

School of Public Health

**Factors Determining Progress of Disaster Recovery Among the
Earthquake Affected Population in Nepal**

Sailesh Bhattarai

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Doctor of Philosophy
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Declaration

To the best of my knowledge and belief, this thesis contains no material previously published by any other person except where due acknowledgment has been made. This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2007) - updated March 2014. The proposed research studies received human research ethics approval from the Curtin University Human Research Ethics Committee (HRE2017-0596).

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Abstract

Background

Disaster recovery is a complex and multidimensional process, but there is a lack of clarity in understanding the complexity of the process. Disaster literature argues the recovery models developed in the past had explored only one or two specific indicators of recovery. Very few studies have been conducted using comprehensive approaches and methods and tested in the real disaster scenario. Furthermore, there are very few disaster studies from developing countries, although the impacts of disasters are often more severe in this setting. This study seeks to present an evidence-based comprehensive approach to explore and understand the path and progress of disaster recovery. The aim of this study is to identify the factors associated with disaster recovery process, in order to produce a data-driven model to better understand the factors that impede or enhance disaster recovery.

Methods

A mixed-methods research design incorporating quantitative and qualitative methodologies was adopted to address the research question from different perspectives. The researcher followed sequential steps and included comprehensive data collection methods to correlate and corroborate the findings from all possible dimensions. These included a systematic literature review and analysis, survey instrument and tool development, over 30 qualitative interviews, observations, discussions, field visits, and a quantitative household survey of 744 earthquake-affected households in the most earthquake-affected Sindhupalchowk district of Nepal. The researcher was involved throughout the whole data collection process in Nepal.

A systematic review of the past disaster studies was done to identify the established factors that impacted disaster recovery in the past. This review guided the development of a survey instrument to investigate disaster recovery factors with a comprehensive approach before developing an integrated model of progress of disaster recovery. A community resilience tool was developed to assess the community capacity to adapt and manage the crises as an important established factor of disaster recovery. The indicator of disaster recovery as 'least' and 'most' recovered villages was identified based on the progress of reconstruction recovery, especially house reconstruction.

A household survey collected data from 744 earthquake-affected households from four most and four least recovered village development committees (VDCs)/municipalities, out of 79 VDCs/municipalities in the Sindhupalchowk district of Nepal. Qualitative interviews were

conducted with five Government administrators, three political leaders, ten local Government representatives, 12 technical persons, five key persons such as teachers, business owner and ward officials, and seven residents, along with two focus group discussions (FGDs) with earthquake-affected residents from both the least and most recovered places. The sample was drawn from 8 randomly selected VDCs//municipalities. However, convenient samples of qualitative interviews were drawn purposively. Descriptive statistics and multiple regression modelling was used to analyse household survey data examining the factors of disaster recovery. Exploratory factor analysis was conducted to develop a community resilience tool. Data from the informant interviews were analysed with a combination of inductive and deductive approaches.

Results

Fourteen factors that impacted disaster recovery, categorised under four significant domains (social, physical/environmental, economic, and institutional/procedural), were identified in the systematic review of the literature. The integrated pathways model was developed to accommodate all of the domains and factors identified in the reviewed literature and the mediation and impact pathways that they influence. This preliminary recovery model guided the tools and questionnaires of survey instrument of the research study.

Exploratory factor analysis conducted among 744 household samples identified six meaningful constructs of community resilience tool correlating with the established theories of community resilience with satisfactory consistency (Cronbach's Alpha 0.56-0.89). The higher resilience score significantly correlated with most recovered VDCs/municipalities. The community resilience scale and all its sub-scales were significantly correlated with established tool Conjoint Community Resilience Assessment Measure (CCRAM) ensuring the validity of the tool.

Univariate logistic regression analysis was conducted on 744 earthquake-affected household samples which identified 33 potential predictors of disaster recovery. Binary logistic regression was done on these potential factors which found that households with lower community resilience scores (community connectedness, disaster management, information and communication, and place attachment), and that consisted of underprivileged caste/ethnicity, households with low family income, households having bad transportation, households having difficulty accessing essential facilities, households that received late house grants, had the higher likelihood of residing in the least recovered than most recovered VDCs/municipalities. Similarly, the households with greater community trust towards disaster

officials, and better indicators of community resilience components related to governance (increasing scores of leadership and governance and good accessibility to essential Governmental facilities) also had higher likelihood of residing in the least recovered VDCs/municipalities.

The thematically analysed qualitative data interviews and discussions reported that communities supported by international and national non-Governmental organisations (I/NGOs) in the reconstruction of the residential buildings and infrastructures were doing better in reconstruction recovery. Similarly, communities supported by local multipurpose financial cooperatives and communities with active leaders had better reconstruction recovery. The delay in building reconstruction was due to various household and logistical reasons, such as adverse economic condition, bad roads, and long distances. These difficulties were compounded by impractical Government policies regarding road and building and the complex process of obtaining house grants. The least recovered VDC/municipalities were found to have bad roads, rugged terrain, and considerable social vices such as caste discrimination, low presence of non-Governmental organisations and less active local Government.

Conclusion

The study concludes that community resilience had an influential role in the recovery after the 2015 earthquake in Nepal along with other pre-existing household and contextual factors, such as caste hierarchy system, household economy, receipt of house grants, the trust held towards Government and local leaders, and geographical vulnerability. These findings were supported by both the qualitative and quantitative data and provides evidence-based approach to understand the complexity of disaster recovery in the context of developing countries. This study suggests disaster recovery plans and programs to focus on the aspects of strengthening the local capacity of the community to develop the community resilience that help to manage the future crises. Local and federal Government need to effectively address the local issues that help strengthen the community resilience to achieve satisfactory recovery progress after a disaster.

Abbreviations

CART: Communities Advancing Resilience Toolkit

CCRAM: Conjoint Community Resilience Assessment Measure

DAO: District Administrative Office

DCC: District Coordination Committee

DEOC: District Emergency Operation Centre

DDRC: District Disaster Relief Committee

DRRC: District Relief and Rescue Committee

EFA: Exploratory Factor Analysis

FGD: Focus Group Discussion

ICC: Intra Class Correlation

INGO: International Non-Governmental Organization

NDRF: National Disaster Recovery Framework

NRA: National Reconstruction Authority

NGO: Non-Governmental Organization

NRA: National Reconstruction Authority

VDC: Village Development Committee

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Chapter 1 : Introduction

Many factors play a role in successful recovery in reconstruction and restoration of infrastructures and livelihoods after a disaster, especially at a household and community level. However, there is a lack of comprehensive approaches and survey instruments at the household level to assess factors affecting disaster recovery in developing countries like Nepal. There is limited evidence upon which to base programs, especially, in these developing countries which are with deeply rooted culture and traditions.

This mixed-method study design has used comprehensive methods to develop a household survey instrument and community resilience tool of disaster recovery and tested them in earthquake-affected households of Sindhupalchowk district in Nepal. The approach was complemented with the formal and informal qualitative interviews and discussions done among the general people and various stakeholders of disaster recovery. The study has sought to identify the established and context-related factors impacting the progress of disaster recovery. The systematic literature informed the development of survey instrument which assessed the progress of disaster recovery. With the help of the survey instrument, this study examined various established and context-related factors and tested and validated the instrument in the disaster impacted population of Nepal in the aftermath of the 2015 Nepal Earthquake. The process also included the development of community resilience tool in Nepalese context after adapting the established theories and validated instruments of the community resilience tool. The findings and conclusion drawn from the project will provide an evidence base for the modifications and further planning for long term disaster recovery strategy at the policy level for the Government and other stakeholders of disaster recovery.

