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People's Perspective towards Earthquake Risks and Its Mitigation Measures: In the Context of Rural Mountainous Region of Nepal

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Abstract

Nepal, located at the convergence of the Indian and Eurasian tectonic plates, is highly vulnerable to earthquakes due to active seismic zones formed by the ongoing continental collision, particularly along the Main Frontal Thrust. Historical records show frequent and devastating earthquakes, including the 2015 Gorkha quake that claimed around 9,000 lives and caused economic losses exceeding $6 billion. The western region, especially around Jajarkot, has not experienced a major earthquake in the past 2–3 decades, indicating significant seismic energy buildup and an increased risk of a high-magnitude event. Jajarkot district, a mountainous and rural area, is particularly at risk due to fragile geology, traditional construction methods, and poor access to disaster risk reduction (DRR) infrastructure. This study examines local perceptions of earthquake risk, drawing on recent events such as the 2015 Gorkha and 2023 Jajarkot earthquakes. It finds that while awareness exists, proactive mitigation is often limited by poverty, remoteness, and fatalistic cultural beliefs. However, these same cultural and religious systems, if integrated thoughtfully, offer potential platforms for community engagement and awareness. The study recommends adopting culturally sensitive education, strengthening community-based disaster preparedness, enhancing access to resilient construction materials, and decentralizing DRR initiatives. A territorially sensitive,

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people-centered approach is essential to improving earthquake resilience in Nepal's rural highland regions.

Keywords: Earthquake Risk, Rural Communities, Disaster Risk Reduction (DRR), Local Perception, Cultural Beliefs, Traditional Construction, Seismic Vulnerability, Community Preparedness, Resilient Reconstruction, Fatalism, Territorial Planning, Mountain Settlements

1. Introduction

Nepal is one of the most earthquake-prone countries in the world, located in the collision zone between the Indian and Eurasian tectonic plates. This geological setting has created the majestic Himalayas but also exposed the country to frequent seismic activity. Over the past century, Nepal has experienced several devastating earthquakes, including the 1934 Bihar Nepal Earthquake, the 1988 Udayapur Earthquake, the 2015 Gorkha Earthquake, and most recently, the 2023 Jajarkot Earthquake. These disasters have caused significant loss of life, damage to infrastructure, and long-term disruption to livelihoods, especially in rural mountainous regions where vulnerabilities are exacerbated by remoteness, poor infrastructure, and fragile socio-economic conditions (Gautam & Phaiju, 2020).

The 2023 Jajarkot Earthquake, with a magnitude of 6.4, struck Karnali Province on November 3, causing over 150 deaths and injuring hundreds. It severely damaged homes, schools, health posts, and vital infrastructure in Jajarkot and Rukum districts. Like earlier disasters, it revealed persistent weaknesses in Nepal's rural earthquake preparedness: inadequate early warning systems, non-engineered construction, poor access to emergency services, and low public awareness of earthquake-resistant practices (UNRCO, Nepal, 2023). Despite national-level DRR frameworks, many rural areas remain underserved and underprepared.

In the rural mountainous regions of Nepal, people's perception of earthquake risk and their attitudes toward mitigation are shaped by a combination of traditional beliefs, past experiences, limited formal education, and institutional outreach (Rijal, D.; Poudel, R.; Adhikari, B., 2016). In many villages, earthquakes are still understood as expressions of divine wrath or cosmic imbalance, rather than geological processes. Such beliefs often lead to fatalism, reducing motivation to take proactive safety measures. Additionally, these communities tend to rely on informal coping mechanisms, such as communal solidarity, rather than state-driven disaster preparedness plans (Acharya, Bhattarai, & Shrestha, 2021).

Topographic challenges also increase risk in mountainous settlements. Unstable slopes, landslide-prone terrain, and lack of road access complicate both pre-disaster risk reduction and post-disaster recovery. The widespread use of traditional building materials like mud mortar and unreinforced stone masonry makes rural houses particularly vulnerable to seismic forces (Sharma, Khadka, & Singh, 2017). Following the Gorkha and Jajarkot earthquakes, reconstruction efforts emphasized safer building techniques. However, adoption in rural areas has been uneven due to cost barriers, lack of technical training, and mistrust of new construction norms (JICA, 2020); (UNDP, 2019).

