



Building ex ante resilience of disaster-exposed mountain communities: Drawing insights from the Nepal earthquake recovery



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ABSTRACT

Government and non-government development agencies are increasingly focusing on building resilience at community level, especially in their post-disaster recovery interventions. But operationalizing the concept of resilience is a methodological challenge. In the aftermath of the recent major earthquake in Nepal, the International Centre for Integrated Mountain Development (ICIMOD) is working on developing a community resilience framework that will help identify policy-relevant factors contributing to building resilience. Using the method of Qualitative Comparative Analysis (QCA), data from 30 earthquake-affected mountain communities has been analysed to identify the combinations of factors that may serve as necessary/sufficient 'conditions' for resilient 'recovery outcomes'. Results establish six factors – natural resource endowment, physical connectivity, access to external development services, entrepreneurship, social homogeneity, and local economy – combining according to the community context to give five different factor combinations. Importantly, factors that are individually insignificant are seen in combination with other factors to exercise significant influence on recovery outcomes. The study concludes by proposing to policymakers that it is possible to identify appropriate combinations of contextual factors and ex ante nourish these to build resilience.

1. Introduction

The Hindukush Himalayan region is one of the most disaster prone areas in the world with frequent occurrences of earthquakes, flash floods, landslides, avalanches, forest fires and – an emerging phenomenon on account of global warming – GLOFs. The region is also home to a very large population that is economically poor and constrained in their development opportunities due to remoteness of location. Disasters and poverty have linked up in a most debilitating manner for mountain people's capacity to respond to and recover from the crises. One disaster event can undo all the development work of years and push people back into the trap of chronic poverty. In fact, several mountain-related specificities [28] come to play to turn the disaster-poverty linkage into a vicious cycle. Thus, 'inaccessibility' imposes restrictions on development interventions and aggravates the impacts of disasters by challenging timely post-disaster relief, recovery and rehabilitation efforts; the 'fragility' of mountain ecology makes the system extra vulnerable to disaster-related disturbances, often resulting in irreversible loss; and 'marginality' has obvious implications of

inadequacy when it comes to development governance and poverty alleviation efforts. Given the above context the popular belief that mountain people are resilient seems more of a myth and worthy of in-depth examination.

Nepal experienced a most devastating earthquake of magnitude 7.6 on April 25, 2015 followed by more than 300 aftershocks with magnitudes up to 7.3. The loss of life and damage to property was at a massive scale, affecting 31 of the country's 75 districts. Close to 9000 people died and 100,000 got displaced, more than 500,000 private houses were completely destroyed, and there was extensive damage to infrastructure [53]. For many people in the country the repeated aftershocks not only hampered their ability to maintain livelihoods but also were psychologically extremely traumatic. The Nepal Planning Commission has estimated the total value of loss and damage due to the earthquake to be USD 7 billion, which is equivalent to about one-third of the country's gross domestic product [42].

Once the immediate post-disaster relief stage got over, both the government and non-government organizations have been focusing on recovery and reconstruction. For the post disaster reconstruction, the

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Government of Nepal set up a National Reconstruction Authority in 2015. However, given the magnitude of the task it has been extremely challenging for agencies to reach all communities. In many cases communities have been trying to organize themselves and get back to their normal activities.

Whether it is through external help or due to own efforts, there is wide variation among communities in terms of time taken to recover as well as in the nature of their post-earthquake recovery. There are communities that were not so severely impacted by the earthquake but still struggling to get back to a normal state whereas, there are more severely affected communities that seem to have found out means of bouncing back relatively quickly. It thus becomes pertinent to examine what distinguishes the latter communities from the former. Accordingly the guiding questions for the present study are framed as follows. Since the notion of resilience includes recovery, would it be appropriate to label the communities that recover relatively quickly as resilient communities? More importantly, is it possible to identify the factors that contribute to early post-disaster recovery, and therefore argue for investment of resources on these factors for *ex ante* resilience building in communities?

In this paper we begin with a short literature review looking at various disaster resilience frameworks and the notion of post-disaster recovery. The review helps us in identifying the factors which impact post-disaster recovery and contributes to the development of the initial version of a conceptual framework that looks at post disaster recovery from a resilience perspective. This framework gets modified when we seek to apply it to the Nepal context by incorporating factors contributing to a qualitative change in the social dynamics. The empirical part of the study uses the Qualitative Comparative Analysis (QCA) method to understand varying recovery outcomes in both time and quality dimensions among 30 earthquake affected communities located in 3 districts of Nepal.

2. Literature review

Over the years various scholars have come up with theoretical frameworks to analyze the concept of community resilience but from different disciplinary perspectives such as that of ecological resilience [20,24,73], social resilience [10,17], socio-ecological resilience [23,4,72,74], sustainable livelihood framework [47,59], engineering resilience [25], disaster risk reduction [26,36,68], urban resilience [70]. However, despite thirty years of conceptual evolution, operationalizing community resilience has been slow [31]. Most of the concepts have remained theoretical with very few robust case studies to prove or test the theories, and thus there is a major gap in understanding how to measure and compare resilience across communities [9]. There is no agreed upon standard in measuring resilience that encompasses the dynamic nature of the community and the interactions between people and nature and built environment within it [1,16,22,37,44,7,66].

The linking of resilience concept to short-term disasters arising from natural hazards and long-term phenomena, such as climate change is a more recent development [19]. Zhou et al. [74] define disaster resilience as the “capacity of hazard-affected bodies (HABs) to resist loss and to regenerate and reorganize after disaster in a specific area in a given period” (p. 30). Djalante and Thomalla [19] note that several development agencies and research organizations have also come up with disaster resilience frameworks based on DRR research and practice that are multi-disciplinary in nature and can be applied at various levels (national, local and community). The authors’ analysis of 12 frameworks of disaster resilience that specifically focus on community resilience to natural hazards result in the identification of important elements of resilience building that address the 3 key aspects of resilience outcome considered important by all the frameworks – sustainable development, disaster risk reduction and community development. The elements include governance and institutions, education, social development, economic development, the built-environment as

well as the natural environment (addressing SD); risk knowledge, disaster preparedness, disaster response, and disaster recovery and reconstruction (addressing DRR); and trust, values, partnerships, networks and capacity among communities (addressing community development). One of the conclusions by the authors relevant to the present study is the importance of “contextual realities of the place in which a particular community is embedded” for the design of resilience building processes ([19]; p-176).