1.1 Background

This research study explores the Nepal earthquake 2015 as its study focus. Disaster is inevitable and has deeply impacted the lives of humankind since decades. Natural disasters such as earthquakes, tsunamis, tornadoes, fires, and floods, etc. suspend normal activities and threaten or cause severe, community-wide damage (Aldrich, 2012a). Disaster is defined as “a potentially traumatic event that is collectively experienced, has an acute onset, and is time-delimited; disasters may be attributed to natural, technological, or human causes”(McFarlane & Norris, 2006). Natural disasters are difficult to predict. We have no control over the event by which a natural disaster is triggered. But, it is the characteristics and circumstances of a community that makes them susceptible and vulnerable to the damaging effects of the hazard

(Alipour et al., 2015). However, the impact of the catastrophe could be reduced if recovery is planned ahead by reducing the vulnerability and risks in the community (Yasui, 2007).

1.2 Recovery concept and meaning

The process of recovery after a disaster restores the damaged physical infrastructure and social life back to its pre-disaster condition. The studies on past disaster experiences discuss how four significant areas or environments of community life get disturbed during a disaster: physical, social, economic, and natural environment. Therefore, disaster recovery is the process of rebuilding and restoring these disrupted environments of community life. Researchers have explored these areas of community life to understand their role in the progress and path of disaster recovery. The recovery actions after an event often include conducting damage assessments, restoring lifelines, carrying out debris management operations, managing shelters and providing short/long-term housing needs, restoring environmental, historical, and cultural features of a community. The process, in the long term, involves the restoration of the shattered economy and reinstating the disrupted livelihood of the affected community.

There is a lack of clarity in defining what constitutes successful recovery. The conventional definition of “returning back to normalcy”(Haas et al., 1977) has been criticized because the normalcy of a pre-disaster state is no longer seen as adequate with multiple recent frameworks suggesting a “new normal” needs to be created, one that can withstand, cope, and adapt to future risks (Global Facility for Disaster Reduction and Recovery et al., 2015; Management, 2015).

The earlier definition of disaster recovery, “returning back to pre-disaster state”, has been furthered by adding a component related to the unique adaptive capacity of a community. This is known as “community resilience” and has been widely adopted by leading organisations and authorities working in designing and planning of disaster recovery. The comprehensive definition of recovery includes reconstruction, restoration and re-establishment of settlements, physical infrastructure, public services, economy and a sense of stability among community members that enables them to withstand the future risks and impacts of disasters (Federal Emergency Management Agency, 2011; Global Facility for Disaster Reduction and Recovery et al., 2015; Management, 2015). This definition emphasizes that the recovery process is also the development of a resilient community that can withstand future risks. It has gained recognition from various reputed disaster organizations and many countries have adopted this definition in their disaster recovery frameworks and plans (IDRF, 2010; Management, 2015; National Reconstruction Authority GoN, 2016).

The concept of self-sufficiency of the community in the aftermath of disaster has gained the attention of many disaster researchers in recent days. The idea of post-disaster self-sufficiency becomes even more relevant especially in the context of low-resource countries where the communities are intertwined in the vicious cycle of poverty and pre-disaster vulnerability such as inaccessibility to essential amenities and services, marginalization, illiteracy, low status of women, etc. (Mishra et al., 2017).

1.3 Disaster recovery phase

Disaster recovery is not static but is a dynamic and extended process of disaster management. This process of recovery management generally passes through certain phases. Few researchers have managed to measure the process of disaster recovery in terms of disaster management phase. For instance, Haas et al. (1977) mentioned that recovery occurs in four consecutive but overlapping phases, with each successive phase being much lengthier than the preceding one. These phases were emergency period, referring to the initial hours or days of relief and rescue activities; restoration period, when evacuees return, major urban services and transportation are restored, and rubble debris is cleared; replacement reconstruction period, during which capital stock is rebuilt to pre-disaster levels and social and economic activities return to previous levels, and; commemorative, betterment, and development reconstruction period, during which “major projects are undertaken and future growth and development begin to take hold”.

Federal Emergency Management Agency (Federal Emergency Management Agency, 2011) in their National Disaster Recovery Framework have mentioned three precisely discrete phases of recovery management: An initial few-weeks’ short-term recovery phase addressing safety, health, rescue, and immediate relief; intermediate recovery phase involving resumption of daily routine to a functional level; and long-term recovery phase which continues from months to years and addresses overall reestablishment of physical, social, economic and environmental aspects of community life. This current study was undertaken little more than two and a half years after the 2015 Nepal earthquake in the intermediate phase of recovery management. Borrowing from (Federal Emergency Management Agency, 2011), this study has captured the progress of “the short term” and “intermediate” disaster recovery phase of the ongoing five-year recovery plan in Nepal.

1.4 Indicators of recovery

Comparing several communities affected by the same natural hazard is expected to help in providing explanations of how communities recover after a disaster and what factors influence the variation in recovery outcomes. To undertake such a comparative study using empirical evidence, it is important to define a set of recovery indicators (Tatsuki & Hayashi, 2002).

Restoration to pre-disaster conditions or normality is usually taken as an indicator of recovery (Han, 2014) which may or may not be the same as the pre-impact level (Quarantelli, 2008). Researchers agree that there is no unanimous indicator of recovery after a natural disaster. The difficulty in understanding the recovery process is in part due to the use of varying metrics and indicators to measure disaster recovery. This is because numerous aspects of community life get disrupted during a disaster such as livelihood, accommodation, daily work, economic activities, business, cultural harmony, social and mental wellbeing, security, etc. This makes it a difficult task to consider what constitutes disaster recovery. Various indicators have been used to measure disaster recovery in the past depending upon the phases of disaster recovery in which the study is conducted. Some scholars have used physical aspects such as building reconstruction and restoration of infrastructures (Liu & Fellowes, 2006) as the indicators to measure short and long-term disaster recovery. Others have used economic indicators (Albala-Bertrand, 1993; Wang et al., 2012) and annual population growth and inward migration (Aldrich, 2011b; Aldrich & Meyer, 2014) as a measure of long-term recovery. Receipt of aid packages, provision of temporary settlements, and construction of houses were taken as a measure of short-term recovery in the Indian Ocean Tsunami study (Aldrich, 2011a). This current study measured physical indicators in the intermediate phase (Federal Emergency Management Agency, 2011) of recovery management by assessing the progress of works in housing reconstruction and restoration of essential services of earthquake-affected population.

1.5 Factors of disaster recovery

Post-disaster recovery is not uniform – some communities recover better and faster whereas others take a longer time and may remain more or less vulnerable (Jordan & Javernick-Will, 2013). Disaster recovery is the least understood phenomena in disaster management (Chang, 2010; Nejat et al., 2016). The impact and recovery after a disaster are affected by many variables (Aldrich & Meyer, 2014). There are many direct and indirect interconnected factors (physical, social, institutional, economic, and environmental) of community life that facilitate or hinder the process of recovery (Cao & Xiao, 2011; McEntire et al., 2010). Furthermore, factors that influence recovery vary depending upon the phases of disaster management (Federal Emergency Management Agency, 2011; Jordan et al., 2014)

Reasons for difficulty in understanding recovery process

Multiple indicators of recovery: There are clear reasons for the difficulty in understanding the complex process of disaster recovery. One of the reasons being that recovery outcomes are moderated by multidimensional aspects of community life that involve physical, social, economic, and institutional components (Jordan et al., 2014). One single aspect of community

life, for example, a social component, includes factors such as household characteristics, the role of local organizations, community participation, socio-cultural values, marginality, etc. that can impact the process of disaster recovery. Similarly, other components may have many factors defined and understood in different ways in different settings. These factors of community life and its representation, with varying indicators, adds complexity to understand the process of recovery. For example, a single term social participation could be assessed by church visiting status, observing yearly festivals, or attending rituals depending upon what activities represent the true participation in a particular community.