Perception matters in disaster preparedness. Research consistently shows that perceived risk is closely associated with preparedness behavior (Paul & Bhuiyan, 2010). However, in Nepal's rural hills, the gap between perceived risk and actual preparedness is stark. People may

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acknowledge the danger but feel powerless to act due to economic limitations, lack of institutional support, or a belief that earthquakes are beyond human control (Gautam, 2018).

This article, grounded in a review of available literature, aims to analyze how people in rural mountainous Nepal perceive earthquake risks and mitigation efforts. It highlights territorial variations in knowledge, belief systems, and coping capacity, and critically assesses the effectiveness of existing risk reduction strategies. By focusing on the human dimension of disaster risk, the study contributes to designing more inclusive, culturally sensitive, and geographically responsive DRR policies, especially for Nepal's most vulnerable communities.

This study employs a qualitative and literature-based research methodology to analyze people's perceptions of earthquake risk and the effectiveness of mitigation strategies in the rural mountainous regions of Nepal. The methodology is designed to synthesize findings from existing academic studies, policy documents, government reports, and post-disaster evaluations to provide a comprehensive understanding of risk perception and DRR practices from a territorial perspective.

2. Earthquake Risk Perception in Rural Nepal

Nepal's rural mountainous regions are highly susceptible to earthquake risks due to their location in the seismically active Himalayan belt, fragile geology, limited infrastructure, and traditional construction practices. Despite these vulnerabilities, the perceptions and preparedness behaviors of local communities vary significantly, shaped by sociocultural, economic, institutional, and territorial contexts. This literature review presents a critical synthesis of existing studies on (1) risk perception, (2) housing vulnerability and construction practices, (3) community engagement and institutional trust, (4) mitigation measures and barriers, and (5) territorial disparities in DRR efforts in Nepal's rural highland regions.

Risk perception is central to understanding how individuals and communities respond to disasters. In rural Nepal, earthquake risk is often perceived through a cultural-religious lens, with many communities attributing seismic events to divine will or karmic consequences (Acharya, Bhattarai, & Shrestha, 2021). This belief can foster a fatalistic attitude that diminishes individual motivation to adopt structural or behavioral mitigation measures.

The social perspective is based on recognition that hazards have an impact on people that is not dependent on the effect of the natural and built environment which directly facilitates individual and collective changes in behavior of the people (e.g. encouraging support and/or adoption of protective measures) and increasing their capacity to adapt the adverse situations (Kuban & Carey, 2001). Blaikie et al. (2005) state that the vulnerability of the people is primarily rooted in social processes and underlying causes, which may ultimately be quite remote from the disaster event itself. It is a means for understanding and explaining the causes of disaster (Blaikie et al., 2005).
Accordingly, disaster can be defined as an expression of social vulnerabilities. It is the result of the underlying community logic of an inward and social process.

Hewitt (1997) describes the new approach to disaster:

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"*The new approach to disaster not only reverses the old hierarchy of factors, but also gets rid of the overwhelming notion of agent. Starting from an analysis of disaster seen as a process tightly tied to social vulnerability, the new paradigm considers that the causes of disaster are to be explained on structural as well as contextual grounds. When social risks explode that are totally raised inward to the community, then there is a disaster. As a result of the first conceptual shift, disaster is no longer experienced as a reaction; it can be seen as an action, a result, and more precisely as a social consequence*".

A study by Gautam (2018) found that rural residents in Gorkha and Sindhupalchowk acknowledged the dangers of earthquakes but rarely implemented preparedness strategies unless they had personally experienced damage or loss. Similarly, Rijal et al. (2016) reported that knowledge about earthquake-resistant construction was low in mountain villages, despite increasing exposure to awareness campaigns. The gap between awareness and action was attributed to economic hardship, mistrust of external experts, and cultural inertia. According to Singh (2016), earthquake risk is high in urban settings and very high in rural settings due to the lack of precise understanding of disasters and their mitigation. People's awareness of earthquake risk mitigation is increased in the urban setting in comparison to the rural setting due to the dissemination of knowledge by various governmental as well as non-governmental organizations. table below shows the comparison of earthquake risk in urban and rural mountainous regions of Nepal (Singh, 2016).