Increasingly, DRR practitioners are linking post-disaster recovery with the ultimate goal of community resilience and this is observed in Nepal’s post-earthquake situation as well. Jordan [30] in her study based on the content analysis of 202 articles on “disaster recovery”, “resilience” and “vulnerability” identifies four dimensions of recovery, namely economic, environmental, social, and infrastructural recovery. Psychological recovery is also important since the ability of communities to recover from the psychological impact of large scale death and destruction caused by the disaster plays an important role in the effectiveness of their own response and recovery efforts [65]. We have found this categorization of recovery outcomes relevant to Nepal’s post-earthquake situation.

Importantly, post-disaster recovery is not uniform – some communities recover better (building back better) and faster whereas others take longer time and may remain more or less vulnerable [6] – and therefore comparing several communities affected by the same natural hazard is expected to help in providing explanations to how communities recover post disaster and what factors influence the variation in recovery outcomes. In order to undertake such a comparative study using empirical evidence, it is important to define a set of recovery indicators [3,46] and have an integrative framework that would allow an examination of interactions among the contributing factors.

3. A conceptual framework

The question that prompted this study is whether it is possible to build resilience of a community *ex ante* by investing in its recovery capacity. Such capacity (or the lack of it) is premised to be dependent on the combined influence of a number of contextual ‘conditions’ (or factors) that may be generically categorized under people-nature relationship, the relationships within a local society, and the relationship between the local society and outside world. These relationships, when combined with key mountain specificities [28], i.e. inaccessibility, fragility, marginality, diversity and niche advantage, then define the complexity typical of an open socio-ecological system in the HKH region.

To start with we adopt the notion of recovery as a post-hazard non-independent process that is multi-dimensional in its outcomes [30]. Drawing from the literature, we look at four dimensions of post-earthquake recovery – infrastructure, economic, social and psychological.³ Social recovery is measured in terms of time taken to get back to normal social life, for example revival of festivals, social events etc.⁴ Economic recovery is measured in terms of time taken to resume primary source of livelihood and infrastructure recovery as time taken to construct safe and semi-permanent shelters.⁵ Psychological recovery

³ Since the focus is on response by the community to disaster, environmental recovery is not considered as an explicit and separate recovery dimension.

⁴ During field work it was expressed by the members of community participating in “Dhan Mahotsav” (rice planning festival) “we are so lucky to have survived this devastating earthquake. Today is the symbol of us moving ahead accepting the devastation that the earthquake caused.”

⁵ Since the context of the studies in the literature differs from the poor rural mountain context, the indicators drawn from literature have been appropriately adapted. In rural mountain context, most households are involved in informal economy (mostly farming) unlike in developed or urban context where people work as salaried employee. Thus, restoration of livelihood is critical to recover from the disaster [71]. Similarly for infrastructure recovery, instead of using housing repair or rebuilding we use construction of safe but semi-permanent shelter as an indicator. In the study sites devastated by the

here refers to the overall “safety perception” which is measured in terms of time taken to resume pre-earthquake diet⁶ and sending children back to school.

At the core of our framework is the interaction between nature and human society. Healthy ecosystems are important as they increase local resilience to disasters [60]. Wetlands and peatlands provide a buffer from flooding events [61]; riparian vegetation contributes to stable riverbanks [61]; and forests reduce damage from landslides, rock falls and avalanches [55,60,61]. Provisioning ecosystem services are particularly important before, during and after disasters as they provide for the basic needs of food, shelter and water [34]. Income from the sale of natural resources can also increase people's pre- and post-disaster resilience [49,67]. Healthy ecosystems with rich biodiversity are important for building resilience as they are themselves more resilient to disturbances [27] while being able to provide local communities with a range of ecosystem services and financial benefits [21,45]. In the context of the four post-earthquake recovery dimensions discussed earlier, nature can potentially play an important role in social, economic and infrastructure recovery.

It is important to understand the pre-disaster context of the communities along with the post disaster response, in order to understand their ability to recover and the post disaster recovery process [11,17,64]. Some pre-disaster factors/situations might enable the communities to recover faster and better (enabling resilience) while others might hinder the recovery (enabling vulnerability) [63]. Also identification of these factors help in cross-community analysis of post disaster recovery [3]. From a review of the relevant literature, and using expert inputs, we identify the likely contributing factors along with their attributes (Table 1). Since we wanted our framework to be operationally relevant, a measurable indicator was constructed⁷ for each attribute; later in the validation phase of the study a select set of these indicators was used to collect data from the field. Broadly we divide the contextual factors into two types – those indigenous to the community (eg. social memory, ethnic composition) and those influenced by external stakeholders (eg. access to technology and information, physical connectivity). However, it is quite likely that there would be overlaps between these two categories.

Figs. 1 and 2⁸ illustrate the argument advanced in this study linking contextual ‘conditions’ (or factors) to post-disaster recovery in its multiple dimensions; at the same time they are expected to serve as guiding frameworks for operationalizing the goal of building resilience at community level in the HKH region. Fig. 1 is a static representation of our premise that recovery outcomes – either individually or jointly – are likely to be determined in a specific community context by a particular combination of the contextual factors. This combination may vary from one community context to another. Thus the same recovery outcome, say on the infrastructure dimension, can possibly be linked with more than one factor combination. The empirical application of the framework is expected to identify all such factor combinations.

Since the ‘bouncing forward’ notion of resilience is linked to transformation in the system, we sought to incorporate this in our

framework by identifying possible ways in which transformative change can be experienced by a community in the post-earthquake situation. The pilot phase of the field work for the current study confirmed the possibility of a transformative change in the community context as a post-earthquake recovery outcome. This would be qualitatively different from the status quo outcome that is simply a return (or ‘bouncing back’) to the pre-earthquake state of ‘conditions’. Thus, for example, in some communities in the VDCs that we surveyed women were reported to have broken age old taboo of mending roof (it is considered inauspicious for women to mend roof) – especially women from households in which the male youth had out-migrated [35] – and came to be accepted by the community in the post-earthquake context. Based on discussions with relief workers and our own observations we identified the following outcomes that would be indicative of the ‘quality’ of recovery: (a) self-organization in reacting and responding to disaster as a community; (b) self-regulation in community response to receipt of aid; (c) breaking of any taboos; (d) timely delivery and effectiveness of aid; (e) uptake of learning; and (f) innovation in technology, practices. Fig. 2 incorporates these indicators of transformative changes in the community context to present the quality dimension of post-earthquake recovery.

4. Application of the framework

For validation of the above framework we designed a small scale data collection exercise that was conducted in the field during September – November 2015.

