

PREPAREDNESS TO RECONSTRUCTION: HOW HIMALAYAN RURAL COMMUNITY DECIDES

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Abstract: Multi-hazard Risks (MHR) are prevalent in Indian Himalayas, thus consequential to many deaths, damages and property losses every year. Exposures to MHR, community's vulnerability and lessons learnt from past events influence community and households' decision and resilience practice. Disaster Management Cycle's pre-and post-disaster phases include Preparedness and Reconstruction. Consequence of economic opportunity and policy is immensely impactful in this region. The present study focuses on MHR in villages of Dharkuri (Rudraprayag), Tatalgaon (Almora) and Arakot (Uttarkashi) in Uttarakhand State of India after a 5.5 Magnitude Earthquake event on 6th Feb, 2017. To identify preparedness in the existing built environment, Hill specific- Multi-Hazard Resilience Assessment (MHRA) is carried out; the MHR is identified with Structural Index of individual building components. Parametric Post-Disaster Recovery Assessment (PDRA) is conducted to identify community preparedness; Regression Analysis (using SPSS tool) deployed to analyse primary data collected with consideration of 'readiness to take mitigation measures' as dependent variable and five major independent variables as socio-economic profile; risk perception; attitudes and trust between community and government; Loss and damage; and short-/long term disaster recovery preferences. Comparative narrative of preparedness and reconstruction from the probed cases identifies risks, assesses preparedness (pre-disaster), impact and significant variables for disaster recovery and reconstruction (post-disaster) and community decision-making perspective. The study finds significant shortcomings in existing construction practices i.e. preparedness for seismic and multi-hazard risks, prioritised building components for retrofit in existing structures or best practices for new construction, varied readiness levels of communities based on Loss and damage profile, and risk reduction plans into action. The Paper establishes need for sensitization on new risks through poor-engineering/ development, importance of economic opportunities and livelihoods, and proactive role of Gram Panchayat Development Plan (GPDP) Policy. The Study has the potential to influence construction practices, development trends, disaster preparedness, recovery and reconstruction in the Himalayan region to achieve sustainable resilience through decision prioritisation from micro level GPDP to Macro level sustainable development goals (SDGs).

Keywords: Indian Himalayas, Multi-Hazard Disaster Preparedness, Post-Disaster Recovery, Loss and Damage, Community decision, GPDP to SDG

1. Introduction

The Himalayan region is formed due to tectonic activities, one of the youngest mountain ranges, and highly prone to Multi-hazard risks (MHR). These risks have, unfortunately, become a recurrent reality for the communities residing in the Indian Himalayas, often resulting in significant human casualties, infrastructure and property damages, and economic losses year after year (Chouhan et al., 2023a). Uttarakhand is one of

the Himalayan states located in the northern parts of India, consisting of 93% mountainous regions and 64% forest area (SDMAP Uttarakhand, 2015). The state is divided into two administrative divisions, Garhwal and Kumaon, with 13 districts (Sekhri.,2020). Disaster management in these regions entails a cyclic process, encompassing pre-disaster preparedness and post-disaster reconstruction and recovery phases (Srinivas 2020). This process is intricately influenced by various factors, including the community's exposure to MHR, their vulnerability, and invaluable lessons gleaned from past calamities, which collectively mould their decisions and resilience practices (Kappe et al., 2012). Moreover, socio-economic dynamics and impact of regional policies play a pivotal role in shaping the fate of these communities (Blaikie and Sadeque 2000). Comprehending loss and damage also guide the development of resilient disaster recovery and preparedness strategies to mitigate future impacts ((Bahinipati and Gupta, 2022).

In response to these pressing concerns, this study embarks on an in-depth exploration of these critical aspects and understanding the problem from the ground level, especially investigating the built-environment perspective for both seismic and multi-hazard scenarios. The detailed study is presented for seismic/ MHR/ Community preparedness, recovery/ reconstruction decision making from experiences of three villages from three different districts of Uttarakhand. These villages are selected based on their experience of past seismic events; and observed over the years in three phases, February 2022, June 2022, and June 2023, to understand their preparedness level at building and community level, risk perception of different rural communities, and losses and damages, linking it with their decisions on preparedness and recovery.

The primary objective is to evaluate readiness of the selected community objectively, their reconstruction decision-making process, to embrace mitigation measures concentrating on six significant variables, including the socio-economic profile of the respondents; risk perception; attitudes and trust of the people towards community, and government authorities; loss and damage; short-term and long-term disaster recovery preferences: and readiness to take mitigation measure. Uttarakhand's complex geography and demographic diversity demand detailed, village-level studies to ensure the safety and resilience of its communities in the face of multi-hazard risks.

2. Materials and Methods

1.1. Study area

The state of Uttarakhand in India, lies in the heart of the Himalayas. It lies within Seismic zones IV and V (high to very high proneness to earthquakes) making it susceptible to a diverse range of multi-hazard risks (BMTPC, 2019; NBC, 2016). The region is tectonically active and experiences a complex interplay of natural hazards. The mountainous terrain further exacerbates these risks, posing a significant challenge to disaster management and mitigation efforts (Sekhri et al., 2020). Uttarakhand is characterised by a diverse demographic landscape. It is home to various indigenous and non-indigenous communities, each with its own unique cultural practices and ways of life. The state's population is dispersed across remote villages and towns, often in geographically challenging locations. This demographic diversity and dispersion present unique challenges regarding disaster preparedness and recovery, as each community's needs and vulnerabilities may differ (Chouhan et al., 2022).