Table 1: Earthquake risk in urban and rural mountainous regions of Nepal

Details	**Urban**	**Rural mountainous region**
Knowledge and technical capabilities in the community for earthquake mitigation	Low	Low
Construction Quality of existing buildings	Low	Medium
Socio-economic condition and awareness	Low	Very Low
Existence of Indigenous materials	low	Medium
Use of modern techniques/materials	High	Low
Building Code Implementation	Low	Very Low
Cooperation between the government, local authority, and community in terms of technology transfer and authority delegation	Low	Very Low
RISK	**HIGH**	**VERY HIGH**

3. Housing Vulnerability and Traditional Construction Practices

Rural housing in Nepal's hills typically consists of non-engineered stone masonry structures with wood, mud, and stone with stone/slate, corrugated and non-corrugated metal sheets, and thatched roofs, which are extremely vulnerable to seismic shocks (Sharma, Khadka, & Singh, 2017). In the majority of urbanized rural areas of Nepal, the following are the observed vulnerabilities, mainly in the 2015 earthquake (Singh, 2016).

In Physical vulnerabilities, observed factors in the study area are responsible for making the setting physically vulnerable.

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- Use a change of the building space
- Incompatible changes
- Lack of Maintenance

The following were the damage patterns observed due to the effect of the earthquake.

- Corner Failures/Cracks
- Shear Failures and Diagonal Cracks.
- Cracks at Openings.
- The gable falls and cracks.
- De-lamination of the wall
- Bulging / Falling of unsupported long walls.
- Damage / Falling of Free-Standing Walls.
- Improper Load Path
- Soft Storey Problems.
- Torsion
- Complete Collapse
- Rocking Failure
- Floor Separation
- Out of Plane Failure
- Settlement / Slope Failure
- Floor Drift/ Slide

The 2015 Gorkha earthquake destroyed over 800,000 houses, disproportionately affecting rural communities living in such dwellings (NPC, 2016). Although post-earthquake recovery plans promoted earthquake-resistant construction (e.g., reinforced concrete or confined masonry), uptake in mountainous areas has been slow.

Studies have highlighted several reasons for this:

- Lack of technical knowledge among local masons.
- High transportation costs for materials like cement and steel in hilly terrain.
- Skepticism about unfamiliar construction methods.
- Limited access to government subsidies or delays in housing grant disbursement (JICA, 2020).

These findings emphasize the importance of context-sensitive retrofitting solutions that combine safety with local affordability and cultural acceptability.

4. Community Engagement and Institutional Trust

Effective disaster risk reduction depends not only on infrastructure but also on social capital and institutional trust. In rural Nepal, community-based disaster risk management (CBDRM) programs have been implemented by organizations such as UNDP, ActionAid Nepal, Practical Action, and others. These programs have demonstrated that local ownership, participation of women's groups, and integration of indigenous knowledge enhance risk communication and preparedness. However, engagement remains uneven across territories. Semi-isolated communities often lack formal institutional presence, such as municipal disaster committees or trained first responders. Gautam & Phaiju (2020) found that in many mountainous villages, residents rely on informal networks like family, caste associations, and religious leaders for emergency response, rather than on state or NGO actors.

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Institutional trust also affects willingness to cooperate with government guidelines. In a review of post-Gorkha DRR programs (UNDP, 2019) observed that poorly coordinated outreach and inconsistent follow-up eroded community confidence in government-led interventions, particularly in remote districts such as Dolpa and Bajhang. Inadequate community awareness and preparedness, and limited community-based disaster resilience in rural communities have led to destruction and loss of life due to earthquakes. Public awareness of what to do in a disaster is low, as is the perception of risk within the population (PDNA,2015).

After the earthquake of 2011, appropriate construction using the local materials through trained masons was initiated to rescue the earthquake victims. A Physical Development Plan for the different rural mountainous areas, along with urban and semi-urban areas, was prepared, which focused on land use zoning (RIBS, 2016).

In this context, land use planning is instrumental in addressing the challenges posed by the earthquake hazard on the built environment as well as. Through land use planning, vulnerability parameters can be modified to reduce risks. With its array of regulatory and non-regulatory techniques and mechanisms, participatory land use planning can become an effective tool for disaster risk reduction through the use of disaster risk information in land use planning. land use planning ordinances control the type of land use permitted in specific areas, for example, residential, commercial, and industrial, and they impose requirements on the physical characteristics of the property, such as density, height, and coverage. This can be an effective tool to regulate development in hazard areas and thereby reduce the exposure of people and property to the potential impact of disasters.