Past studies in disaster recovery explored a wide range of factors that impacted the process of disaster recovery. For example, some research findings found the availability and distribution of Government grants and external aid to be crucial in the recovery progress (Han, 2014; Liu & Fellowes, 2006; Wang et al., 2012). A study done post 2011 Tsunami in Japan concluded that a top-down approach and refusal to decentralize the process by the Government was the reason for delayed recovery(Cho, 2014). Some studies also found that the damage intensity of disaster was the reason for the variation in differential recovery outcomes (Haas et al., 1977; Yasui, 2007). There are many studies which have established the relationship of factors with disaster recovery such as demographic characteristics (Aldrich, 2011b; Liu & Fellowes, 2006; Wang et al., 2012; Yasui, 2007); economic status (Han, 2014; Sawada & Shimizutani, 2008; Tatsuki & Hayashi, 2002), and social capital (Aldrich, 2012a; Nakagawa & Shaw, 2004; Putnam et al., 1994), etc. It becomes difficult to generalize the findings even in a similar setting unless all possible factors are adjusted and interpreted within its context. This requires a comprehensive approach and adjustment of all the possible factors in which the event has occurred while making a decision. Importantly the phase, indicator of disaster recovery, and its factors need to be properly defined and measured to generalize the findings of disaster recovery in similar settings.

Varying contextual influences: The other vital reason for the difficulty in understanding recovery is attributed to the variation in contextual and geo-spatial influences on the community. The progress of recovery and reconstruction also varies across the context and region depending upon what provision of resources, facilities, support, and grants they have to tackle the crises. Monetary support and grants may be a substantial help for recovery in the initial stage, but it is the unique socio-cultural and household characteristics of a community and their response to the disaster which determines and shapes the pace and progress of recovery after a disaster(Bolin & Bolton, 1986; Chang et al., 2012a; Kusumasari & Alam, 2012). But little is known about how the responses to a disaster crisis vary across the communities and in different settings. Disaster has a differential impact on the individual community and social groups within it based on geographic location, race, class, caste, and gender (Rubin et al., 1985). These differential impacts on individual and community combine

with their different pre-disaster resource capabilities leading to recovery needs which are specific to context and site. Evidence from the past disaster experiences shows that the recovery after a disaster takes significant time and follows certain paths and these paths and pace of recovery may vary with the socio-cultural settings and context in which they originate (Alipour et al., 2015; Chandrasekhar, 2010; Mannakkara & Wilkinson, 2015). This is because disaster recovery is a complex process that is deeply intertwined with the social life of the community. The cultural life they live, the family tradition they observe, the common values and belief they hold, and the way they respond to any external stimulus such as calamities and disaster is unique in themselves (Bolin & Bolton, 1986). It is this unique way of life of people living in different parts of the world that makes the process of recovery outcomes different. Different communities and individual households have different needs for recovery and hence this variation in recovery response with the variation in the socio-cultural settings, family life, and make the process of recovery difficult to understand.

Various models of disaster recovery: Literature evidences many disaster recovery frameworks and theoretical models are developed to identify the crucial factors and explain the path and progress of disaster recovery. The recovery models developed in the past are different and are based on the various indicators of recovery. Most of the models are derived from the findings in the literature and very few are tested in the real disaster scenario. For example, some frameworks are specific to geography (Norman, 2006), some are focused on urban recovery (Miles & Chang, 2011) and some are core economic models (Rose, 2004) but very few took a comprehensive approach and strategy to capture all the aspects of recovery factors especially in the context of developing countries. Practically, it is a very painstaking task to represent the findings and concepts from past studies and create a model that accommodated what was known. For example, a single aspect of social capital has been represented by many indicators' in various studies, such as voting turnout rate, presence of non-profit organizations (Aldrich, 2011b), presence of caste councils (Aldrich, 2011a), traditional family organizations *Guthi* (Bhandari, 2014), and the parish church (Airriess et al., 2008), and yet this may not fully capture the term in the broad sense.

Combined effect of the factors affecting disaster recovery: Another important issue that adds to the complexity of understanding the recovery process is the interactive effects of the factors that lead to differential outcomes in disaster recovery. The variables within the factors often combine and interact to produce different recovery outcomes than they would when produced alone. For example, a study done in the aftermath of the Yao'an earthquake of China found households with a higher ratio of males, and a low ratio of migrant workers, achieved higher economic recovery than those with a high ratio of migrant workers (Wang et al., 2012). Therefore, trying to capture the dynamic interactions between the domains and variables and

to present them in the form of a recovery model is a difficult task for researchers. This calls for the development of a recovery model which is succinct, simple, and yet accommodates all the roles and interactions of factors identified in the literature. This study has attempted to enhance the understanding of the interaction between variables and to produce a data-driven model to better understand the factors that impede or enhance disaster recovery.

This study also emphasizes the crucial role of community capacity or community resilience as informed by many prominent disaster studies done in the past and has investigated its relationship with disaster recovery. Prominent disaster recovery frameworks (Federal Emergency Management Agency, 2011; Management, 2015; National Reconstruction Authority GoN, 2016) have emphasized the role of community capacity that enables people to withstand the risks of disasters for sustainable disaster recovery. This capacity of a community known as 'community resilience' is defined as the capacity to remain connected, function and sustain even under stress, adapt to changes, be self-reliant if external resources are limited, or cut off and learn from the experience to be more prepared for next time (Arbon et al., 2013; Council of Australian Governments, 2011; National Research Council, 2012).

Community resilience has been long acknowledged, assessed (Cohen et al., 2013; Mishra et al., 2017; Peacock et al., 2010; Pfefferbaum et al., 2013; Sherrieb et al., 2010), applied and incorporated by various disaster managers from different subjects, fields, and organization in its various forms (Aldrich & Meyer, 2014; Cutter et al., 2003; Eakin & Luers, 2006; Holling, 1996; Peacock et al., 2010). Most of the disaster recovery frameworks and national policies of disaster management have incorporated it as an essential component of disaster recovery. (Council of Australian Governments, 2011; Federal Emergency Management Agency, 2011; Global Facility for Disaster Reduction and Recovery et al., 2015; Price-Robertson & Knight, 2012). In the absence of community resilience, a community fails to mobilize collectively and often have to wait for assistance from public or private sectors and agencies (Chamlee-Wright & Storr, 2010). Resilience with adapting and coping capacities has an influential role in overall disaster recovery and management in the context of a developing country, like Nepal, which is deeply rooted in culture and tradition (Mishra et al., 2017). In this current project, a community resilience tool specific for Nepal was developed, validated and tested in the community with the survivors of the earthquake.

1.6 Framework informing this study

Aldrich and his team have adopted a comprehensive approach to identify and assess comprehensive factors that impacted disaster recovery in four different disaster events and settings (Aldrich, 2011a, 2011b, 2012b; Aldrich & Meyer, 2014). He considered to include previously established factors of disaster recovery such as quality of governance (competent

and better-informed leaders, corruption status); external aid (amount of aid and expertise provided); damage intensity (human and property loss); population density, demographics and socio-economic condition (income, education, race, average age, homeownership, economic inequality); to establish the role of social capital (voting rates, number of voluntary organization, participation in local events and festivals). This current project used similar factors to Aldrich (2012a) as a baseline guide. Then, an extensive review of peer-reviewed literature was conducted to identify the established factors of disaster recovery in the real disaster scenario. Informed by the literature review, a range of factors that were associated in the disaster recovery in the past disaster study were identified leading to the development of a survey instrument that was used to investigate the factors that explained the variation of disaster reconstruction progress among the earthquake-affected communities.