This study is anchored in the aftermath of a significant seismic event – the 5.5 Magnitude Earthquake on 6th February 2017. Initially the study concentrated on two distinct villages: Dharkuri, in Rudraprayag district of the Garhwal region and Tatalgaon, in Almora district of the Kumaon region, for a comparative understanding of seismic and multi-hazard preparedness. Then, the study focus was narrowed to the multi-hazard scenarios in the Garhwal region; primary recovery data from the villages of Arakot in Uttarkashi district, and Dharkuri village in Rudraprayag district were collected for in-depth understanding of the post-disaster recovery phase where multiple events of earthquake, flood, flash flood, landslide, cloudbursts, windstorms, and industrial accidents are considered. The three villages (shown in Figure 1.), Dharkuri, Tatalgaon, and Arakot, present distinct microcosm for examining the region's seismic and MHR preparedness and disaster recovery dynamics.

The first village, Dharkuri, situated in the Garhwal region of Rudraprayag district, houses a population of 507 in 107 households. This diverse community primarily relies on agriculture and related activities. There is at least one retired army officer in each of the households. Other economic contributions are from the remittances from the males working in the hotel management industry in Kuwait and Mumbai. The literacy rate of the village is 78.9%, with one primary school. Dharkuri has no hospital and very limited nearby access to medical facilities

like dispensaries and clinics. The second village, Tatalgaon, located in the Kumaon region's Almora district, is home to 665 residents in 156 households. While agriculture remains a core occupation, tourism has led to the emergence of homestays and guesthouses. The literacy rate of the village is 77.45%, with one government primary school and 2 private schools. Medical facilities are difficult to access here as it is not available in the village but outside the nearby areas of a 5-10 Km radius. The village encountered agricultural challenges due to heavy rainfall in May 2017.

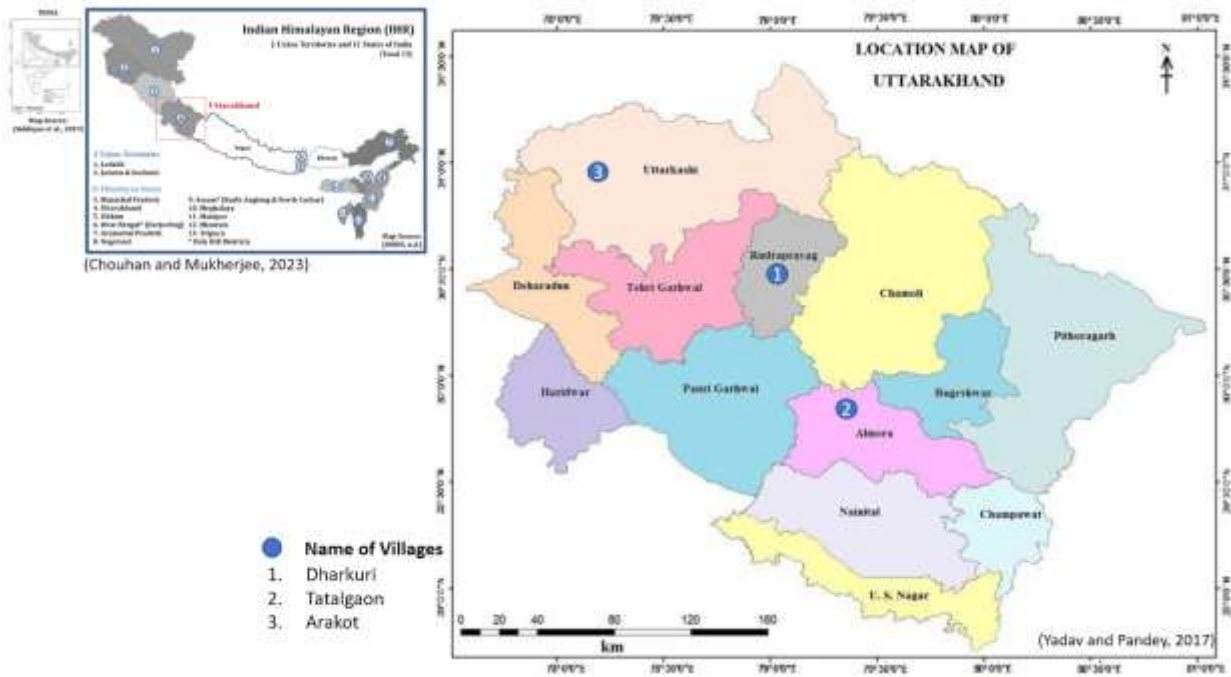


Figure 1: Study area (Adapted from Chouhan and Mukherjee, 2023; Yadav and Pandey, 2017)

The third and last village is Arakot, located in the Garhwal region's Uttarkashi district, which hosts 748 inhabitants in 188 households. This village represents the complexities faced by remote, mountainous communities. It primarily relies on agriculture with limited non-farm opportunities, and remittances from urban family members support income. The demographic structure may be skewed towards the elderly due to the outmigration of working-age individuals. The literacy rate of the village is 77.43%, with two government schools, many nearby engineering and medical colleges, and proper access to medical facilities. Arakot endured significant damage from landslides caused by heavy rainfall in August 2021 (Census, 2011; Chouhan et al., 2023b). The brief profile of the three villages is given in the Table 1 below:

Table 1. Brief Description of Study Area (Source: COI, 2011; Chouhan et al., 2023b)

Village Name	Dharkuri	Tatalgaon	Arakot
District	Rudrapur	Almora	Rudrapur
Administrative zone	Garhwal	Kumaon	Garhwal
Coordinates	30.4940° N, 78.9189° E	9.9260° N, 79.3367° E	31.0188° N, 78.0474° E
Total Population (2011)	507	665	748
Total Households (2011)	107	156	188
Surveyed Households	32	35	35
Survey	MHRA and PDRA survey	MHRA	PDRA survey

These villages epitomize the multifaceted challenges encountered by Himalayan communities. They are perched in high-risk zones, susceptible to earthquakes, floods, and landslides (BMTPC, 2019), having endured a series of past disasters, including the 1998 Chamoli Earthquake, the 2013 Kedarnath flash flood (UNDRR, 2023), and the 2017 Rudrapur earthquake. Yearly occurrences of cloudbursts and flooding, which worsened in the year 2023, further underscore their vulnerability. The monsoon season, with its heavy rains, frequently triggers landslides and flash floods, disrupting daily life, damaging infrastructure, and posing risks

to residents. While these communities may possess traditional knowledge and practices for disaster preparedness, the accessibility of modern disaster response and relief services is often constrained.