After the earthquake of 1988, the government initiated the Nepal National Building Code. On-the-job training is initiated by DUDBC in municipalities along with urbanized and rural municipalities of Nepal for the effective implementation of the building code. Raised earthquake awareness has started showing the positive results – as an initial step towards building code implementation, construction of residential buildings in this urbanized rural setting is mostly carried out as informal construction. Importance is also given to the capacity enhancement of the contractors, builders, and masons, as well as monitoring and evaluation of the works carried out by them. Incorporation of seismic provisions into the bylaws and the pertinent regulations for making the buildings earthquake-resistant has been started (JICA,2002).

5. Mitigation Measures and Barriers

The Government of Nepal, through the Ministry of Home Affairs and the National Disaster Risk Reduction and Management Authority (NDRRMA), has introduced various policies and plans to reduce earthquake risk, including the National Building Code, the Local Disaster and Climate Resilience Planning (LDCRP) framework, and post-earthquake housing grants.

Different earthquake risk reduction approaches are used in the rural communities in the context of rural mountainous and hilly regions of Nepal. Some tools are easy to use and ensure the involvement of the community and local authorities in the assessment process. Planning and implementation of earthquake risk mitigation activities at the local level depend more on the

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involvement of concerned stakeholders than the accuracy of the assessment result (Singh, 2016).

Rural mountainous and hilly regions of Nepal are still rich in the tradition of buildings made up of local materials such as mud, stone, wood, bamboo, and straw. The traditional materials are found at a cheaper rate, which are more ecological and safer during earthquakes. During the earthquake of 2011, the symmetrical buildings of 2 -3 stories of stone in mud mortar survived, whereas RCC buildings without following design guidelines collapsed. After the earthquake of 2011, the local technologies with bamboo reinforcement were started to retrofit the existing buildings (RIBS, 2020).

The local techniques used for making the earthquake are effective in the rural setting of Nepal. To make the building earthquake resistant, 1sqm.A grid of punched holes is created in the stone wall, which is then covered with about 10 cm mesh of bamboo on the inside and outside building. The net is secured to the wall using 12-gauge Gabion wire, which is inserted through the holes and fastened strongly. It is covered with a stucco of mud to ensure longer life for the bamboo mesh (JICA, 2020). Earthquake-safe "Building features" still exist in some buildings due to the introduction of several earthquake features. Wooden posts, provision of bands, tundals, and roofs that are tightly held to the wall are examples of earthquake-resistant techniques that are still found in traditional buildings (Singh, 2016).

Despite these efforts, practical implementation in rural mountainous areas faces significant barriers**.**

Key obstacles identified in the literature include:

- **Economic constraints**: The inability to afford new construction or retrofitting despite awareness (NPC, 2016).
- **Geographical isolation**: Transporting materials and technical personnel to mountain villages is logistically challenging (JICA, 2020).
- **Limited skilled workforce**: A shortage of trained engineers and masons in rural areas delays safe reconstruction (Sharma, Khadka, & Singh, 2017).
- **Weak policy enforcement**: Municipalities cannot often monitor compliance with building codes in remote regions (UNDP, 2019).

Moreover, short-term donor-funded DRR projects sometimes fail to integrate with long-term local governance, leading to unsustainable outcomes once funding ends.

6. Territorial Disparities and Context-Specific Needs

There is growing recognition in the literature of the need for a territorial perspective in disaster planning. The risks, vulnerabilities, and coping capacities of communities differ not just between urban and rural areas, but among different types of rural settlements, e.g., high-altitude villages vs. mid-hill towns. The 2023 Jajarkot Earthquake starkly illustrated these disparities. Although the Karnali Provincial Government had developed DRR plans, many affected municipalities lacked earthquake preparedness due to underfunding and poor institutional presence (UNRCO, Nepal, 2023). In contrast, post-2015 investments in the Gorkha district, such as retrofitting schools and training masons, were shown to reduce structural damage and improve response readiness (ActionAid Nepal, 2018). Thus, a one-size-fits-all approach to mitigation is insufficient. DRR strategies must be tailored to specific geographic, economic, and cultural conditions to be effective in Nepal's diverse mountainous regions.