1.7 Gaps

A better understanding of the recovery process and its influencing factors, can lead to more effective post-disaster planning and recovery (Nejat et al., 2016), but, a comprehensive understanding of the process by which a community recovers from disasters has yet to emerge. Various frameworks (Abramson et al., 2015; Aldrich, 2012a; Miles & Chang, 2003; Mishra et al., 2017; Nakagawa & Shaw, 2004) and disaster recovery theories have been developed to guide relief efforts and achieve satisfactory disaster recovery, however many of the models and theories are not comprehensive (Cao & Xiao, 2011) and are not empirically replicable (Aldrich, 2011a). Similarly, most of the disaster studies are based on a single or few case studies and are therefore not generalizable (Olshansky et al., 2008). While many studies have explored aspects of the recovery process, focusing on specific outcomes related to recovery, few have attempted to consider the various aspects of social and community life to explain the complex process of disaster recovery especially in a rural setting like Nepal. Several aspects of community life converge and interact in the ways that vary significantly from community to community and respond uniquely in a recovery process. Hence, it is worth considering what; if any, common features might define the recovery processes of all households and communities in similar settings. The common features and practices thus identified among homogenous groups might be helpful in understanding and tackling the problems in the recovery process.

Moreover, most of the disaster studies have focused on developed countries and there are very few disaster studies from developing countries, particularly from Nepal. Although the impacts of disasters are more severe in the low resource developing countries in terms of damage and destruction, very few studies have been conducted using a comprehensive approach and methods. The lack of knowledge of disaster recovery from the communities of developing countries which have, a very different socio-cultural background, family values, and

Governmental systems compared to that of developed countries, challenges the generalizability of the research findings.

This study seeks to address previous gaps in disaster recovery by presenting an evidence-based comprehensive approach to explore and understand the process and progress of disaster recovery and then test it in the real disaster scenario. Specifically, this study has investigated comprehensive sets of variables and factors involving household characteristics; economic status; and variables specific to Nepal such as marginalization, the status of women, accessibility to transport and essential services; along with external characteristics such as Government aid, governance, and damage intensity to identify the critical factors that determine the pace of recovery. In addition, dimensions of community resilience were developed, validated, and tested in disaster reconstruction and recovery along with other factors described above. This study has considered the progress of ongoing reconstruction works as an indicator of disaster recovery. This reconstruction works included the reconstruction progress works of heavily impacted prioritized sectors as identified by the National Planning Commission (2015) especially housing, health, education, electricity, transport, and water and sanitation.

This dissertation contributes to the knowledge of disaster recovery by examining household and community recovery processes after the catastrophic 2015 Nepal earthquake. It uses data that was obtained through surveying and interviewing different levels of stakeholders of disaster recovery after the 2015 earthquake in Nepal. The study addresses four major research questions. First, what could be a suitable instrument to assess and capture disaster recovery in the context of developing countries in the aftermath of the 2015 Nepal earthquake? Second, what are the crucial factors that facilitate or impede the process of disaster recovery and how can this be applied in the development of a model of disaster recovery for similar settings? Third, what is the role of community resilience in disaster recovery? Lastly, how can the findings of this thesis be used to contribute to the theorization effort of disaster recovery? To answer the research questions the following aims and objectives were set for this study.

1.8 Aim and Objectives

This study aims to identify the factors that facilitate and hinder the recovery process in the aftermath of the 2015 Nepal earthquake with a comprehensive approach.

The objectives were:

- To identify the most recovered and least recovered VDC/municipalities based on the progress of ongoing reconstruction works among the earthquake-affected population in the intermediate phase of disaster management in Sindhupalchowk district of Nepal.

- To develop and test a household survey instrument that will measure the factors impacting on disaster recovery among the earthquake-affected communities in Nepal.
- To develop, validate, and assess a community resilience tool at the household level among the disaster-affected population in Sindhupalchowk district of Nepal.
- To identify the crucial factors that impeded or facilitated the reconstruction progress at the household level among the earthquake-affected population in the intermediate phase of disaster management in Sindhupalchowk district of Nepal.

1.9 Significance of the Study

Currently, research studies on disaster recovery focusing on individuals and household and community together is limited in the low-resource countries, especially in Nepal. This study is the first of its kind in Nepal to investigate the recovery process after a major earthquake using a mixed-methods approach and examining factors of physical, social, economic, institutional aspects of community life along with contextual variables. For this, a survey instrument including a community resilience tool was developed informed by the systematic review to comprehensively examine the critical factors listed above in the disaster recovery. The factors investigated by this instrument will provide evidence-based information useful for the stakeholders of recovery management to make necessary changes at the policy level for future disaster management programs in Nepal. In terms of theoretical value, a comprehensive model allows scholars and practitioners to ground continuing research within the context of the overall process.

The survey instrument developed as part of this project could be used in similar settings of earthquake-affected communities in Nepal to identify the factors of disaster progress. This instrument is flexible as it has included comprehensive sets of factors, both established and contextual. Hence, this survey instrument can also be utilized in other developing countries having similar geopolitical condition with some minor modifications related to the contexts. Similarly, the instrument thus designed can also be used in developed countries after removing some of the irrelevant factors since most of the established factors used in the instrument come from disaster literature all over the world. The method used to identify the most recovered and least recovered village development committees (VDCs)/Municipalities among the earthquake-affected communities could be used for assessing recovery progress in other parts

of affected communities and across a range of disasters in Nepal and countries with similar characteristics.

1.10 Statement of the problem

Pre-disaster planning (Mannakkara & Wilkinson, 2015), effective mechanism to tackle immediate impact (Horney et al., 2016), well-organized reconstruction and restoration of damaged structures and disrupted lifelines (Bilau & Witt, 2016; Rozdilsky, 2001) are the key to effective recovery from natural catastrophes. For this, communities and decision-makers need proper contingency plans, policies, procedures, and guidelines to implement recovery actions. Past disaster experiences can provide important clues in designing and planning future recovery programs in similar settings. The mega earthquakes of April 25 and 12 May in Nepal earthquake claimed over 8790 lives, over 22,000 people sustained injuries and over half a million houses were destroyed (Ministry of Industry Government of Nepal, 2016). The total damage was estimated at US\$7 billion which was equivalent to one-third of Nepal's total GDP (National Planning Commission, 2015). Poorer rural areas were more adversely affected than towns and cities because of the inferior quality of rural houses. It was the disadvantaged social groups in the poorer districts who suffered the highest damage (Gotham, 2005; Ministry of Industry Government of Nepal, 2016).

The country responded with all its ability and effort in managing the immediate relief works. Aid poured in from all over the world and within the country, but relief and rehabilitation works were not managed optimally. The establishment of an apex body to oversee the overall reconstruction and rehabilitation works, National Reconstruction Authority (NRA) was delayed for eight months due to political turmoil and a serious fuel crisis following the border blockade by sit-in protests of agitators further added to delayed progress (Himalayan News Service, 2016; Nielsen et al., 2016). The Government was heavily criticized for the delay in the recovery process by news media and representatives of partner aid organizations and countries (ABC News, 2016; Express, 2016; Spotlight, 2015; VOA, 2016). At the time of this study in November 2017, NRA had already started its recovery works in line with the five-year reconstruction plan of National Disaster Recovery Framework (NDRF). The works that were done by National Reconstruction Authority consisted of completion of the enrolment of the impacted families for recovery package and some initial works on reconstruction of essential infrastructures. Three instalments of housing grants were provided to eligible households from March 2016. (Authority, 2016).

Despite the efforts of Government and International organizations, the reconstruction works were not going satisfactorily and the housing reconstruction works were delayed (National Planning Commission, 2015; Neupane, 2015). After two and a half years, the National Reconstruction Authority update reported that less than 3% of damaged houses were rebuilt

and more than half of the survivors of the earthquake had not received housing grants (National Reconstruction Authority, 2017). More than two and half a year after the mega earthquakes in 2015, Nepal was still struggling in the intermediate phase of recovery management due to delays in the reconstruction process (National Reconstruction Authority GoN, 2016).

The Nepalese people are living in a country with the highest seismic hazard (Government of Nepal, 2017), and have faced the consequences of many previous earthquakes including those of great earthquakes. According to the seismological centre of Nepal, medium and small size earthquake events occur in a different part of Nepal frequently. Nepal holds the record for experiencing over a dozen high magnitude earthquakes since the 13th century, the last great earthquake of magnitude 8.3 occurred in 1934 (Koirala, 2014). Although a comprehensive and integrated approach to disaster management has been pronounced in the Government plans and programs in Nepal, it has been limited to papers and not practice.