4.1. The study area

Based on the severity of damage and in order of priority for rescue and relief operations, the Government of Nepal categorized the 31 earthquake-affected districts as severely hit (7 districts), crisis hit (7 districts), hit with heavy losses (5 districts), hit (6 districts) and slightly affected (6 districts) [42]. For the purpose of this study it was decided to collect village (or ward) level data from one district each from the top 3 priority categories (i.e. severely hit, crisis hit, and hit with heavy losses categories).⁹ This was done because we wanted to know if the extent of damage impacted recovery outcomes (in terms of time and quality). The researchers chose Gorkha from the severely hit, Makawanpur from the crisis hit and Tanahun from the hit with heavy losses categories. The choice of these three districts was based on their proximity to each other¹⁰ as well as respective Human Development Index (HDI) scores such that there is some degree of similarity in terms of pre-earthquake development status across the districts.¹¹ Further, 5 VDCs (Village Development Committees) were chosen from each district and from each VDC, two wards were randomly chosen for the study¹² (Fig. 3). In total therefore 10 sites were visited each in Gorkha, Makawanpur and Tanahun districts, bringing the total number of field sites to 30. The limitation of the sample is that we had to choose VDCs that were accessible and relatively safe for fieldwork in the wake of landslides and aftershocks that were continuing for months after the earthquake.

(footnote continued)

earthquake, even having semi-permanent shelter is a major achievement and consistent with the notion of recovery.

⁶ Again, during field work, it was mentioned by the communities that even though food shortage was not an issue, they had lost appetite due to the trauma of experiencing the earthquake and especially the multiple aftershocks that followed the disaster. Similarly, sending children to school away from home was another important decision taken by families which is indicative of their acceptance of the post-disaster situation as well as their perception that it is now safe to do so.

⁷ The questions on the indicators are framed based on the authors' first-hand understanding of the context, which got considerably enhanced due to the relief work carried out by ICIMOD immediately after the earthquake.

⁸ We have used the ‘Yin-Yang’ icon in Figs. 1 and 2 to symbolize the notion that people and nature, though at times opposing forces (e.g. human disturbance on the environment), are parts of a whole.

⁹ As per the government's classification, Gorkha, Dhading, Rasuwa, Nuwakot, Sindhupalchowk, Dolakha and Ramechhap fall in the severely hit category; Kathmandu, Lalitpur, Bhaktapur, Makawanpur, Kavreplanchowk, Sindhuli and Okhaldhunga lie in the crisis-hit; and Lamjung, Tanahu, Chitwan, Solukhumbu and Khotang fall in the hit with heavy losses category.

¹⁰ Owing to the short time frame this research was conducted in, travel to distant and remote areas was not possible.

¹¹ These three districts had comparable HDIs according to the data from National Planning Commission of Nepal (Gorkha = 0.48, Makawanpur = 0.50, Tanahun = 0.51).

¹² The list of VDCs and wards chosen for the study are listed in the Annexure Table A1.

Table 1
Contextual factors influencing recovery with attributes and indicators for measurement.

Factors influencing recovery	Attributes (sources cited in brackets)	Measurable indicator identified for the present study
Social capital (SOC)	Collective action [33,69]	Have there been instances of collective action in implementing development projects, mobilizing petitions, and organizing events in the past one year?
	Absence of conflicts in community (expert input)	Any instances of conflict (over inter-group social relationships, violation of community norms/taboos, sharing of community assets, infrastructure & resources, over political affiliations) in the community in the past one year?
	Common code of conduct (expert input)	Are there any common codes of conduct laid down by the community itself for community members with respect to social issues like gambling, alcoholism, drugs abuse, etc?
	Common festivals [39,9]	Are there any common festivals where the entire community participates?
	Social network [30,41,43]	Does social network influence households' decisions on migration to nearest cities and outside of the country?
Social homogeneity (SOH)	Ethnic composition [18,66,9]	Number of social/ethnic groups in the community and what proportion of households in the community belong to the major social/ethnic group?
Natural resource endowment (NRS)	Quality of forest cover [30,9]	What is the quality of Forest Cover (open, highly degraded, moderately degraded, dense)?
	Dependence on natural resources (expert input)	How accessible is the forest system to people (in terms of the months in a year collection of fuelwood and minor forest produce is allowed from the forest)?
	Water sources [29,30]	What is the nature of Water Sources (Perennial/Seasonal)?
	Biodiversity [30,48,69]	What is the degree of species richness in both plant and animal biodiversity? (Respondent group asked to list 10 species each from plants and animals)
Quality of life (QOL)	House type [15,30,9]	What proportion of households are pucca (brick and mortar type)?
	Health [30,32,44]	Time spent to access nearest health facility/provider for safe child delivery (cases where medical care required)?
	Sanitation [29,30]	Proportion of households having toilets?
	Drinking water (expert input)	In times of scarcity/shortage/constrained water supply (or absence of community water point), what is the time spent to access the nearest drinking water sources?
	Education [12,15,30,9]	Time spent to reach the nearest secondary school?
Physical connectivity (CONNECT-P)	Energy use [29,30]	Availability of national electricity grid, Community Hydropower, Solar Home Systems, Biogas and other modern energy sources?
	Access to road [15,9]	Time spent to reach the nearest bus stop and motor able road?
	Nature of road and means of transportation [15,63]	Presence (or not) of all-weather motor able road, with frequent and regular transportation service?
	Access to market [9]	Time spent to reach the main market (e.g. to purchase construction material, marriage related clothes, etc.)?
Economic security (ECONOMY)	Access to credit [50,9]	What proportion of HHs have some form of access to a formal financial institution?
	Diversity of income source [1,15,30,54,69,8,9]	What proportion of HHs have more than one source of income?
	Remittance receipts [35]	What proportion of HHs are regular recipients of remittances from migrant members?
Institutional progressiveness (INSTI-P)	Economically active population [15,30,39]	What is the proportion of economically active population (as per census definition) in the community?
	Presence of Self Help Groups (SHGs) and their inclusiveness [15,29,32,40,69,9]	How many SHGs and/or community user group associations (e.g. CFUGs, WUAs) are present in the community?
	Effectiveness of SHGs (expert input)	What is the community perception on the effectiveness of SHGs (and user group associations) in carrying out their activities?
	Gender inclusion [30,69]	What is the degree of women representation (beyond the legal requirement) and participation in decision-making processes?
Access to external development services (ACCESS-DEV)	Decision-making process of local institutions [30]	Office-bearers of local community institutions (e.g. CFUGs, Cooperatives, etc) - does the community accept the choice of office-bearers; are there reservations regarding the process of selection; are their constraints to expressing dissent?
	Presence of external development projects/programmes [30]	How many external development projects/programmes (by government and non-government agencies) are on-going and since when?
	Interaction with local government agencies [30,38]	In the past one year, what has been the community's experience in terms of interactions with local (up to district level) government officials?
	Access to extension services (uptake of technology in agriculture and livestock) [69]	What is the incidence of application of modern and scientific techniques in agriculture and livestock management (HYV seeds, intercropping practices, pest & nutrient management, drip irrigation, rainwater harvesting, artificial insemination, livestock immunization)?
Risk preparedness	Social memory on disaster [23,65,71]	Does the community have memory of past disasters, and ability to relate past coping experience with their present response to disaster?
	Existence and pro-activeness of DRR system [9]	Presence of DRC at community level and awareness of respondent group of its activities
Literacy (LIT)	Literacy rate [14,18,30,39,44]	What is the literacy level in the community based on the highest level of formal education among a significant number of adults?
Entrepreneurship (ENTREP)	Non-traditional occupations [15,8]	Presence of non-traditional occupations (e.g. tea shops, vegetable farming) with degree of impact on local economy
Access to information (ACCESS-INFO)	Access to information and communication [13,2,30,58]	Degree of access to non-electronic and/or electronic media, and usage of cellphones
Female headed HHs (FEM-HH)	Female-headed households [15,62,9]	What was the proportion of female-headed HHs in the community just prior to the earthquake?