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The literature underscores the complexity of earthquake risk perception and mitigation in rural mountainous Nepal. It reveals a paradox: while communities are acutely aware of their vulnerability, multiple structural and cultural barriers prevent effective action. For DRR to succeed in these regions, interventions must be territorially responsive, community-driven, and integrated with local governance and livelihood systems. Jigyasu (2002) mentions a new paradigm for reducing the risk through participatory solutions, which has territorial, cultural, and eco-development perspectives. This focuses on how we can reduce vulnerability by building on existing skills and capacities. In this paradigm, various inter-relationships and processes are considered in a time continuum (preceding, during, and after the disaster).

6.1 Territorial Perspective

According to Hettne (1995), a territorial strategy consists of specific elements rooted in space: a geographical bounded community, controlling a certain set of natural resources, and united through a certain set of cultural values.

According to Bjønness (2007), efforts to contribute to cultural continuity and positive change in society should be addressed within a framework of alternative development or "another development". He thinks the framework of "another development" and the focus on the principle of territorialism offer an opportunity to develop a test for the authenticity of historic centers. He adds that the subject of territorial relationships, as a test of the authenticity of historic areas of cities, is a large area to address.

Bjønness (2007) has summarized the principles of territorialism through different forms of social integration, resources, technology, and skill links, contrasting functional and territorial perspectives and traditions. Land, land use, and relationships within the society in the way they organize land tenure ownership. Access to the quality of the built environment and the publicness of open spaces. Territorialism in a regional nature –settlement relation.

6.2 Cultural Perspective

A culture is the fundamental condition for collective existence; it is the unconscious universal frame of reference which becomes specific only in confrontation with other cultures (Hettne, 1995). The reduction of risk, as a crucial path to disaster reduction, has to be focused not only upon protection by technology in building construction, nor in warning and communications (UNCED,1993 cited in Jigyasu,2002), but in measures more to do with accessibility of social and material resources and social participation linked to cultural expression and traditional knowledge and norms. It emphasizes the need for study. This perspective serves to bring the traditional knowledge and expert knowledge to interact with each other, more in terms of the needs and priorities of the local community. Disaster planning and management cannot be explicitly tailored for traditional communities in a sectarian manner; rather, this needs to be internalized holistically into their frames of reference and not those of experts from outside.

6.3 Eco-development Perspective

According to Sachs (1974;4 cited in Jigyasu,2002), "---eco-development is a style of development, that in each eco-region, calls for specific solutions to the particular problems of the region in the light of cultural as well as ecological data and long term as well as immediate

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needs. Accordingly, it operates with criteria of progress that are related to each particular case, and adaptation to the environment plays an important role."
According to Bjønness and Corneil (1998), an ecological framework for development and disaster management is based on three underlying principles.

1. Ecology is fundamentally value-laden; it is an ideological framework in search of balance, equity, and improvement.
2. The study of ecology is both process–oriented and system-based. It is about the process of transformation and the complexity of the relationship.

3. It is driven by a desire for "development "but rather by a need for positive change.

7. Traditional & Religious Perspectives on Earthquakes in Nepali Society

Religious explanations of earthquakes in Nepal are deeply rooted in ancient Hindu texts. Subedi & Hetényi (2021) reviewed narratives in Puranas and epics such as the Ramayana, which describe the Earth shaking due to divine acts, e.g., the Vasuki serpent or Mount Meru's movements. These traditional stories reinforce the view of seismic events as supernatural phenomena, often distinct from purely geophysical models. In the case of rural settings, poor quality of construction of buildings and infrastructure was also observed as the main cause of structural vulnerability. Prevalence of non-engineered construction, poor quality control of materials, and construction mechanisms make the construction poor enough even for normal Conditions. Lack of awareness and concentration of knowledge and skills only in academic centers contribute to the vulnerabilities (ACAPC, 2023).

In the rural, hilly, and mountainous context of Nepal, a large part of the communities belonging to low-income strata of the area, the locally available materials (i.e., mud, stone, and wood) make the communities both sustainable and affordable. To counteract the loss of local knowledge about traditional building techniques and materials, a system should be developed to keep the craftsmen in work and make sure their knowledge will be passed on next generations. In rural mountainous areas where wood is easily available and the majority of the buildings are less than 3 stories, the affected buildings can be retrofitted with the available local materials, e.g., retrofitting with wood bands and corner strengthening with wood. The indigenous approach is appropriate for reducing the earthquake risk in the current context. However, community-level awareness, visionary planning, and compact settlement are advantageous for reducing the earthquake (Blaikie, Cannon, Davis, & Wisner, 2014).