The first legislation that completely addressed disaster management in Nepal was the 1982 Natural Disaster (Relief) Act, which covered mostly post-disaster-oriented activities and did not address the preparedness aspect. Following the reported delay in the establishment of the National Reconstruction Authority after the 2015 earthquakes and subsequent recovery works, the Government put a lot of effort into reconstruction activities especially house reconstruction (Government of Nepal, 2017; UN Office for the Coordination of Humanitarian Affairs, 2015).

Very few studies have been conducted to explore the complexity of the recovery process and to develop a recovery model to address problems in the future. Previous studies have examined only limited focused areas of factors to investigate the recovery process disregarding prominent other factors that could potentially impact the recovery. This kind of study is more useful in developing countries like Nepal, where difficult geo-territory, political instability, and complex socio-cultural traditions make the process of recovery more difficult. This calls for a need to study the unexplored dimensions of disaster recovery that helps to understand the complexity of the recovery process in this area. Hence a survey instrument was developed following a sequential process informed by the systematic review of established literature and tested in the actual disaster scenario to design and validate the approach to investigate the disaster recovery, especially for the developing countries.

1.11 Thesis outline

1. Chapter one introduces and conceptualizes the thesis and provides an overview of the rationale of the research and its context.

2. Chapter two describes findings of the literature review that focuses on the factors that impact or facilitate the progress of recovery following a natural disaster.
3. Chapter three outlines the research methods. It details the research design, sample and sampling, methods of data collection, and the process of data analysis for both qualitative and quantitative analysis.
4. Chapter four describes the details of the findings of the qualitative and quantitative household survey.
 - a. Development validation and utilization of community resilience scale: A psychometric community resilience tool was developed to assess the community capacity on aspects that are believed to increase the power to adapt and manage the crises. The response was recorded in Likert scores and factor analysis was conducted to identify domains and a justifiable number of items. The tables were presented in tables and graphs.
 - b. Qualitative component — semi-structured interviews were conducted with Government officials, village local leaders, and local community members. This section also outlines the findings of focus groups discussions and all the unstructured conversations, observations, and discussions done with the local people regarding the progress of reconstruction. The data were managed by NVivo Software and analysed both inductive and deductive methods and described as per the emerging themes.
 - c. Quantitative household survey: The findings of quantitative data were collected from the sample survey of 744 households and presented in the tables with univariate and multivariate analysis. The descriptive results were presented in tables and graphs. The inferential statistics were presented with crude and adjusted Odds ratio to interpret the findings. The findings of factor analysis were presented in a table with factor loadings.
5. Chapter five presents the synthesis and discussion of the findings from both the qualitative and quantitative data leading to conclusive remarks. The discussion is followed by the strengths and limitations of the study. The contribution, application and significance of the instruments, tools and overall research is also explained in this section.
6. Chapter six concludes the thesis with the summary of the whole research and offers suggestions and recommendations for future research.

Chapter 2 : Review of Literature

This study conducted a systematic literature review on real disaster studies to identify the factors impacting the disaster recovery. This information was utilized to develop the survey instrument and a preliminary pathways model of disaster recovery as a part of comprehensive approach to investigate the disaster recovery process. The literature regarding the established factors of disaster recovery and a summary of development of preliminary model of disaster recovery is discussed in this Chapter. (Please refer to the published article ‘Development of an Integrated Pathways Model of Factors Influencing the Progress of Recovery after a Disaster’ attached in Appendix II for the full details on model development). The development of a survey instrument is discussed in detail in Chapter 3 under ‘Development of comprehensive survey instrument designed to capture the factors impacting the disaster recovery’.

An extensive literature review was done to identify all the possible factors that could impact the process and progress of disaster recovery. The literature search identified 54 eligible articles from 1845 disaster articles from databases ProQuest, Scopus, Web of Science, and Google Scholar after removing irrelevant articles and duplicates. The identified articles covering different natural hazards including hurricanes, tsunamis and coastal storms, floods, and earthquakes occurring in many locations around the world. (A full description of the methods used in this systematic literature review is discussed in method section in Chapter 3 under the heading ‘Literature review’.)

Altogether 14 factors of disaster recovery were identified from the thematic content analysis (Table 1). These were broadly summarized into 4 main categories (or domains) of disaster recovery: social, physical/environment, economic, and institutional/procedural. Each of these domains contained a variety of factors that were assessed via a range of variables, and which are identified in Table 1 along with the corresponding authors. The variables column identifies literature-derived variables related to the factors and domain. For example, variables like networks, community participation, organization, voting turnout rate, internal bonds, membership of the council, and so on, are taken as an indicator of social capital under the social domain. This literature review informed the development of preliminary pathways of the disaster recovery model which further guided the development of the survey instrument.

Table 1 Categorisation of domains and factors affecting disaster recovery identified in past studies.

Domain	Factors	Variables	Author/Year
Social	Social Capital	Church-based networks Number of non-profit organizations Family bonds <i>Uur</i> Panchayat*, council membership Voting turnout rate Pre-disaster community networks Family relations, <i>Guthi</i> ** organization, link to govt. Community activities, community-based organizations Community participation Community willingness Social network Social homogeneity Social isolation	(Airriess et al., 2008) (Aldrich, 2011b) (Nejat & Damnjanovic, 2011) (Aldrich, 2011a) (Aldrich, 2012b; Aldrich & Crook, 2008) (Mukherji, 2014) (Bhandari, 2014) (Nakagawa & Shaw, 2004; Storr & Haeffele-Balch, 2012) (Ganapati, 2013; Raju, 2013) (Peng et al., 2013) (Buckland & Rahman, 1999; Green et al., 2007) (Mishra et al., 2017) (Swanson et al., 2009)
	Social vulnerability	Marginalized neighbourhood Women, Dalits***, Muslims Socio-economic marginalization Women resilience (adaptive capacities) Race, religion, ethnicity, inequality Minority neighbourhood Race and class Structural inequity (micro-enterprise exploitation) Racial blaming Single family, neglect from authorities, abuse by strong	(Alipour et al., 2015) (Aldrich, 2011a) (Green et al., 2007) (Kusumasari, 2015) (Reid, 2013; Smith et al., 2006) (Wang et al., 2010) (Cutter et al., 2006) (Aijazi, 2015) (Wiek et al., 2015) (Dash et al., 2007)
	Community Resilience	Community network, community cohesion, involvement Grass root adaptive capacity Faith, spirituality, cultural values and heritage social support, kinship, resourcefulness, Local cultural norms, sense of place	(Mannakkara & Wilkinson, 2015) (Chhotray & Few, 2012) (Banks et al., 2016) (Binder et al., 2015)

	Household characteristics	Male: Female ratio, labour: members aged 16-55 years ratio, migrant worker: members aged 16-55 years ratio, education Unemployment, returned migrants, vulnerable members Age, working away from home Age, occupation Unemployment, low education, loss of loved ones Ownership of residential unit, family size, income Culture and tradition-based wisdom Community-based housing structures	(Wang et al., 2012) (Huafeng, 2016) (Yang et al., 2015) (Tatsuki & Hayashi, 2002) (Wang et al., 2015) (Ainuddin & Routray, 2012) (Kusumasari & Alam, 2012) (Chang et al., 2012b)
Physical/ Environment	Impact of disaster	Damage to household buildings Damage intensity Loss of human lives	(Haas et al., 1977; Sawada & Shimizutani, 2008; Tatsuki & Hayashi, 2002; Yasui, 2007) (Al-Nammari & Lindell, 2009; Chang, 2010) (Balgah et al., 2015)
	Geographical vulnerability	Recurrent hazards Experience of flood History of natural disaster	(Chhotray & Few, 2012) (Boamah et al., 2015) (Binder et al., 2015)
	Infrastructure	Infrastructure and levee construction Built environment: water, light, human waste disposal, fuel, communication, shelter Physical connectivity, natural resources Road, water, and power supply related engineering	(Green et al., 2007) (Dhakal, 2018) (Mishra et al., 2017) (Rozdilsky, 2001)
Economic	Household Economy	Low household income, flood insurance External funding for reconstruction Poor economic and employment condition, Rental units and low-income Pre-disaster collateralizable asset, economic security Economic vulnerability, house insurance,	(Green et al., 2007) (Wang et al., 2015) (Huafeng, 2016) (Wang et al., 2010) (Sawada & Shimizutani, 2008) (Dash et al., 2007)
	Economic Development	Economic development Uneven distribution of Wealth	(Cao & Xiao, 2011; Dynes & Quarantelli, 2008; Peng et al., 2013) (Cutter et al., 2006)