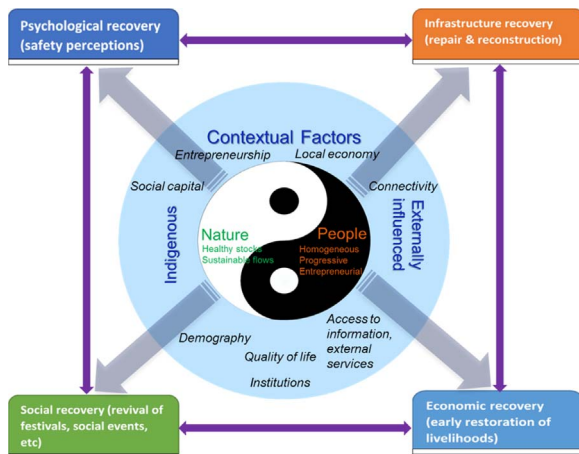


Fig. 1. Post-disaster recovery framework (without transformative change).

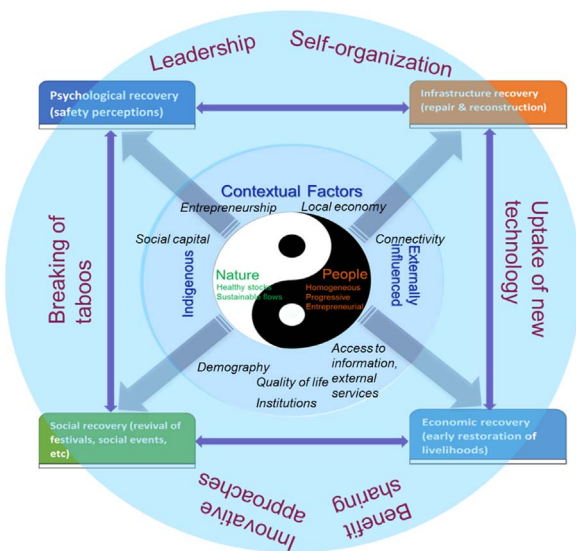


Fig. 2. Post-disaster recovery framework (with transformative change).

4.2. Data collection

Data used in this study are mostly qualitative and collected through Focus Group Discussions (FGDs) since we were interested in capturing perceptions of community and not of individuals. We developed questions related to the indicators (Table 1) of factor attributes impacting on resilience outcomes. The purpose was to come up with scores for each community with respect to a specific indicator on the basis of discussions with the community. Later in this paper we explain how these scores were assigned.

The pre-test of the questions in a pilot site provided researchers an understanding of the reactions of villagers, which helped in rephrasing the questions. The pre-test was also a very enlightening experience because the participants of the FGD thought that researchers were bringing them aid—a sentiment that was shared, as it turned out, in most of the other field sites the researchers later went to. This taught the researchers to be prepared for other similar misconceptions that future FGD participants might have of them in the field. The researchers learnt that it is necessary to make it clear to the community at the outset that their research work would not bring any tangible benefits to the community.

For each study site there was one FGD and the number of FGD participants (male and female) varied from 12 to 38 in different sites. While we intended to have a representative sample of the concerned community for each FGD, in the given circumstances it was not possible to choose the participants. The composition of the groups was ultimately determined by those who were present in the village and had time and willingness to participate. The questions were translated to the vernacular with assistance from a local resource person. The responses from participants were recorded as stated. During the discussions one of the researchers kept a note of group dynamics with an eye on social cohesion, women's ability to present their ideas, men's perception towards women's decision making role, state of awareness etc during and after the FGDs.

Along with observations we triangulated some of the information received from discussions by talking to schoolteachers, local political leaders, self-help group representatives, etc. The researcher's team carried out short transects and visited schools, walked around religious sites, market places, etc. in every study sites. Researchers spotted and

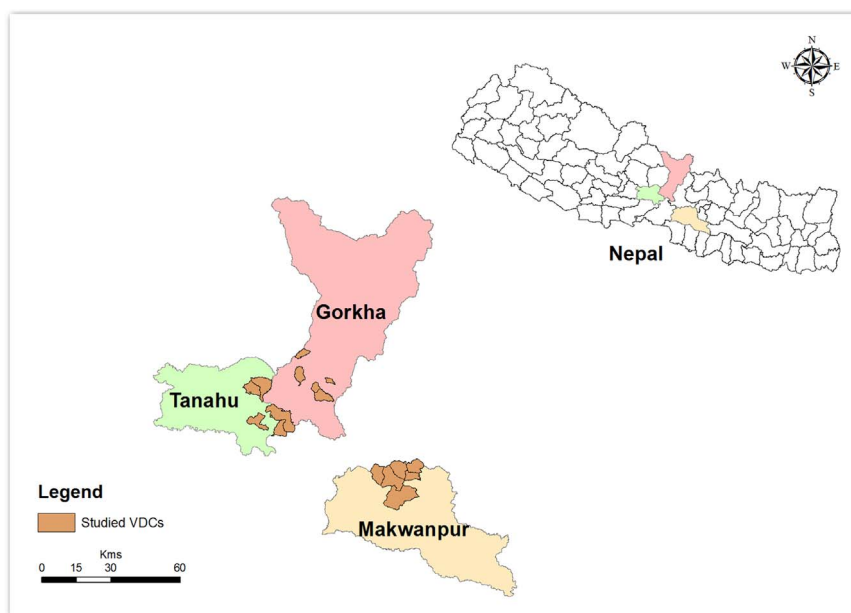


Fig. 3. Study sites in earthquake hit districts.