Many Nepalese interpret earthquakes as moral or spiritual consequences. Daniel Burke's CNN reporting offers insight: Earthquakes are often discussed in terms of karma or a warning from gods, rather than purely scientific events. Gellner (2020) noted widespread beliefs that earthquakes are divine reactions to disrupted rituals, such as errors in the "chariot procession" of deity Bungadya, or linked to the living goddess Kumari's protection being withdrawn. Post-disaster Nepal often sees a surge in religious activities. Gellner remarks on how rituals for appeasing deities like serpent worship around water springs (Malikarjun Case, 2022) become central after an earthquake as communities seek spiritual protection. These rituals reflect cultural resilience, blending coping mechanisms between spiritual traditions and scientific assistance. Beyond mainstream Hinduism, Nepal's ethnic diversity includes

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animist/shamanistic traditions: Kirat Mundhum among Kirati communities, jhākri shamans among Janajati and Dalit groups, and sorcery beliefs in temperate regions (Cultural Atlas, 2017). These practices interpret earthquakes through local spirits, ancestors, or cosmic balance, often involving rituals and spiritual intermediaries to restore harmony.

Efforts to integrate scientific messaging with religious beliefs have shown promise. Subedi & Hetényi (2021) highlight educational programs about earthquakes in schools that reference Hindu narratives to enhance community understanding. Temblor.net suggests scientists use allegories from epics as entry points to communicate hazards and reinforce safety measures. Cultural and religious beliefs in Nepal, ranging from Hindu mythologizing to local animism, play a dual role: they can both bind communities and limit scientific preparedness. Understanding these perspectives is essential for disaster planners aiming to co-design culturally sensitive DRR strategies. A hybrid approach that respects spiritual frameworks while promoting seismic safety may enhance local resilience.

Table 2: Key Insights of Traditional/ Religious View and their Implications

Traditional/ Religious View	Implications
Earthquakes as divine acts or karma	Can foster fatalism, reduce motivation for proactive mitigation
Rituals as collective moral/spiritual responses	Provide community cohesion, but may delay technical intervention
Local rituals interwoven with kinship ties	Offer pathways to co-create culturally grounded DRR messaging
Integration of myth and science	Can increase in community trust in seismic education

8. Discussions

Understanding how rural mountain communities in Nepal perceive earthquake risks and corresponding mitigation measures is essential for designing contextually appropriate and sustainable disaster risk reduction strategies. The literature reveals a complex interplay of cultural beliefs, lived experiences, geographical isolation, economic hardship, and institutional trust, all of which influence both risk perception and behavior in significant ways.

In Nepal's rural hills, perception of earthquake risk is not shaped solely by scientific knowledge but is deeply embedded in historical memory and cultural cosmology. Many people interpret earthquakes as acts of divine will or spiritual imbalance (Subedi & Hetény, 2021). For instance, in Jajarkot and Rukum, following the 2023 earthquake, numerous residents cited disruption in religious rituals or anger of the deities as reasons for the disaster, prompting communities to organize mass pujas and shrine repairs before resuming reconstruction efforts (UNRCO, Nepal, 2023).

This belief system, while culturally rich, can contribute to fatalism, a sense that disasters are uncontrollable and therefore unpreventable (Acharya, Bhattarai, & Shrestha, 2021). As a result, many households do not proactively engage in retrofitting or preparedness drills unless they have experienced direct losses. For example, a study by Gautam (2018) found that residents of Gorkha who had not personally suffered structural damage in 2015 were far less likely to adopt earthquake-safe practices, even when trained or advised. Even when awareness exists,

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economic and logistical barriers often prevent action. In high-altitude settlements such as those in Dolpa, Rasuwa, and Bajura, the cost of transporting construction materials like steel, cement, and skilled labor can be prohibitively high (JICA, 2020). These constraints lead many to rebuild using the same traditional stone-mud materials that failed during previous earthquakes. For instance, in post-2015 reconstruction efforts in Sindhupalchowk, it was observed that more than 60% of households rebuilt in traditional styles, despite guidelines promoting resilient techniques (UNDP, 2019). The reason cited most frequently was: “We know it's not safe, but it’s what we can afford.”