These villages encompass a diverse range of socio-economic backgrounds, each responding uniquely to these hazards. Delving into the intricacies of these communities provides invaluable insights into their readiness, response, and recovery dynamics. The selection of these areas is rooted in their proximity to the 2017 earthquake's epicentre, rendering them critical cases for comprehending disaster recovery and resilience under such conditions. Understanding these villages is imperative for informed research, informed policy recommendations, and development endeavours aimed at bolstering resilience and enhancing residents' quality of life in the face of varied challenges posed by the local environment and economy.

1.2. Data collection

Primary data collection was meticulously executed through a door-to-door field survey, divided into three phases. The timeline of data-gathering started on February 1, 2022, and then June 28, 2022, for Arakot and Tatalgaon, respectively, and was further extended to encompass Dharkuri from June 9, 2023, to June 13, 2023. The survey was conducted employing two distinct questionnaires, MHRA and PDRA, each tailored to address specific aspects of preparedness, reconstruction, and decision-making of the community in the villages of Dharkuri, Tatalgaon, and Arakot.

To assess seismic and MHRA preparedness, the Multi-Hazard Resilience Assessment (MHRA) survey form (Chouhan & Mukherjee, 2023) served as a crucial tool. Specifically designed to address the unique multi-hazard challenges prevalent in hilly terrains, this survey form is characterised by its self-explanatory, visually intuitive design and user-friendly language. Its structured sections encompass various aspects of buildings, covering site conditions, building geometry, foundations, walls, earthquake bands, structural cracks, openings, roofs, flooring, overhangs, staircases, columns, beams, and potential risks from the surroundings (Chouhan & Mukherjee, 2023).

Concurrently, the second questionnaire, the Post-Disaster Recovery Assessment (PDRA) survey form is a meticulously crafted instrument designed to capture the intricate dynamics of Himalayan disaster recovery and aimed to measure different variables helping in understanding the decision-making process of the community. Employing a triangulation approach, it harmoniously combines survey data, insights from existing literature, and expert discussions into a comprehensive tool. This form delves into six major topics, encompassing the socio-economic profile of respondents, risk perception, past experiences, recovery status, attitude and trust, and preparedness. Marked by close-ended questions and quantifiable responses, it facilitates precise analysis, providing a comprehensive understanding of Himalayan recovery dynamics (Chouhan *et al.*, 2023b).

The total sample size for data collection amounted to 102 households, comprising 32 from Dharkuri, 35 from Tatalgaon, and 35 from Arakot village. This robust dataset forms the basis for the subsequent analysis and insights derived from this research (refer Table 1).

1.3. Methodology

After collecting data from the three selected locations, the initial data cleaning process was done using MS Excel for 102 datasets to ensure data quality. To assess the reliability of the collected data, the Shapiro-Wilk test was conducted separately for preparedness and recovery data using SPSS. A significance level of 0.05 was set, and the obtained p-values were greater than 0.05, indicating that the data followed a normal distribution.

The calculation of Seismic and Multi-Hazard Resilience (MHR) preparedness, i.e. 'readiness to take mitigation measures', involved the application of the Resilience Vulnerability Safety (RVS) methodology, precisely the Safety Index calculation as proposed by Ruggieri *et al.*, (2020) The focus was on the structural index, which is one of the parts for the calculation of the Safety Index under vulnerability, to identify shortcomings in existing construction practices, serving as a fundamental framework for understanding the complex MHR landscape, readiness of the household and their reconstruction practices. The household data collected from the MHRA survey form (Chouhan and Mukherjee, 2023) was then normalised on a scale ranging from 0 to 5, where 0 represents low risk, and 5 corresponds to high risk. This scale aligns with the local, IS building codes, and government reports (IS Code 13935, 2009; NDMA 2020). To calculate the structural index, the Primary Index (I_{Primary}) equation, as provided by Ruggieri *et al.*, (2020), was utilised (as per equation 1). In this equation, I_{stru} represents the structural index of the building component, UR_i signifies the score obtained from each question

in a particular section, and $URI_{high,i}$ denotes the score assigned to the highest risk. The structural index results in values ranging from 0 to 1, with values between 0 and less than 0.33 representing low risk, values from 0.33 to 0.67 indicating medium risk, and scores exceeding 0.67 signifying high risk.

$$I_{Struc} = \frac{\sum_{i=1}^n URI_i}{\sum_{i=1}^n URI_{high,i}} \quad (1)$$

Following the PDRA survey, helps in understanding the relationship between preparedness and the decision-making process of the community. Primary household data collected from the PDRA form was gathered through Likert scale responses ranging from 1 to 5. Here, a rating of 1 indicated minimal concern or satisfaction, while a rating of 5 signified a high degree of concern or dissatisfaction. To facilitate a comprehensive analysis, various questionnaire sections, encompassing risk perception, past experience and recovery, attitude and trust, preparedness, and socio-economic profiles were individually normalised. This normalisation process, as outlined in Equation 2, transformed the data for each section to a uniform scale ranging from 0 (lowest value) to 1 (highest value). In this equation, Y_{ij} represents the normalised value of the j^{th} indicator, X_{ij} represents the value of the j^{th} indicator, and Max_j and Min_j correspond to the maximum and minimum values of the j^{th} indicator, respectively. This normalisation approach ensures that all indicators can be compared and analysed consistently, providing valuable insights into the surveyed responses.