observed natural resource stocks, the state of physical infrastructure, agriculture fields, amounts of damage due to the earthquake, and for anything else that would be of interest for the research. Special remarks were documented and photographs were taken to give more insight into the research findings. On an average the research team spent half-a-day per site.¹³

4.3. Qualitative Comparative Analysis (QCA)

As described above, for empirical application of our post-disaster resilience framework, we took the post-earthquake situation in three select districts of Nepal as our research setting. Data was collected at the community level on indicators of recovery outcomes and the factors/conditions hypothesized to be contributing to these outcomes. Since it was evident from literature that post-disaster recovery outcomes are best understood as the result of multiple factor combinations, and given the small size of the sample (community cases = 30), conventional statistical methods were ruled out. Instead we opted for the method of Qualitative Comparative Analysis (QCA) which is one of the most formalized technique for set-relational research [57] and “provides a middle ground between case studies and statistical analysis” ([30], p.89).

The QCA method involves a systematic comparison of cases to identify combinations of causal factors resulting in a specific outcome [51,56]. The choice of causal factors in QCA is expected to be informed by theory and the method allows for several different combinations of factors to be causally associated with the same outcome. The QCA method draws on set theory to capture causal relations between multiple factor combinations and the outcome, and interpret such relations in terms of the necessity and sufficiency of causal combinations in leading to the outcome [51,57].

Most of the raw data collected from our field work are qualitative in nature and have been calibrated using a 4-point fuzzy scale with values ranging from 0 to 1 (i.e. 0 = fully outside the set; 0.33 = more out than in the set; 0.67 = more in than out of the set; 1 = fully in the set). To apply the fuzzy scale to a variable (or its attribute) an appropriate set of assignment criteria were identified and finalized after testing through a pilot.¹⁴ This is illustrated for the variable ‘social capital’ in Table 2. For quantitative data (as in case of the time measure for recovery outcomes), values were directly calibrated after setting value-thresholds for fully out, fully in, and the crossover between in and out of the set. The calibration process was completed with a final triangulation of the scores with field notes/observations and secondary data [5].

Many variables have multiple attributes, so aggregation of scores (i.e. scale values) was required prior to analysis. The aggregation rules were determined based on expert judgement of the importance of attributes in relation to the variable under consideration. If all attributes were judged to be equally important, then we took an average of the attribute scores. If all attributes had to be present for the case to be considered in the set, then we took the minimum of all the attribute scores.

Following the aggregation of the attributes we have a final list of eight variables that may be tested for their contribution to resilience outcomes at the community level. We use the fsQCA software [52] to test the variables whether they are necessary or sufficient to explain the recovery outcomes; based on this analysis a further minimization of explanatory variables is possible.¹⁵ The fsQCA software generates the

¹³ Annexure Table A1 gives the schedule of the fieldwork.

¹⁴ Even after pilot testing, some of the criteria had to be iterated as the field work progressed and new understanding of the context developed.

¹⁵ Necessity provides a measure of the degree to which the outcome is a subset of the causal condition. Therefore, if all (or nearly all) instances of the outcome show the condition, we would consider the condition necessary. In contrast, sufficiency provides a measure of the degree to which the causal condition is a subset of the outcome. Therefore, if a specific condition always (or nearly always) results in a positive outcome, that

Table 2
Illustration of 4-point fuzzy scale and assignment criteria for the variable ‘social capital’.

Indicators - >	Are there any common festivals where the entire community participates? (comm_fest)	Have there been instances of collective action in Development Projects, mobilizing petitions, and organizing events in the past one year? (coll_action)	Any instances of conflict (over inter-group social relationships, violation of community norms/taboos, sharing of community assets, infrastructure & resources, over political affiliations) in the community in the past one year? (Conflicts)	Are there any Common Codes of Conduct laid down by the community itself (or by a community group like Ama Samuha, a monastery, temple, and church) for community members with respect to social issues like gambling, alcoholism, drugs abuse, etc? To what degree is this code/s being adopted by the community members? (comm_codes)
Scale	0 = fully out 0.25 = more out than in 0.75 = more in than out 1 = fully in	No common festivals, either at the community or sub-community level Festivals at sub-community level (e.g. Tihar, Dashain, etc), with no participation by other groups Festivals at sub-community level, with some degree of participation by other groups All festivals (including meals, jatras) celebrated at community level	No instances in the past one year Instances of failed attempts in the past one year At least one instance in the past one year Multiple instances for multiple purposes in the past one year	Multiple instances over multiple issues in the past one year At least one major instance in the past one year Few minor incidents that got resolved No instances in the past one year
Definition				Absence of common code/s of conduct Code/s of conduct present but nil/negligible adoption Code/s of conduct present with some adoption Code/s of conduct present with nearly full adoption

truth table based on which we get the configurations of variables along with their scores for consistency and coverage.¹⁶

5. Results

5.1. A typology of recovery outcomes

This study looks at recovery outcomes at the community (ward) level in terms of time taken to get back to the pre-earthquake state as well as the quality of recovery. There are four dimensions of the pre-earthquake state with respect to which outcome indicators have been chosen and all these indicators are based on 'time taken' as a recovery measure. A quick or early recovery on all four dimensions is considered as partly characteristic of a resilient recovery. The other part is the quality of recovery captured through the 6 indicators discussed earlier at the end of Section 3. A resilient outcome is one in which the post-earthquake recovery is both 'early' and 'better'.

Given our operational definition of a resilient outcome as consisting of both 'early' and 'better' recovery in the post-disaster (in this case, earthquake) period, a typology of four recovery outcomes emerges from the 30 cases (communities) chosen for the study. This typology can be applied to recovery on any one of the four individual dimensions of recovery (psychological, social, economic, infrastructure) or to any combination of these dimensions. The typology is as follows (Table 3):

According to the 4-level scale applied in this study, a case that is given a value of 1 is in the successful outcome set and a value of 0.67 signifies that the case is 'more in than out' of the set. Accordingly Table 4 presents the distribution of cases for different recovery outcomes. Adding up the figures given in the last three columns gives us the total percentage of cases that are either completely in or more in than out in the successful outcome set. Thus 'infrastructure' emerges as the dimension in which the largest percentage (83.9) of the 30 cases made an early recovery. This is followed by the 'psychological' dimension in which 71% of the cases recovered early. There is greater diversity across the cases when it comes to the 'social' and 'economic' dimensions. While in the 'social' dimension we have 58% of the communities in the outcome set, the comparable percentage figure is 54.9 in the 'economic' dimension. Fig. 4 presents the distribution of cases for each of the recovery dimension.