People’s willingness to adopt mitigation measures is closely linked to their trust in institutions. Many rural communities have historically had limited interaction with state disaster management systems, which remain heavily centralized. In areas like Karnali Province, local governments often lack capacity and resources to implement or enforce the National Building Code or provide effective DRR training (Gautam & Phaiju, 2020). In contrast, where community-based organizations (CBOs) and NGOs are active, such as in Gorkha and Makawanpur, there is more evidence of participatory risk management. For example, Action Aid Nepal’s 2018 project in Gorkha trained women’s groups in emergency preparedness, resulting in localized action plans and retrofitting of schools using local masons. These localized efforts increased both risk perception and practical mitigation behavior, demonstrating the power of grassroots engagement.
Religious beliefs, though sometimes seen as obstacles to science-based preparedness, can also be powerful platforms for education and mobilization. Studies by Subedi & Hetényi (2021) show that incorporating Hindu earthquake narratives into school curricula and local meetings increased receptiveness to scientific messaging. This suggests a hybrid strategy, where scientific and religious worldviews are not treated as mutually exclusive but rather integrated. Moreover, traditional authority structures such as village elders, shamans (jhankris), and priests remain trusted figures in many mountain villages. Their inclusion in DRR communication can significantly enhance message credibility and uptake, especially when formal government channels are distrusted or absent.

The analysis also reveals stark territorial disparities in mitigation capacity. Urban and peri-urban municipalities in hill regions like Pokhara or Dhulikhel have greater access to trained engineers, technical inspection services, and government subsidies. In contrast, rural mountainous municipalities such as Chaurjahari (Rukum West), Dolpa, and Mugu are chronically underserved. For example, in Jajarkot, following the 2023 earthquake, initial assessments showed delays in damage reporting, limited presence of technical personnel, and slow distribution of relief due to rugged terrain and poor road access (UNRCO, Nepal, 2023). In such contexts, DRR strategies need to be decentralized and mobile, with pre-positioned resources, local DRR committees, and community-led construction monitoring.

A recurring theme in the literature is that DRR policies must move beyond a “one-size-fits-all” model. What works in Kathmandu or even in mid-hill urban centers may not be relevant or feasible in remote highland communities. Cultural compatibility, economic feasibility, and territorial access must shape the design of mitigation efforts. The Local Disaster and Climate Resilience Planning (LDCRP) framework introduced by the Government of Nepal is a step forward but remains underutilized in mountainous municipalities due to a lack of technical

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guidance and funding (MoHA, 2021). Integrating local knowledge systems, religious values, and community voices is crucial for making such frameworks effective at the grassroots.

The people's perception of earthquake risks in rural Nepal is shaped by a tapestry of lived experience, cultural meaning, and structural constraints. To be effective, mitigation strategies must not only inform but also empower and resonate with local realities. A territorially grounded and culturally sensitive approach, one that works *with* rather than *against* people's beliefs, is vital for advancing resilient futures in Nepal's mountainous regions.

9. Conclusion

The rural mountainous regions of Nepal are uniquely vulnerable to seismic hazards due to their fragile topography, traditional building practices, and limited access to technical and institutional support. This article has explored the multifaceted perceptions that rural communities hold toward earthquake risks and the measures intended to mitigate them, drawing from an extensive review of academic literature, field reports, and disaster management frameworks. One of the central findings is that earthquake risk in rural Nepal is perceived through a hybrid lens shaped by both lived experience and deeply rooted religious and cultural beliefs. While many rural households acknowledge the dangers posed by earthquakes, their preparedness actions are often hindered by economic constraints, fatalistic worldviews, and geographic isolation. In communities where earthquakes are viewed as divine punishment or karmic destiny, there is often reduced motivation to invest in structural mitigation or preparedness training.