$$Y_{ij} = \frac{Max_j - X_{ij}}{Max_j - Min_j} \quad (2)$$

The multiple regression analysis method is used on the normalised data using the Statistical Package for the Social Sciences (SPSS) for further establishing the positive and negative relationships between different variables. This analytical approach allows us to delve into the interrelationships among our five key variables. The central focus of this analysis lies in our dependent variable i.e. 'readiness to take mitigation measures', which serves as a comprehensive measure of households' preparedness for future disasters. This preparedness encompasses a spectrum of factors, including the condition of their dwellings, the availability of emergency provisions, financial savings, and the extent of their insurance coverage. Within this analytical framework, we consider five distinct, independent variables, each addressing specific facets of the study:

- Socio-Economic Profile: This variable quantifies the current economic circumstances of households, encompassing aspects such as their expenditures, housing conditions, and structural attributes of their residences.
- Risk Perception: This variable quantifies households' perceptions regarding the likelihood of encountering future disaster events.
- Attitude and Trust: This variable evaluates whether households place more trust in government authorities or their local community regarding disaster-related matters.
- Loss and Damage profile: It considers individual losses and damages from the past disaster events, their experiences and assesses the households' ability to rebound from such adversities.
- Disaster Recovery: This variable aims to gauge the impact of previous disaster events on households. It focuses on the short and long term disaster recovery process and their expectations.

This method helps in establishing the complex web of relationships that influence disaster preparedness in the Indian Himalayan community of Uttarakhand, shedding light on the decision-making processes, and their recovery stages from past experiences. And finally, the last part of the study is assessing loss and damage at the household level from the data collected from the PDRA survey form. This, in turn, will contribute to more informed policies and strategies for enhancing disaster resilience in this region.

3. Results

3.1. Seismic and MHR Preparedness

Seismic and MHR preparedness is calculated for Dharkuri and Tatalgaon villages to understand the preparedness level of two villages with similar socio-economic profiles but different geographical setups, i.e., Garhwal and Kumaon regions. Table 2 displays the conclusive outcomes of the structural index computations. The structural index values for Dharkuri village range from 0.08 to 0.86. Building components, including earthquake band, building geometry, parapet, column, and slope, are at high risk. Other building components like site conditions, walls, structural cracks, openings, overhangs, beams, plinths, and building materials are

at medium risk. The foundation, roof, heavy weight on top, and staircase are identified as low risk for this village. In contrast, the Structural index for Tatalgaon village varies from 0.06 to 1.00. In this village, only earthquake bands and parapets are considered high risk. Building components like building geometry, walls, openings, overhangs, columns, beams, plinths, and building materials are classified as medium risk. Site conditions, foundations, structural cracks, roof, heavy weight on top, staircase, and slope are determined to be at low risk.

Table 2. Structural index final scores for Dharkuri and Tatalgaon villages

S.no.	Components	Dharkuri, Rudraprayag	Tatalgaon, Almora
1	Site Conditions	0.51	0.12
2	Building Geometry	0.69	0.65
3	Foundation	0.08	0.17
4	Wall	0.45	0.47
5	Earthquake bands	0.86	1.00
6	Cracks	0.50	0.27
7	Openings	0.52	0.42
8	Roof	0.31	0.32
9	Heavy weight on top	0.00	0.06
10	Parapet	0.71	0.88
11	Overhangs	0.33	0.60
12	Staircase	0.21	0.16
13	Column	0.75	0.55
14	Beam	0.54	0.63
15	Plinth	0.58	0.53
16	Slope	0.67	0.23
17	Building Material	0.58	0.49

To enable comparative analysis between Dharkuri and Tatalgaon, figure 2 shows a spider-web diagram that provides a visual representation of the seismic preparedness (2a) and MHR preparedness (2b). While seismic preparedness exclusively considers earthquake-related parameters, MHR preparedness considers additional components like slope, plinth, and building materials. Dharkuri village significantly shows a higher MHR risk when compared to Tatalgaon. Earthquake bands and parapets are the common building components with a higher risk in both villages. There is a minor variance in the case of building geometry, walls, openings, roofs, and heavy weight on top for both villages, showing nearly identical results. A significant difference emerges in