When we take all dimensions into account, 63% (=19 cases) of the 30 cases studied are found to have recovered relatively early. This figure however drops sharply to 16% (=5 cases) if we consider the cases that recovered in a qualitatively better manner. A resilient outcome in which recovery is both early and better is seen for only one case that is not completely 'in' the set, but 'more in than out'.

5.2. Limited diversity among cases

The 19 communities that are found to have demonstrated early recovery in all 4 dimensions are distributed across the three study districts (Tanahun=7 cases, Makwanpur=8 cases, and Gorkha=4 cases). A mapping of the factors to the cases (Table 5) is useful for a common characterization of the communities. These are certainly connected (CONNECT) either physically or through means of modern communication, are with relatively high social and natural capital (SOC and NRS, respectively), and having progressive institutions (INSTI-P). A majority of these cases are relatively better off in terms of QOL indicators. At the same time, for most of the communities' early recovery seems to have been possible despite the lack of access to external development programmes (ACCESS), lack of local entrepre-

Table 3
Typology of recovery outcomes.

Quality of recovery		
Time taken to recover	Early and better recovery(a resilient recovery outcome)	Early recovery but back to status quo(a partly resilient recovery outcome)
	Late but better recovery(a partly resilient recovery outcome)	Late recovery and back to status quo(a non-resilient recovery outcome)

Table 4
Membership distribution of all 30 cases across recovery outcomes (in % terms).

Recovery outcome	% of VDCs with set membership scores of 0, and > 0 but < 0.67	% of VDCs with set membership scores of 0.67, and > 0.67 but < 1, and 1
recov_soc	42	58
recov_infra	16	84
recov_eco	45	55
recov_psych	29	71
recov_all	37	63
recov_qual	84	16
recov_resil	97	3

neurship (ENTREP), and despite suffering from the disadvantage of not having a secure and robust local economy (ECONOMY).

Given the limited diversity among cases, we are forced to either drop a few causal factors from further analysis or find appropriate substitutes. The three causal factors for which the case membership (or non-membership) is 90% or more are SOC, INSTI-P and CONNECT. For the factor CONNECT, which was formed using the aggregator 'OR', we find the constituent factor ACCESS-INFO (access to information) responsible for the complete absence of diversity among cases since all communities studied have some or other means of communication that make them virtually connected to the outside world. In terms of physical connectivity, however, there are several cases that score low on membership in the RD & TRNSP set. Thus, we chose to adopt a stricter definition of connectivity and take RD & TRNSP as the causal factor in place of the original choice CONNECT. In place of social capital (SOC), we now take social homogeneity (SOH) as a possible causal factor; for progressive institutions (INSTI-P) we don't have any substitute so we drop this variable from the set of causal factors.

5.3. Configurations of factors with cases

We use the fsQCA software to test our hypothesis that the recovery outcome on all four dimensions is determined by specific configurations of six factors – access to road and transport (rd & trnsp), local economy (economy), access to external development services (access), local entrepreneurship (entrep), natural resources stock (nrs), and social homogeneity (soh). Table 6 presents the configurations along with the cases that have greater than 0.5 value in the membership set. The solution coverage and consistency scores are good enough to accept the results.

Here it is pertinent to note that each of the configuration need to be looked at as a whole and the presence or absence of any single factor cannot be looked at in isolation for explaining the outcome. The five configurations that have emerged from the 30 case studies are explained below in terms of factors interacting with each other resulting in a common outcome of recovery.

5.3.1. $\sim rd \& trnsp * entrep * nrs$

The first configuration ($\sim rd \& trnsp * entrep * nrs$) seem to suggest that physically remote communities could demonstrate recov_all outcome because of access to natural resources and entrepreneurship from

(footnote continued)

condition would be deemed sufficient, although it may not appear in every pathway to the outcome.

¹⁶ For a factor configuration, consistency is the same measure as necessity and coverage is the same measure as sufficiency.