At the same time, the article identifies important territorial and institutional disparities. Areas with better infrastructure, NGO presence, and community-based disaster risk management (CBDRM) programs, such as parts of Gorkha and Makawanpur, have demonstrated stronger uptake of mitigation measures. In contrast, more remote and under-resourced areas like Jajarkot, Dolpa, and Rukum struggle with access to information, materials, and skilled human resources needed for earthquake-safe construction. Importantly, religious and traditional systems should not be seen solely as barriers to disaster risk reduction. When engaged meaningfully, they can serve as catalysts for community mobilization and risk communication. Integrating indigenous belief systems, respected local leaders, and cultural narratives into DRR messaging can help bridge the gap between modern science and local acceptance.

Though numerous vulnerability reduction strategies exist, appropriate grassroots-level technology transfer initiatives should be put in place for creating awareness, appreciation, and application models for using disaster-resistant and cost-effective building technologies where a large part of the communities belong to low-income strata with non-engineering construction practices. The traditional skills for building demonstrate the use of local materials, which are available locally, such as wood, mud, and stone. This makes them both sustainable as well as affordable for both rural and urban communities. In addition, the traditional morphology of the first case study area represents a hierarchy of public, semi-public, and private open spaces, which might be fruitful for escape during the earthquake. In technological aspects, the local craftsmen play an essential role. Technicians and engineers have little control over the construction of owner-built buildings. Proper training of craftsmen can build their confidence in using the technology and skills to construct safer buildings.

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Small improvements in design and construction of buildings can make a large change to their overall earthquake resilience in the low/medium income community in the case of rural settings. For example, instead of changing very high-strength construction material or applying higher technology in construction, stitching the walls, providing bands, tying roofs and floors, and vertical rods at corners, etc. In the second study area where majority of the buildings are of masonry buildings were improving workmanship in case of frame structure buildings are important than adopting new construction material.

For this purpose, an environment should be created to involve resident members, the private and professional sectors to play a major role in the earthquake risk reduction in both settings. The current policy should be realistic and emphasize the community-based approaches towards earthquake risk mitigation in the rural setting compared to the urban setting. As an important tributary of a broader sustainable development pathway, earthquake risk reduction must be integrated with the development process in the communities. It needs to be mixed up with the development process at different stages, and must become an integral part of the development activities. In the earthquake risk reduction process, a culture of safety can also be easily introduced if the communities are adequately educated, equipped, and resourceful through good governance. Through this study, it was found that people are not adequately aware of even simple disaster issues.

Therefore, we must shift the focus to the poorest and vulnerable sections of society, and ensure that the interventions are integrated with integration of both approaches. Only one approach may not have the solution to reduce the earthquake vulnerability in the current urbanizing situation, and the insufficiency of local resources. However, the local solution searched within the social, cultural, and environmental framework for reducing earthquake risk will be only sustainable in the majority of poor communities, particularly in rural settings.

In conclusion, effective earthquake risk reduction in rural Nepal requires a culturally sensitive, territorially tailored, and socially inclusive approach. Policies and programs must go beyond technical standards and top-down directives to recognize and work within the social fabric of these communities. By aligning national disaster frameworks with local knowledge, belief systems, and livelihood needs, Nepal can foster more resilient, empowered, and prepared rural populations in the face of future seismic threats.

10. Recommendations

Based on the analysis of people's perspectives toward earthquake risks and mitigation measures in the rural mountainous regions of Nepal, the following key recommendations are proposed to enhance disaster risk reduction (DRR) effectiveness in these areas:

- **Integrate Cultural Beliefs with Scientific Awareness:** Develop earthquake education and preparedness strategies that respect and incorporate local religious and spiritual beliefs. Use familiar narratives, trusted figures like elders and religious leaders, and folk media to effectively communicate risk and safety measures in culturally resonant ways.
- **Promote Community-Based, Low-Cost Mitigation:** Provide accessible, affordable earthquake-resilient construction techniques using local materials. Train local masons

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and carpenters in retrofitting and safe building practices, while decentralizing preparedness support through community-level hubs and first responder training for youth and women.

- **Foster Trust and Participation in DRR Efforts:** Ensure transparent and timely disaster aid distribution with community oversight, and involve locals in DRR planning through participatory methods. Empower communities by sharing success stories and demonstrating how preparedness actions can save lives, thereby countering fatalistic attitudes.

These people-centric recommendations aim to strengthen the effectiveness and sustainability of earthquake mitigation efforts by aligning with the perceptions, realities, and values of rural mountain communities in Nepal**.**

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