		Revitalizing community tourism	(Robinson & Jarvie, 2008)
Institutional/ Procedural	Policy	Land appropriation policy Change in household registration status Post-earthquake public policy	(Ganapati, 2013) (Yang et al., 2015) (Tafti & Tomlinson, 2013)
	Governance	Governmental guidance Decentralization, people's participation in local Government. Citizen's expectation of Government intent and capacity Institutional progressiveness, resources mobilization Housing reconstruction and livelihood management, Disregarding community participation, corruption, relocation,	(Peng et al., 2013) (Cho, 2014) (Chamlee-Wright & Storr, 2010) (Mishra et al., 2017) (Di Gregorio & Soares, 2017) (Sadiqui et al., 2012)
	Disaster Management	Institutional capacity and procedural vulnerability Post-disaster legislations that simplify and fast track existing legislative procedures Weak institutional support Reconstruction management Disaster management Coordination among stakeholders (multi-organization)	(Hsu et al., 2015; Matanle, 2013) (Bassett et al., 2017) (Chhotray & Few, 2012) (Bilau & Witt, 2016; Chang et al., 2012b) (Raju & Becker, 2013)
	Politics/leadership	Political capital Crisis leadership Governance/ Political instability	(Dhakal, 2018) (Liu, 2014) (Matanle, 2013)
	Aid and aid organizations	Proportion of funding for reconstruction Uncertainty regarding reconstruction budget Foreign aid/grant Aid organization Coordination management Stakeholder participation/ (power, legitimacy, urgency of action, trust) Access to external development services Stakeholders' coordination, collective decision making, and resource sharing	(Wang et al., 2012) (Cho, 2014) (Athukorala, 2012) (Ganapati, 2013) (Chandrasekhar, 2012) (Mishra et al., 2017) (Khan et al., 2015)

*Parish Council, **institution of shared properties specially to carry out religious activities, ***Underprivileged

Domain Descriptions

2.1 Social Domain

The social domain was summarized under 4 broad factors: social capital, community resilience, social vulnerability, and household characteristics. Each factor is described under separate headings in subsequent paragraphs below.

2.1.1 Social Capital: Social capital was characterised as the networks, norms, and trust that facilitate cooperation (Aldrich & Meyer, 2014). It was considered as a collection of “resources arising out of durable networks of the relationship among the people to pursue their goals” (Coleman, 1988). Social isolation increases disaster disturbances (Swanson et al., 2009), whereas a strong social network help to enhance collective actions and decision-making during the crisis (Nakagawa & Shaw, 2004), and increases community resilience (Pfefferbaum, Van Horn, et al., 2015). This network of relations could be within close circles (bonding), between neighbourhood members (bridging), or completely different (linking) communities (Aldrich, 2012a). The review of past disaster studies showed that various indicators and proxies of social capital such as civic engagement, religious networks, local Government membership, community participation, community networks, family bonds, and voter turnout rates had been influential in the process of disaster recovery after various disaster events. The proxies and indicators of social capital that had an influential impact on disaster recovery have been described in the paragraphs below.

Strong relationships and support within the family act as a source of social capital to tackle unfavourable circumstances. It helps the family members to adapt to the crises and make collective decisions in dealing with the disaster. The influential role of family support and network on disaster recovery was evident in a study of the residents of New York following Hurricane Sandy which reported the people who lived with family members before Sandy were less likely to plan for relocating than those who lived alone after adjusting for variables like demographic and socio-economic attributes, residence type and status, impact level of damage to households, amount of external aid grant and psychological impacts (Nejat et al., 2016).

Small community groups within a society can act as a strong source of social capital that can help people to organize some collective actions. For example, a case study done in Kobe, Japan showed that the neighbourhood with a tradition of having community groups such as women’s associations, elderly associations, sports clubs, social worker's associations, etc., can pro-actively participate in reconstruction programs and make a speedy recovery. This model when applied to four communities in Gujarat, India explained that the community with social

networks had the speediest recovery rate and had the highest satisfaction rate for the new town planning (Nakagawa & Shaw, 2004).

Non-Governmental organizations were taken as proxies of social capital in several studies as these organisations have been the primary authorities to take care of vulnerable or marginalized populations at the time of crisis (Aldrich, 2011b; Storr & Haeffele-Balch, 2012). The community-based organizations not only provide the needed support and resources during the crises but also help the loosely connected communities to leverage the extra-community connections and to get access for the other resources needed during the crises to recovery (Storr & Haeffele-Balch, 2012). Besides welfare-based clubs and associations (Nakagawa & Shaw, 2004), these networks could be religious organizations like church-based parish council (Airriess et al., 2008), or even traditional ones like *Guthi* (Bhandari, 2014) that provide substantial support and help to handle the crises during the disaster recovery.

Although several studies have demonstrated the positive role of social capital, at the same time some studies reported that all the levels of social capital (bonding, bridging, and linking) did not have a positive impact on disaster recovery, especially the bridging social capital between two groups. These studies reported that strong internal bonds do not necessarily lead to collective action for disaster recovery (Mukherji, 2014), but sometimes favour the dominant population and neglect those at the periphery or minority due to the existing prejudices (Aldrich, 2011a). For example, following the 2004 Indian Ocean Tsunami in Tamil Nadu India, the membership of the *Uur* panchayats (hamlet councils) and parish councils, sped up their recovery by connecting them to aid organizations, but at the same time reinforced obstacles to recovery for women, Dalits, migrants, and Muslims (Aldrich, 2011a). These contrasting outcomes highlight the importance of understanding context, vulnerability, and power differentials in the role of social capital on disaster recovery.

2.1.2 Community resilience: Community resilience refers to the inherent capacities of the community to adapt before, during, and after a disturbance (Mishra et al., 2017; Fran H. Norris et al., 2008; Sherrieb et al., 2012). However, social capital and community resilience were used interchangeably in some studies (Aldrich, 2012a; Aldrich & Meyer, 2014). Several studies (Airriess et al., 2008; Aldrich, 2011b, 2012b; Bhandari, 2014; Nakagawa & Shaw, 2004) reported the influential role of community networks and social capital in determining the progress of recovery where improved social networks demonstrated increased community resilience. Although social networks form an important part in building community resilience, there are also other inherent capacities of community that help them to adapt during crises.

The literature review brings to attention two prominent groups of scholars that have been utilizing the community resilience concepts in disaster studies in a measurable way. The

scholars led by Cutter et al. (2008) developed a place-based model for understanding community resilience where they have explained six components of community resilience: ecological, social, economic, institutional, infrastructure and community competency. These components included household level proxies such as the financial status of households, disaster programs run by the Government, wellness of the community members, status of natural resources, etc. These concepts were used to develop the community resilience scale 'Conjoint Community Resiliency Assessment Measure (CCRAM)' and apply it in real disaster events (Cohen et al., 2016; Cohen et al., 2013). A study conducted on 1139 adults in small to mid-size communities in Israel highlighted that suitable information from municipalities for the population was associated with the higher the community resilience (Cohen et al., 2016). The constructs: leadership, collective efficacy, preparedness, place attachment and social trust were used in these studies by the mentioned researchers to represent the community resilience with minor changes.