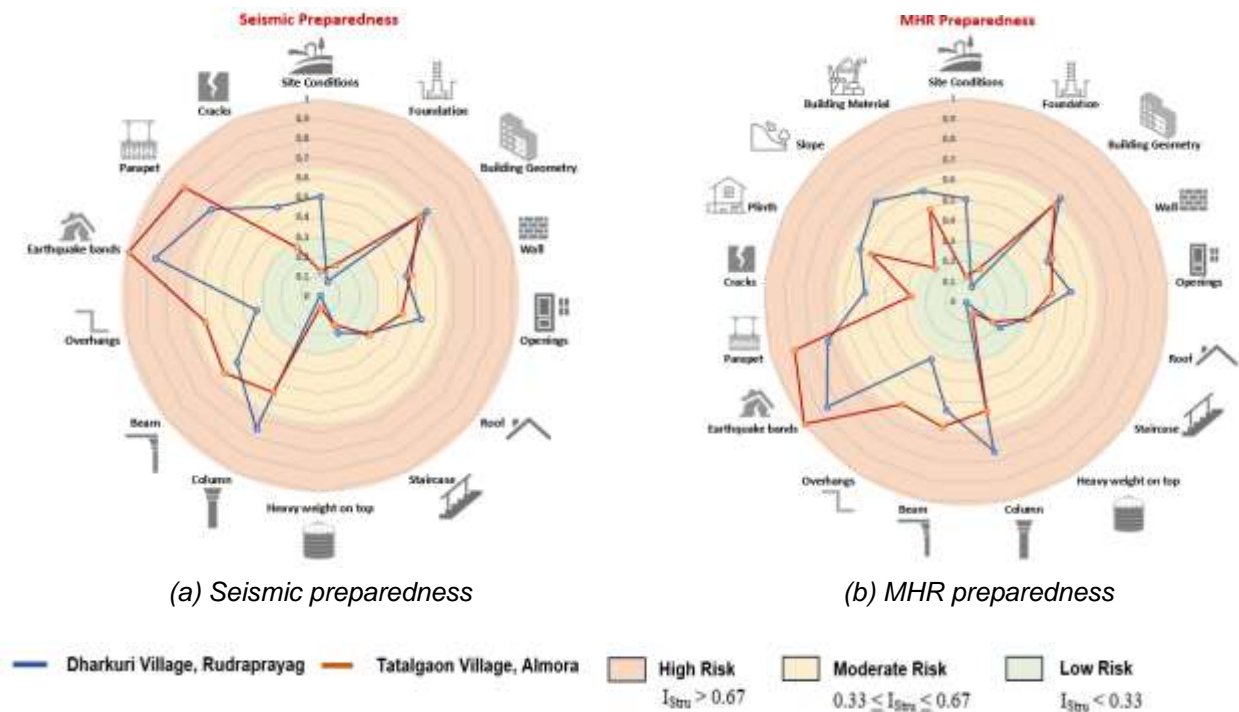


Figure 2: Seismic and MHR preparedness of Dharkuri and Tatalgaon villages.

evaluating slope stability and site conditions, where Tatalgaon is notably more secure. In these particular building components, Dharkuri is classified as at high risk, while Tatalgaon is at lower risk.

3.2. Readiness to take mitigation measures: Household and Community Preparedness

The results of the multiple regression analysis conducted for Dharkuri and Arakot villages, showed that the overall model was statistically significant as $(F(4, 51) = 3.32, p < 0.05)$. However, only two of the independent variables, *risk perception* ($\beta = 0.65, p < 0.05$), and *disaster recovery* ($\beta = -0.22, p < 0.05$), were statistically significant predictors and played an important role in determining Household/ community preparedness. Risk perception has a positive coefficient, i.e. it is directly proportional relationship, indicating that the preparedness of the community increases as risk perception increases. Disaster recovery had a negative coefficient, i.e. this context suggests an inverse relationship between disaster recovery efforts and community preparedness. In other words, as disaster recovery efforts increase, community preparedness decreases. This might imply that the community relies more on external assistance for recovery, potentially leading to decreased self-reliance in preparing for disasters. It highlights the importance of raising awareness and educating individuals about the role they play in enhancing community preparedness, emphasizing that disaster preparedness is not solely the responsibility of the government but also rests on individual actions.

3.3. Community Risk Perception

Community risk reception is calculated from the PDRA survey for the Garhwal region for Dharkuri and Arakot villages. This examination is done to understand how a community collectively perceives and comprehends various hazards, which is mostly influenced by their past event experiences, access to information, disaster preparedness, and community resilience strategies. In the case of Dharkuri, 93% of respondents identified earthquakes as a potential risk, followed by 76% recognizing the risk of floods, 72% for windstorms, 66% for cloudbursts, 53% for landslides, and 38% perceiving flash floods as potential risks. In contrast, in Arakot, 61% of respondents viewed cloudbursts as their primary concern, with 31% recognizing the risk of landslides, 27% mentioning earthquakes, and 15% highlighting floods and flash floods. The community in Arakot does not perceive any threat from windstorms. Additionally, 7% of respondents from the village added industrial accidents as their potential hazard risk, as shown in Figure 3.

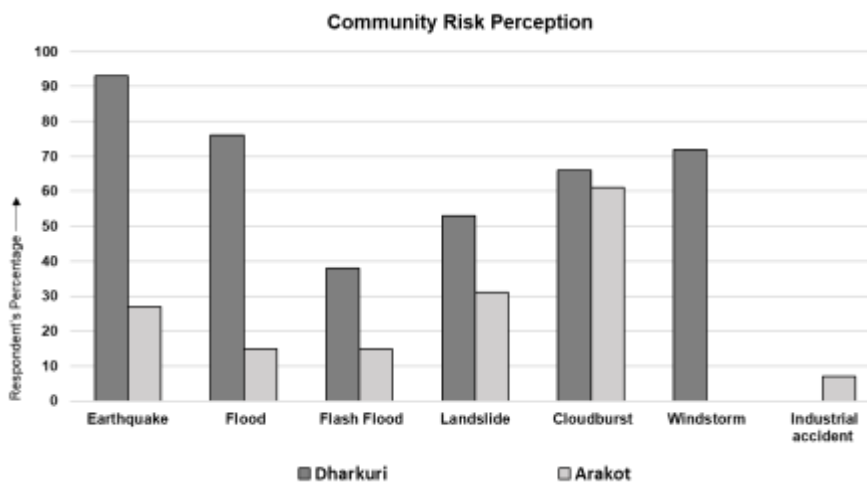


Figure 3 Community Risk perception of Dharkuri and Arakot village

3.4. Loss and Damage Assessment

To understand how rural communities decide, it is important to study the losses and damages experienced by each household, which helps in understanding what people need most, whether it's rebuilding homes, replacing lost assets, or restoring livelihoods. Also, the Community's risk perception is influenced by their past disaster impacts and the damages they faced collectively, which further influences their preparedness and decision-making process. The study's findings, shown in Figure 4, reveal the extent of the impact experienced by the communities in Dharkuri and Arakot villages followed by a disaster event. In the Dharkuri village, a substantial impact of 95-98% was observed in agricultural activities leading to losses in crop production and livestock losses, further straining the community's economy and their family savings. A significant impact of 75% was seen on the housing and belongings, resulting in damage and property loss. The health sector

