the Community-based Disaster Risk Management (CBDRM) platform has been launched as an arrangement to reduce Nepal's vulnerability from the impacts of disasters and build disaster-resilient communities, facilitating coordination and policy co-creation among the stakeholders^[57,58].

On the other hand, the lack of attention to communities and vulnerable groups when large-scale relief and recovery efforts are brought in from outside has sometimes been criticized for excluding vulnerable groups and undermining the goal of building resilient societies^[59]. In other countries, consideration must be given to coordinating with external relief efforts, such as ensuring the principle of Do No Harm, which is considered in contexts where external assistance is required, such as humanitarian relief operations after large-scale disasters^[60,61].

Technology regime

Innovative technologies play a pivotal role in enhancing DRR and management in Nepal. One recent initiative that has received attention is the RA2CE (Resilience 2023) tool developed by Deltares and the World Food Program (WFP) Nepal. The tool aims to improve emergency response by providing real-time information on road access during disasters. It uses graph theory to identify isolated settlements and facilitate efficient disaster response, especially during floods.

Another innovative technology used in Nepal is drones, which have been deployed in various disaster response and climate change mitigation initiatives since the 2015 Earthquake to survey damage rapidly, map flood and landslide risks, and provide valuable real-time information. Although there are many challenges, including a lack of data analysts and qualified professional pilots, underdeveloped standards, systems and licenses, and hardware development, drones in the disaster sector can be a pioneering example^[62].

The GoN, in collaboration with development partner organizations such as the World Bank and USAID, is also exploring the use of digital and spatial technologies for disaster risk governance. This includes developing analytical models using open data sources and cloud computing to assess risks from disasters such as landslides and floods at the local level.

On the other hand, adopting innovative technologies in Nepal faces several obstacles, including a lack of infrastructure, skilled human resources and finance^[63]. The policy environment and strategic direction for utilizing information and communication technologies (ICT) and digital technologies are also lacking^[64]. Barriers to renewable energy development, such as economic policy issues, further hinder technological progress^[65]. The ICT sector, in particular, is constrained by challenges related to institutions, infrastructure, and access to financing^[66]. A comprehensive strategy is needed to address these barriers and promote the adoption of innovative technologies in DRR efforts in Nepal.

CONCLUSION

Disaster risk governance in Nepal has been driven by recognizing of preparing for and responding to large-scale disasters in the country and the paradigm shift of international trends toward disaster risk management. Nepal, vulnerable to climate change and facing many disasters, such as frequent earthquakes due to its topography, is experiencing rapid urbanization and population growth, especially in urban areas. On the other hand, due to overexploitation and lack of proper adherence to various standards, many natural hazards turn into man-made disasters when they occur.

With the transition to a federal system, government institutions for disaster risk management have been established, and laws and policies have been drafted and updated on time. However, reality has not kept pace with this framework regarding implementation. It will take time for the concept of disaster risk governance, which is the aim of the international community, to be correctly understood and systematized

as a governance. The urgent task is to ensure that governance is responsive to disaster risk in a manner that considers Nepal's current situation. It is essential to build governance that can respond to disaster risks in a way appropriate to Nepal's situation by leveraging the strengths of local communities encouraging actions that will facilitate DRR and disaster response by frontline communities, and promoting the diffusion of technologies that can easily take root in Nepal.

DECLARATIONS

Authors' contributions

Conceptualization: Kato N, Shaw R

Data collection and analysis, writing: Kato N

Review and guidance: Shaw R

Availability of data and materials

All the data and documents analyzed here are available online with public and open access.

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Conflicts of interest

Both authors declared that there are no conflicts of interest.

Ethical approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

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