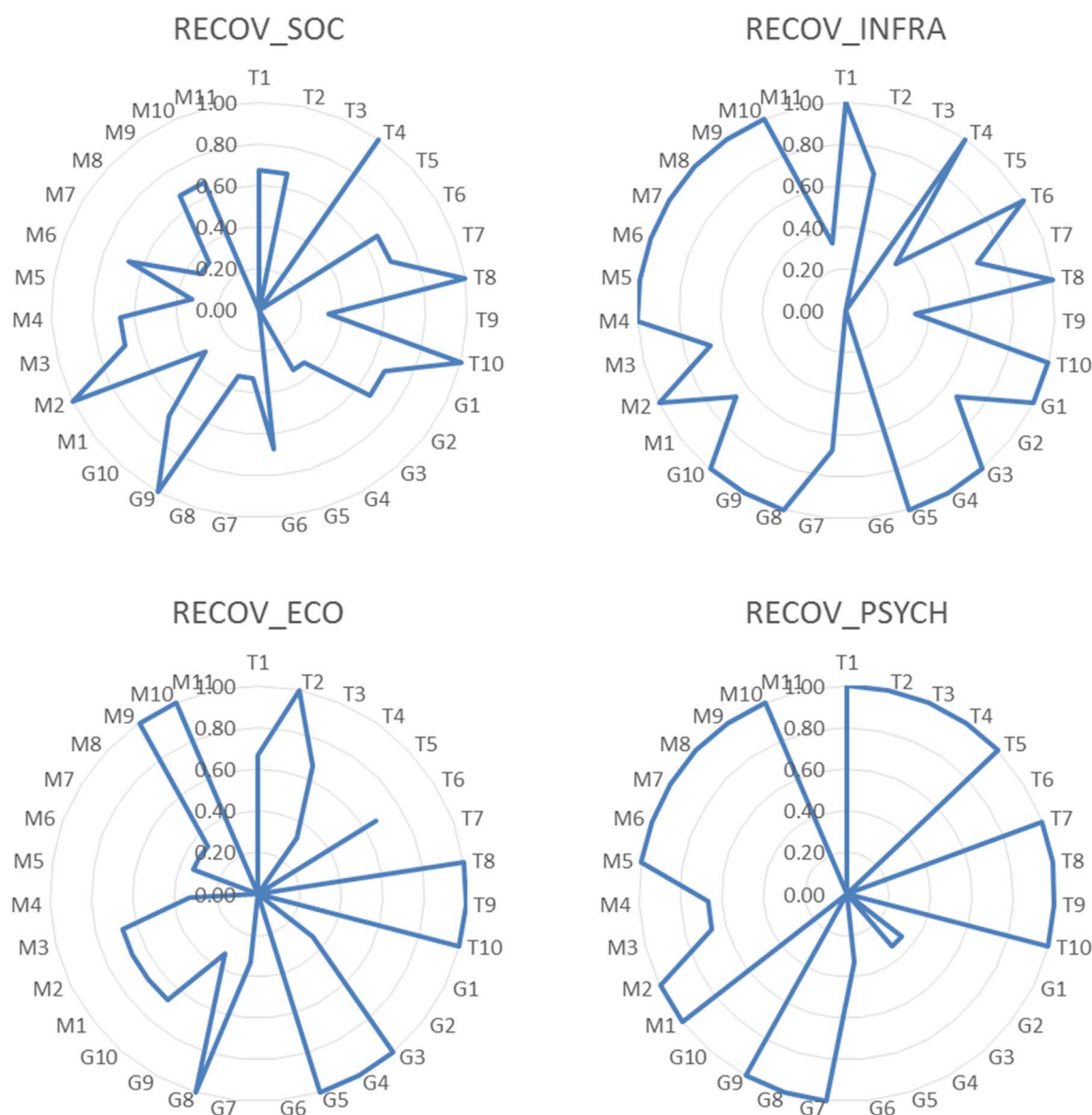


Fig. 4. Distribution of cases (communities) for each of the four recovery dimensions.

Table 5
Membership distribution of all 30 cases across factors (in % terms).

Factors	% of VDCs with set membership scores of 0, and > 0 but < 0.67	% of VDCs with set membership scores of 0.67, and > 0.67 but < 1, and 1
SOC	6	94
NRS	32	68
QOL	19	81
ENTREP	52	48
ACCESS	87	13
INSTI-P	10	90
CONNECT	0	100
ECONOMY	87	13

within the community. Both Dandakharka 2 and 3 have mostly Tamang people. This community has no access to motorable road and one has to walk two hours to reach the place. Unlike other communities in the region, farmers are not engaged in vegetable farming because of lack of transportation service to market their produce. Locals in this community were able to quickly construct the safe temporary shelter using Bamboo and locally available *Khar* (kind of grass used for thatched

roof) while people in other communities waited for Tarps from government and aid agencies. When asked, “why did not you wait for aid from outside as people in other communities had done?”, locals replied they were very skeptical about receiving aid quickly because of remoteness, which prompted them to make use of their own resources. The community has a forest committee. They are in process of getting it registered as a community forest. The forest committee is in process of extracting Khoto (resin from Pine tree) and selling it out to the market.

5.3.2. $rd \& trnsp \ast access \ast nrs$

A common factor between wards in Palung (in Makwanpur), Abukhaireni and Barbhanjyang (in Tanahun), and Choprak (in Gorkha), was access by roads. All of the communities in the wards in Makwanpur and Tanahun have yearlong transportation (i.e. their roads were not damaged during monsoon). It is probably because of this that all of them have sustained NGO and INGO interventions. Such interventions have led to uptake of improved technology in livelihood activities. Thus, in Aaanbukhaireni 3 for example, the community has a dairy where they collect milk from modern cow farms; they have agriculture groups, which try to improve agriculture and farming practices. Post-earthquake, residents in Barbhanjyang and Choprak

Table 6

Configurations of factors for Model: recall = f(rd & trns, economy, access, entrep, nrs, soh).

Configuration	Raw coverage	Unique coverage	Consistency	Cases (VDCs) with greater than 0.5 membership
~rd & trns*entrep*nrs	0.28	0.01	1.00	Dandakharka 2 (0.67,0.87), Dandakharka 3 (0.67,0.87), Gogane 2 (0.55,0.6)
rd & trns*access*nrs	0.51	0.08	0.99	Abukhaireni W3 (0.67,0.87), Palung 4 (0.67,0.93), Abukhaireni W8 (0.64,0.87), Choprak W5 (0.64,0.6), Tistung 4 (0.61,0.67), Barbhanjyang W6 (0.56,1), Barbhanjyang W5 (0.55,0.73), Phinam W2 (0.53,0.8)
entrep*nrs*soh	0.59	0.04	0.96	Agra 6 (1,0.8), Tistung 4 (0.84,0.67), Tistung 1 (0.84,0.73), Choprak W5 (0.67,0.6), Palung 4 (0.67,0.93), Dandakharka 2 (0.67,0.87), Dandakharka 3 (0.67,0.87)
rd & trns*entrep*~nrs*~soh	0.16	0.02	0.97	Bungkot W4 (0.67,0.6)
rd & trns*economy*nrs*soh	0.37	0.04	0.98	Chimkeshwari W4 (0.67,0.53), Chimkeshwari W5 (0.67,1), Phinam W2 (0.61,0.8)
Solution coverage: 0.75				
Solution consistency: 0.95				

have used bamboo and other leafy foliage to construct makeshift shelters.

5.3.3. *entrep*nrs*soh*

The third configuration **entrep*nrs*soh** has the maximum raw coverage (0.59). Agra, Tistung, Palung, Choprak and Dandakharka all have a majority of Tamang populations in their settlements, and hence, higher social homogeneity. Entrepreneurship in these communities was found in different forms; the commonality was the linkage with natural resource stock. For example, the key informant from Agra 6 mentioned that they were the first farmers to introduce “*Hariyo Tauke Mula*” (Green Headed Radish) in the Nepali market. Furthermore, in Tistung and Palung, due to their proximity to the highway and Daaman, nearly all locals are commercial vegetable and cash crop farmers. In Choprak, locals said they shared agricultural techniques and farming methods amongst each other, which was made easier because of their high social homogeneity.

5.3.4. *rd & trns*entrep*~nrs*~soh*

Bungkot W4 is quite close to the Gorkha district headquarters. The community is very diverse; there is no sizable majority of any of the three ethnic groups (Brahmin, Newar, Gurung). Compared to other villages, the locals here are not allowed to frequently extract forest and timber resources. There is however evidence of entrepreneurship in the community – residents of the area have constructed vegetable “tunnels” to grow various vegetables and cash crops. During the time of the earthquake, because of their lack of access to forests, they sought shelter in these same tunnels.

5.3.5. *rd & trns*economy*nrs*soh*

Both, Chimkeshwari and Phinam, were 5 min away from large national highways. In Chimkeshwari, many locals go to the Middle East or join the Indian Army, resulting in high rates of emigration and remittances. This, coupled with their close proximity to a large highway, means many locals have multiple income generating options. The same can be said for Phinam W2, where the majority of the population are Muslims resulting in even higher degrees of social cohesiveness.