experienced a 50% impact, including inaccessibility to the medical facilities. Food availability and water facilities were impacted by 57% and 35%, respectively. Daily wage laborers in Dharkuri faced an 18% impact, impacting their livelihoods, while commercial activities and private jobs were moderately affected at 10% and 8%, respectively. Tourist activities showed a minimal impact of 4%, and no impact was seen on the businesses. In contrast, Arakot village faced a more diversified range of impacts. Daily wage laborers and businesses were the most severely affected, with a significant impact of 96% and 98%, respectively, indicating the disruption of livelihoods and economic activities. The family economy, and house and belongings were similarly challenged, experiencing a 77% and 73% impact, while 75% of private jobs were affected, leading to disruption or unemployment cases. The agricultural sector suffered a 71% impact, affecting farming and crop production. The health sector faced a 64% impact, suggesting challenges in accessing healthcare services. Food availability was constrained for 52% of the community, and tourist activities also experienced a significant impact of 50%. Water facilities and quality were affected for 28% of the population, impacting their access to clean water. Commercial activities experienced a 25% impact, affecting the local economy. In both the villages, government jobs remained unaffected.

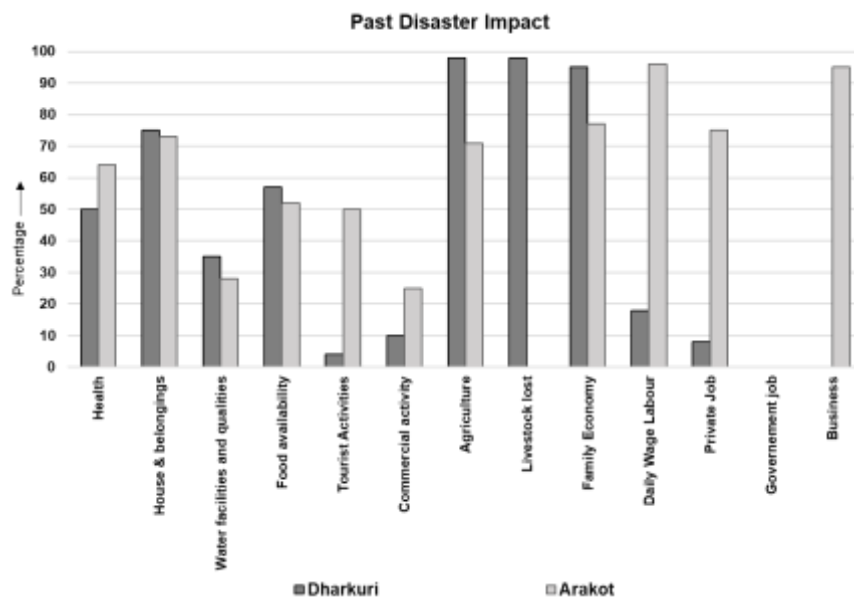


Figure 4 Past Disaster impact on different sectors in Dharkuri and Arakot villages

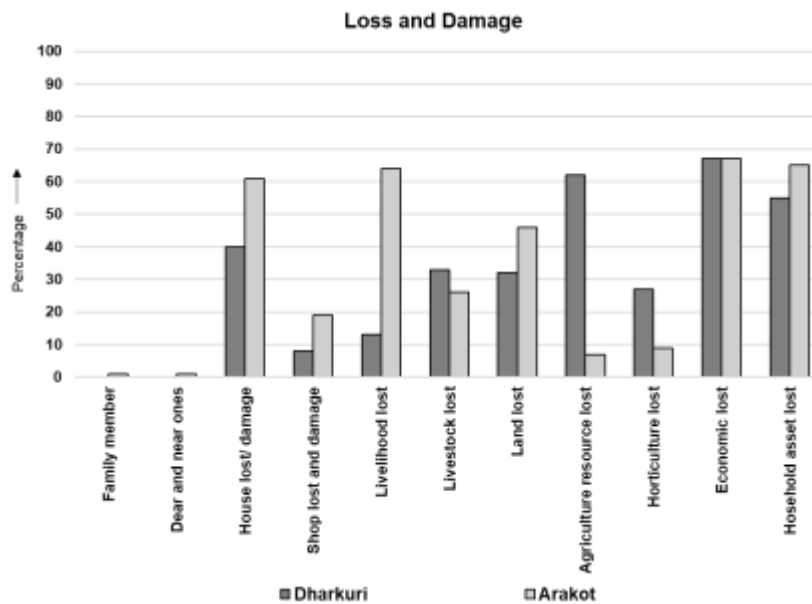


Figure 5 Average Loss and Damages in percentage faced by households in Dharkuri and Arakot Villages

Figure 5 illustrates the average losses and damages experienced by each household in the Dharkuri and Arakot villages. Losses related to family members and relatives were minimal in both the communities with an average economic loss of 67%. In Dharkuri, where agriculture is the predominant occupation, the disaster resulted in substantial losses, including a 62% decline in agricultural resources, 33% livestock losses, 32% land losses, and a 27% decrease in horticulture resources. They faced 40% of house damages and 55% of household assets lost. For those involved in commercial activities, some of them faced 8% of business damages and a 13% decrease in their livelihoods. On the other hand, Arakot, where daily wage labour is more prevalent, faced a 64% loss in livelihoods, accompanied by a 61% impact on housing and a 65% reduction in household assets. Similar to Dharkuri, agriculture-related activities showed considerable losses, including a 62% decrease in agricultural resources, 33% livestock losses, 32% land losses, and a 27% reduction in horticulture resources.