Similarly Fran H Norris et al. (2008) led the other group that developed and applied the community resilience concept focusing on the constructs of social capital, economic development, community competence, and information and communication and disaster management. This led to the development of 'The communities Advancing Resilience Toolkit (CART)' (Pfefferbaum et al., 2012). The application of this toolkit was followed up in subsequent studies (Sherrieb et al., 2012; Sherrieb et al., 2010). Pfefferbaum et al. (2012) used the community resilience constructs as Connection and Caring, Resources, Transformative Potential, and Disaster Management. A study that investigated 887 school principals in US from various geographical areas showed that principal's rating of community resilience varied according to level of school poverty concluding the CART was effective tool to measure resilience in diverse locations (Sherrieb et al., 2012; Sherrieb et al., 2010). Similarly, Banks et al. (2016) used constructs, such as faith, spirituality, cultural values and heritage, social support, kinship, resourcefulness to assess the community resilience. A recent study conducted on 30 earthquake-affected mountain communities in Nepal using qualitative comparative analysis established that six factors - natural resource endowment, physical connectivity, access to external development services, entrepreneurship, social homogeneity, and local economy, were critical to developing community resilience (Mishra et al., 2017). Although scholars have presented the components of community resilience with different typologies, components regarding community capacity related to tradition and culture, community network and communication, and local resources remain common on most of the frameworks. Recent disaster studies have highlighted the importance of disaster preparedness and management strategies and the role of local Government in building community resilience along with socio-cultural components that helped to build resilient communities after the

disaster events (Leykin et al., 2013; Fran H Norris et al., 2008). This revealed that the both the community resilience tools CCRAM and CART were validated and tested tools to capture the resilience capacities of communities and had shared similar theoretical constructs.

Various coping mechanisms and adaptive capacities help the impacted community to restore equilibrium and tackle the crisis during disaster events. The coping mechanism becomes strong when the components of community resilience are strong. Weak adaptive capacities among the neighbourhoods lead to failure in bringing the recovery to a pre-disaster state (Chhotray & Few, 2012). A study examining a flood-prone rural community in Central Appalachia, United States revealed that the community had a combination of unique coping strategies related to faith and spirituality, cultural values and heritage and social support to manage the circumstances that helped the community to adapt the flood impact and restore equilibrium during times of adversity (Banks et al., 2016). A study done in the aftermath of Hurricane Sandy in two working-class communities in New York revealed that community resilience played an influential role in a home buyout decision for relocation in the community, and contextual community factors such as the history of natural disasters, local cultural norms, and sense of place, were instrumental in explaining these different responses (Binder et al., 2015). Evidence reveals that a community with strong community resilience helps the vulnerable groups in the community to adapt and overcome the impact of crises during the disaster. For example, women in Indonesia attest to being empowered and demonstrated high self-esteem and these qualities were reflected in their skills, expertise, and doing new jobs that were starkly different from those they had before the disaster (Kusumasari, 2015). Hence influential community adaptive capacities such as strong community cohesiveness, culture, traditions, competencies, communication, internal resources, and strong institutional support help to build a resilient community and forms an important component in the path and progress of disaster recovery.

2.1.3 Social vulnerability: Vulnerable groups are often the ones most affected in disaster events because of low access to resources, limited support systems, and usually poor economic conditions intertwined with longstanding structural inequity (Green et al., 2007; National Planning Commission, 2015). Social vulnerability is a state or a situation of an individual, group, or community that influences their capacity to cope, resist or recover from the impacts of natural hazards (Blaikie et al., 2014). Researchers argue that natural disasters are socially constructed instead of them being indiscriminate events (Peacock et al., 2014). It is not only the function of demographics of the population but is the product of social stratification and inequalities that determines the vulnerability of society (Cutter et al., 2003). The household living conditions measured by Modified Domestic Assets Index (MDAI) to help track recovery efforts overtime was negatively associated with heightened household vulnerabilities such as

a higher percentage of dependants and women, indicating the poor accessibility of these groups to resources (Arlikatti et al., 2010). The Modified Domestic Assets Index (MDAI) is a culmination of household economy of the monetary value of seven domestic assets.

The neglect of groups such as women, children, single people, people with disabilities, minority groups, and marginalized communities make these populations more vulnerable to crises, especially when they already face social prohibitions and pre-disaster structural inequity. There are numerous examples of vulnerable people being exploited, not being considered, or not having the resources or supports to participate in post-disaster recovery. For example, the cash grants provided to the low-scale frontline beekeepers following the flooding of Kuvri village in Pakistan to restock their hives and replace their equipment did not help them to increase their market price and connect them to the world market. This was because they were exploited by the wholesalers of honey bee who paid less to the poor villagers leaving them no choice and instead sold it at a much higher price in the international market leaving the poor villagers in the same stage predated to disaster (Aijazi, 2015). Similarly, people living in rental units and low-income neighbourhoods were the ones to recover slowly following Hurricane Andrew in south Miami-Dade County, FL compared to people who had their own apartments and houses (Zhang & Peacock, 2009). The problem of social vulnerability is a feature of both developing and developed countries in the aftermath of a disaster. For example survivors of hurricane Sandy who lived with family members before the disaster were less likely to relocate than those who lived alone, underscoring the vulnerability of the single individual in rebuilding and decision making during the recovery (Nejat et al., 2016).

Social vulnerability impacts the various stages of recovery and at the same time combines itself with other household characteristics to explain the variance in the recovery. A study conducted in the aftermath of Hurricane Katrina revealed that the odds of being in the worse job situation among the black residents in New Orleans were 2.6, times higher compared to non-white residents. The odds of being in a worse job situation was 2.10 times greater for women compared to men, 3.3 times greater for people who moved compared to those who stayed, and 0.82 times less for people with a higher income compared to those with a lower-income (Zottarelli, 2008). This finding explains that the impact of disaster compounds with added structural vulnerabilities and further indicates people in the lower social strata are the ones to be most affected. This was evident in a study where Hispanics and Blacks in the United States were, 'typically more likely to belong to poor and large families' had the most trouble in acquiring adequate aid and recovering from the disasters and are consequently more vulnerable (Bolin & Bolton, 1986). However, evidence revealed recovery progress got more affected at the middle strata of social vulnerability not only at lower strata. For example, the flood-prone neighbourhood in the mid-range of social vulnerability (moderate household

damage) in the coastal regions of New Orleans got most affected and recovered slower than the high and low levels of social vulnerability because private resources and Government helped high and low vulnerable tracts but mid-range vulnerable were tract was left out (Finch et al., 2010).

The appropriate approach in the identification and management of social vulnerability and structural inequity can bring positive changes and help the vulnerable groups to adapt to the crises. The approach to manage social vulnerability and inequity could be external (Government/non-Government approach) or internal (cultural/traditional). Especially, internal vulnerability is difficult to manage unless the approach is rooted in tradition and does not conflict with the local culture. For example, cultural-based competence provided effective and sustainable assistance to crisis-affected women in Indonesia to adapt to post-disaster situations (Kusumasari, 2015). They exhibited starkly different high self-esteem from what they had before the disaster evident in their skills, expertise, and doing new jobs that enhanced their contribution to family livelihoods and communities, as well as post-disaster socio and economic recovery. The proper management of the social vulnerability led to facilitation of disaster recovery among the vulnerable population.

2.1.4 Household characteristics: Several earlier studies established the role of household factors in disaster recovery, either individually or in combination with other factors such as external aid, Government policies, and disaster management (Wang et al., 2012; Wang et al., 2015; Yang et al., 2015). Household characteristics such as family size, the number of earning members, sources of income, literacy, and gender composition substantially impact the recovery process. For example, a follow-up study done among 200 households in the Yao'n earthquake of China revealed that better household demographic indicators, such as more working members, higher literacy rate, and small family size were mutually linked and influential in speeding up recovery following the Yao'n earthquake in China (Wang et al., 2012).