If we compare the third configuration (**entrep*nrs*soh**) with the fifth (**rd & trns*economy*nrs*soh**) it seems that local entrepreneurship (entrep) can act as a substitute for the combination of access to road and transport (rd & trns) and a strong local economy (economy) when it comes to explaining recovery outcomes. On the other hand, in the absence of natural resources (nrs) and social homogeneity (soh) in the Bungkot case (**rd & trns*entrep*~nrs*~soh**), entrepreneurship (entrep) combines with access to road and transport (rd & trns) to result in the *recov_all* outcome.

The role of the social homogeneity factor seems to vary from case to case depending on the configuration. Thus for Phinam 2 that has mostly Muslim population, the community was able to collect significant amount of assistance and distribute it wisely among the Muslim as well as non-Muslim households in the village. Moreover they were also very cautious about preventing any social conflict (between Muslim and non-Muslim communities) while distributing any aid received from Islamic organizations. In spite of all other factors (like connectivity and livelihood opportunity) almost same as in Tamang communities nearby, Palung 4 has comparatively better literacy and is wealthy. This community has mostly Brahmins and Newars, which are considered as upper castes in Nepali society. The community has a *Guthi* (a traditional socio-economic organization formed for a specific purpose) has been protecting a patch of forest for the use of temple, religious functions and for the cremation as per Hindu rituals. Women are also active in this community as compared to their counterparts in Tamang communities. Respondents mentioned that they rerouted their aid to more affected Dalit (less privileged) community. Although upper castes seemed to have played a leadership role in this community, this was not commonly seen in other places.

6. Discussion and conclusion

The present study is relevant to design and change the focus of development interventions by government and non-government agencies from recovery to resilience building. Building resilience as a policy goal in the policy process seems to be hindered because of the lack of an operational framework.

The twin earthquakes of 2015 in Nepal and the damage they brought made it possible for us to visit multiple sites and see for ourselves recovery in its varying forms at the community level. Our premise has been that quick and better recovery in a post-disaster scenario is indicative of a resilient community. Our study indicates that no single factor can be attributed to early or better recovery outcomes; rather it is a configuration of factors that lead to these outcomes. Furthermore, the context, which would differ from community to community, determines the configuration. Thus there can be multiple configurations in which individual factors can be varying positioned as either necessary or sufficient for achieving the recovery outcomes.

We believe that an approach which focuses on context-specific factor configurations is a better approach to ex ante build resilience at the community level. As our study reveals, individual factors may be necessary but not sufficient (or vice versa) to ensure community resilience to disasters. The current practice of development agencies to work independently according to their own thrust areas may not be leading to resilience building. Thus a coordinated approach of various

development agencies, both government and non-government, is necessary.

This study throws up some interesting questions about accepted linkages between factors and outcomes. A commonly held premise, for example, is that homogeneous communities have better social capital, so can be expected to behave resiliently. Similarly, another premise links connectivity with better access to external services and therefore predicts resilient outcomes when such linkage is present. The present study brings out counterfactuals to the above commonly held premises and therefore prompts more questions about building resilience rather than providing answers.

The aftermath of the 2015 earthquake saw many informal groups coming forward impromptu and with little outside support to help out the affected people. Can we say this as indicative of Nepal being a resilient society, or was it an act of coping with the disaster? We believe that resilience is a broader concept and resilience building is a long-term phenomenon. The process of resilience building can be considered as a continuum, starting with DRR, moving to adaptation and ultimately achieving sustainable development.

It is typical to the whole of South Asia that disaster risk reduction (DRR) as a public policy goal at the national or local level is considered separate to that of economic growth or poverty alleviation. It is difficult to come across an example in the region of an integrated policy framework that not only recognizes the link between disasters and poverty, but also specifically includes DRR as a vital component of any poverty alleviation strategy. Such an integrated policy framework is

possible only when at the strategic level the policy goal is more inclusive in its focus than the conventional sectorally-determined sector-specific goals. This paper therefore argues for a shift in policy/programme level focus from goals such as income generation or infrastructure development (as has been the case for most of externally funded development programmes in case of Nepal) to the more inclusive goal of ‘building resilience’ at the local community level. We are aware of the limitations of this study. The four dimensions of recovery are probably inadequate to capture the multi-faceted nature of resilience; also we have limited questions on each of the variables so the data collected cannot be vouched to have comprehensively captured each of the community context. Moreover, in validating the framework we have taken only one country and one disaster type (earthquake); what is warranted is a more rigorous application of this framework in multiple countries and for multiple disaster types before conclusive statements can be made regarding its operational use.

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Annexure

See Annexure [Table A1](#).

Table A1
Schedule of the field Visit.

Date	VDC-Ward No.	No. of FGD Participants	Place
Makawanpur			
22/09/2015	Palung-9	20	Local primary school
22/09/2015	Palung-4	28	Temple compound
23/09/2015	Tistung-4	19	Key informant's home
23/09/2015	Tistung-1	17	VDC building
24/09/2015	Aagara-5	18	Local secondary school
24/09/2015	Aagara-6	16	Key informant's home
25/09/2015	Dandakharka-2	26	Makeshift VDC compound
25/09/2015	Dandakharka-3	18	Local primary school
26/09/2015	Gogane-1	14	Roadside
26/09/2015	Gogane-2	15	Key informant's home
27/09/2015	Namtar-1	12	Roadside
Tanahun			
28/10/2015	Chhimkeshwori-4	22	Community forest building
28/10/2015	Chhimkeshwori-5	18	Key informant's home
29/10/2015	Dharampani-3	19	Roadside hotel
29/10/2015	Dharampani-4	17	Under the <i>Peepal</i> tree
31/10/2015	Bhanu-4	38	Key informant's home
31/10/2015	Bhanu-6	19	Roadside
01/10/2015	Barbhanjyang-5	22	Roadside
01/10/2015	Barbhanjyang-6	18	Key informant's home
02/11/2015	Aanbukhareni-3	22	Youth club compound
02/11/2015	Aanbukhareni-8	15	Roadside
Gorkha			
04/11/2015	Baguwa-1	14	Roadside
04/11/2015	Baguwa-2	27	Key informant's home
05/11/2015	Phinam-2	18	Key informant's home
05/11/2015	Phinam-5	21	Local primary school
06/11/2015	Chhoprak-1	19	Roadside
06/11/2015	Chhoprak-5	17	Roadside
08/11/2015	Kerabari-1	15	Local school
08/11/2015	Kerabari-2	26	<i>Aama Samuha</i> building
09/11/2015	Bungkot-3	22	Temple Compound
09/11/2015	Bungkot-4	18	Roadside

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