3.5. Disaster Recovery Preference

In the context of disaster-related issues, rural residents exhibit a 66% reliance on government authorities, 26% on community support, 6% on both sources, and 2% do not rely on either. During the field survey, a targeted question was asked to understand the community's expectations from the government authorities regarding their speedy recovery in both the short and long term. Figure 6 shows the findings for the same, where medical assistance and safe shelter are consistently highlighted by a larger proportion of respondents as vital needs in both the recovery stages. However, a notable shift in priorities becomes apparent: in the short-term recovery phase, there was a high demand for increased financial support and access to food and grains, whereas, in the long-term recovery stage, the emphasis shifted towards the importance of educational training facilities and opportunities for sustainable livelihoods and locally driven professions, like tourism.

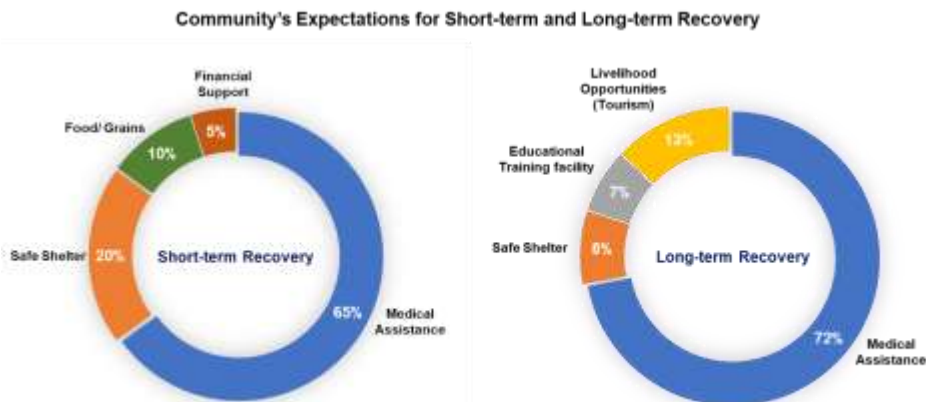


Figure 6: Community's expectations for Post-Disaster Recovery of Dharkuri and Arakot Village

4. Discussion

The findings of the preparedness study are summarised in Table 3, which highlights the shortcomings of existing construction practices and preferences for further reconstruction. Building components have been classified into three risk categories: high, medium, and low risk. This classification allows communities to make informed decisions and allocate their reconstruction budget accordingly. The first priority lies in the inclusion of earthquake bands and fixing their existing parapet, both of which account for higher risk. Additionally, building geometry should be considered in the new construction buildings. The second level of prioritisation is to strengthen existing columns and beams, elevate plinth heights, conduct wall repairs, strengthen overhangs and openings, and finally repair structural cracks. The final priority focuses on the roof retrofitting, improvement in the site conditions, and ensuring slope stability. These priorities serve as a roadmap for communities to enhance their construction practices and boost their resilience against potential hazards.

Moving forward from reconstruction practices to the decision-making process of the communities, the findings of the multiple regression analysis gives us the insights of what variables are affecting the preparedness of the community and influencing their decision in the recovery stages. The positive relationship between risk perception and preparedness suggests that communities that perceive themselves to be at greater risk of disaster are more likely to take steps to prepare. This is likely because communities with higher risk

perceptions are more aware of the potential consequences of a disaster and are more motivated to take action to reduce their risk. The negative relationship between disaster recovery and preparedness suggests that communities that have experienced a disaster in the past are less likely to take mitigation measures for future disasters. This is likely because communities that have experienced a disaster are more focused on recovering from the damage and less likely to invest in preparedness activities. They consider that taking mitigation measures are the government's responsibility and not individual's responsibility. The findings of this study also suggest that disaster risk reduction awareness programs should focus not only on increasing risk perception and supporting communities in their recovery from past disasters but also on educating and awaring the people on importance of preparedness and their individual's role. Increasing risk perception can be done through public education campaigns that highlight the potential consequences of disasters. Supporting communities in their recovery from past disasters can be done by providing financial and technical assistance.

Table 3. Preferences for Reconstruction

High Risk		Medium Risk		Low Risk	
Building Component	Structural Index Score	Building Component	Structural Index Score	Building Component	Structural Index Score
Earthquake bands	0.99	Building Geometry	0.66	Roof	0.32
Parapet	0.82	Column	0.61	Slope	0.29
		Beams	0.60	Site Condition	0.25
		Plinth	0.54	Staircase	0.18
		Building Material	0.52	Foundation	0.14
		Overhang	0.51	Heavy weight on top	0.04
		Wall	0.46		
		Openings	0.46		
		Structural Cracks	0.35		

By comprehending how past disasters have affected the community's risk perceptions, authorities, and organisations can tailor their disaster preparedness initiatives to align with the specific concerns and vulnerabilities of the affected communities, ultimately enhancing their capacity to respond effectively and build resilience against future crises. The findings also highlight that disasters affect different parts of each community in unique ways. This shows how important it is to customise disaster planning and recovery actions to address the specific weaknesses and requirements of each village. In Dharkuri, annual per-household losses averaged INR 15000-20000, primarily attributed to agricultural losses and building damage, whereas in Arakot, the annual per-household losses significantly escalated to around INR 2.5 lakhs, encompassing livelihood loss, agricultural losses, and building damage. Assessing these losses and damages experienced by rural communities is essential and serves as the critical starting point for both short-term and long-term recovery processes. In the short-term recovery stage, it helps in the identification of immediate needs, allowing the efficient allocation of resources to provide emergency relief, shelter, and basic necessities. The data can also be helpful for the initial stage of reconstruction, which can be especially challenging in the rough terrain of the Himalayas. In the long-term recovery stage, understanding these losses guides the formulation of comprehensive recovery and reconstruction strategies tailored to the distinct vulnerabilities of these Himalayan communities, including rebuilding infrastructure, restoring livelihoods, and enhancing community resilience to prevent or mitigate future disasters. This way, the recovery process can not only help communities rebuild but also strengthen their ability to withstand future challenges.

The study reveals that there is the consistent emphasis on medical assistance and safe shelter, with a significant proportion of respondents considering these as fundamental needs in both the short-term and long-term recovery phases. However, there is an intriguing shift in priorities as we delve deeper into the recovery stages. In the short-term recovery phase, demand for increased financial support and better access to food and essential grains is prominent. This suggests that, during the initial stages of disaster recovery, the immediate material needs of these rural residents are of paramount importance, reflecting the urgency of addressing basic sustenance and financial stability. In the long-term recovery stage, the emphasis moves away from immediate material support and towards the significance of educational training facilities and opportunities that can contribute to sustainable livelihoods. This shift in priorities highlights the aspiration for self-sufficiency and resilience within these communities, with an emphasis on locally driven professions, such as tourism. This evolving focus underscores the community's desire for more enduring solutions that empower them to build a better, more sustainable future beyond the immediate aftermath of a disaster.

In India's pursuit of achieving the Sustainable Development Goals (SDGs), the government has adopted a strategic approach that includes micro-level objectives known as Village-level goals within the Gram Panchayat Development Plans (GPDP). These GPDPs encompass 29 distinct sectors, each serving as a fundamental building block with the potential to advance the overarching objectives of the SDGs (David, 2018) directly and indirectly. Applying the Connectivism Learning Theory (Goldie 2016; Kop and Hill 2008), that says if there is a connection between two concepts, they are linked. All 29 GPDPs and 17 SDGs are aligned with the three pillars of sustainability: social, economic, and environmental, thus it becomes evident that all GPDP goals play a significant role in contributing to the achievement of the SDGs. The study's findings reveal that specific GPDP sectors require heightened priority in development programs and policies. Notably, GPDP-18, focusing on vocational skill development for disaster preparedness and awareness, GPDP-1, 8, and 9 supporting livelihoods and economic growth, and GPDP-10 concentrating on rural housing for earthquake-resistant construction all emerge as high-priority areas. These GPDP goals are aligned with SDG-4 (quality education), SDG-8 (decent work and economic growth), and SDG-11 (Sustainable Development), highlighting their crucial role in achieving broader sustainable development objectives. This underscores the vital connection between the village-level efforts in GPDP sectors and the promotion of SDGs on a broader regional scale. This will also help SFDRR's (UNDRR, 2015) build back better target.

5. Conclusion

The research paper, 'Preparedness to Reconstruction: How Himalayan Rural Community Decides,' has unveiled vital insights into the dynamics of disaster management, recovery, and sustainable development in the Himalayan region. Through a comprehensive study conducted in Dharkuri, Tatalgaon, and Arakot villages of Uttarakhand, several key findings have been illuminated, shaping our understanding of the challenges and opportunities faced by Himalayan rural communities. One of the most significant findings is the identification of critical gaps in existing construction practices that contribute to heightened risk across the region. These gaps include the absence of the required number of earthquake bands, inadequate building geometry, and poorly attached parapets, prevalent in both villages. These shortcomings underscore the urgent need for improved construction practices and increased seismic resilience.

The positive correlation between risk perception and preparedness indicates that communities perceiving higher disaster risks are more motivated to prepare due to increased awareness of potential consequences. Conversely, the negative link between disaster recovery and preparedness suggests that previously affected communities might prioritise recovery over future preparedness, emphasising the importance of enhancing risk awareness and supporting post-disaster recovery through educational campaigns and financial/technical assistance. Another crucial discovery is the diversity in risk perspectives among respondents concerning various disasters. Dharkuri village witnessed high impacts on agricultural resources, livestock losses, and family economies. In contrast, Arakot village experienced significant impacts on livelihoods, including businesses, private jobs, and daily wages, as well as housing and belongings. This disparity highlights the importance of tailoring disaster management strategies to the specific needs of each community. The study further underscores the significance of short and long-term recovery expectations from government policies. Respondents emphasised the need for immediate medical assistance for short-term recovery and long-term access to medical facilities in their localities. These expectations highlight the essential role of healthcare infrastructure in post-disaster recovery. It is essential to emphasise the significance of community facilities, such as village community halls, as safe gathering points during emergencies, facilitating the storage and distribution of immediate relief assistance.

The study highlights the GPDP and SDG intersections that play a pivotal role in rural community recovery. GPDP-18 (disaster preparedness), GPDP-1, 8, 9 (livelihood and economic growth), and GPDP-10 (earthquake-resistant housing) are identified as priority areas, in harmony with SDGs 4, 8, and 11, fostering broader sustainable development. In essence, this research serves as a valuable roadmap for policymakers and community leaders, offering actionable insights into disaster management, recovery, and sustainable development in the Himalayan region. By addressing the identified gaps, aligning with community expectations, and prioritising specific GPDP sectors, the path to a safer, more resilient, and economically vibrant future for Himalayan rural communities becomes clearer. This paper underscores the importance of tailoring policies and practices to the unique needs of these communities, forging a path toward a more secure and prosperous Himalayan region.

6. References

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