The reason for slow recovery does not always arise out of the consequences of the intensity of the damage due to disaster, rather it may be related to the pre-existing socioeconomic inequality of the households. This was evident in a study done in the Upper and Lower Ninth Ward of New Orleans, post-Katrina, where recovery activity was found to be delayed by household issues related to financial and social capital along with problems of levee reconstruction, even in areas that suffered only limited or moderate damage to the housing stock (Green et al., 2007). Similarly, household financial status such as people living in rental units, low-income households (Zhang & Peacock, 2009), change of household registration (Government upgrading rural households to urban), households with higher age group, and

having members working away from home town during the recovery were the ones to recover more slowly than people owning houses, not having house registration changed and people working in their own place (Yang et al., 2015).

The review also revealed that household characteristics did not always have the same impact on the recovery process, rather it varied contextually and spatially. This was observed in a study comparing between two sub-Saharan African countries Tanzania and Nigeria that were prone to coastal surges. The study revealed Nigeria, unlike Tanzania, had a plethora of significant household factors positively contributing to adopting coping strategies such as personality disposition, age, education, ethnicity, income, housing quality, and employment status suggesting the need to developmental plans based on local needs and orientation (Boamah et al., 2015). Some studies on disaster events also revealed the interaction effect of the household in explaining the disaster recovery progress. For example, in the study conducted in the aftermath of the Kobe earthquake, the least recovered among the young-aged group were those whose houses were fully damaged and those who were engaged in small business as proprietors. While among the middle-aged the least recovered were those whose houses were half or fully damaged and who were either unemployed or involved in small scale business (Tatsuki & Hayashi, 2002). Similarly, race and place interacted in employment recovery post-Hurricane Katrina in New Orleans (Zottarelli, 2008). Furthermore, literacy, lower economic status, together with the loss of loved ones were the significant influencing factors of disadvantaged households that lagged in the post-earthquake life recovery process compared to more prosperous ones in the follow-up study done in the Wenchuan earthquake (Wang et al., 2015). Thus, based on this review it can be summarized that the social dimensions and population characteristics at the household level are potential influential negative and positive? factors of recovery in almost every type of disaster situation and thus should be accounted for while explaining the progress and path of disaster recovery.

2.2 Physical/environment domain

The variables that impacted disaster recovery in the physical/environmental domain were grouped under the broad headings of the impact of the disaster on households, geographical vulnerability, and the condition of available infrastructure (Table 1).

2.2.1 Severity of Impact of disaster: Physical factors play a major role in the explanation of the path and progress of disaster recovery. Damaged infrastructure creates serious consequences for both residents and rescuers, prolonging the post-event recovery process (Liu & Fellowes, 2006). For example, following the 1995 Hanshin-Awaji Kobe earthquake in Japan, the level of damage incurred during the disaster correlated with household economic recovery, that is the higher the damage the greater the decrease in household consumption

(Sawada & Shimizutani, 2008). The loss of near and dear ones and the injuries sustained during the disasters leave a deep impact on the survivors which makes them more vulnerable during the crises. The irreparable loss of human lives and injuries cripple them mentally and hence hinder their recovery progress. For example, a comparatively higher level of household recovery was attributed to the low loss of human lives in the aftermath of the 2012 Babessi floods in rural Cameroon (Balgah et al., 2015).

2.2.2 Geographical Vulnerability and Physical Infrastructure: Topography such as mountainous terrain and transportation difficulty due to its land makeup such as steep slopes, landslide prone hills hinder the reconstruction process thereby delaying the recovery process. (Mishra et al., 2017). The risk is compounded when the pre-existing geographical vulnerability such as mountainous terrain with isolation, poor roads, etc (Mishra et al., 2017), recurrent natural hazards, e.g. costal storms and hurricanes (Chhotray & Few, 2012), pre-existing infrastructure vulnerability, such as failure of levees (Green et al., 2007) combines with adverse physical infrastructures such poor essential facilities, weak community adaptive capacities, and poor institutional support. This combination of factors explained the slow recovery, after Hurricane Katrina in Lower Ninth Ward where pre-existing social and economic adversity exacerbated the impact of levee failure and impeded the recovery process even in the areas where the houses suffered limited damage.

Engineering considerations such as the width of streets, distances of structures to electricity lines, or the placement of nodes of water and power distribution may prove to have enormous social consequences, thereby impacting the recovery process (Rozdilsky, 2001). Enormous resources and efforts will be wasted if the construction of the social fabric is not considered while planning for resettlement, either temporary or permanent. For example, newly constructed houses of the relocated residents in the aftermath of the 2004 Indian Ocean Tsunami in Sri Lanka were not appreciated by the disaster-affected residents since it was not suitable for their family need (Ganapati, 2013). Similarly, the sitting trailers provided by the Federal Emergency Management Agency (FEMA) for temporary settlement in the aftermath of the 2005 Katrina in New Orleans was not liked by the communities with stronger social ties since it was considered nuisance to their neighbourhood (Aldrich & Crook, 2008). Geographically vulnerability caused by recurrent hazards such as periodical storms, floods, landslides, or ocean surges has mixed effect in the recovery after a disaster. It had added up to the vulnerability combined with the impacts of disaster damages (Mishra et al., 2017). In contrast, at some places, exposure to hazards helped increase the community's coping mechanism of the community. For example, the experience of floods in Tanzania and ocean surges in Nigeria were important predictors of participants adopting strategies in a comparative study (Boamah et al., 2015). Hence, physical factors such as infrastructures suitability and

geographical vulnerability should not be forgotten to be taken into consideration while explaining the progress and path of recovery.

2.3 Economic domain

The economic domain contains two factors: household economy and economic development of the entire community or region. Financial security is critical to any development works and the rate of disaster recovery (Buckland & Rahman, 1999). The status of the household economy before the disaster significantly affects the disaster recovery capabilities of a household (and eventually neighbourhood), enabling economically sound households to use their resources to cope and recover from a disaster event even before Government relief arrives (Green et al., 2007). Household income has been a substantial factor in predicting recovery outcomes especially in physical reconstruction (Sawada & Shimizutani, 2008; Wang et al., 2012). This was evident in China after the 2009 Yao'n earthquake where households with lower income took longer to rebuild (Wang, Chen, & Li, 2012).

Two important financial transactions had been traced to impact the disaster recovery other than monthly household income. They are a loan from financial institutions (whether bank or cooperatives or welfare groups involved in financial transactions) and external aid from the Government and non-Government agencies. Easy access to inexpensive loans (Sawada & Shimizutani, 2008) and disaster insurance (Green et al., 2007) are other important economic support along with aids from donor agencies (Wang et al., 2012) that can support households at the time of crises to assist speedy reconstruction and recovery. The external aid from donor agencies helps the disaster-affected population especially during the reconstruction period (Athukorala, 2012), whereas loans from the financial institutions (Sawada & Shimizutani, 2008) and state insured vulnerable households (Green et al., 2007) help in the reconstruction of houses. Low-income households and residents of the area whose households were not insured by FEMA flood insurance in Lower Ninth Ward, New Orleans were more likely to be evacuated a greater distance from their homes than household with higher income and insured with natural hazards after Hurricane Katrina as they had limited resources to return and begin repairing their homes independently (Green et al., 2007).

The financial status of households such as family income, assets, and savings as well as indirect indicators of household economic status such as percentage of dependants, number of earning members, external aid play a vital role in recovery especially in the reconstruction of damaged houses and physical structures. A study conducted in the aftermath of the Indian Ocean Tsunami in India revealed that the household living conditions measured with Modified Domestic Assets Index were found to be positive with indicators of higher socio-economic

resources such as income, as well as indicators particularly germane in semi cash rural areas, such as household size, the number of economically active members and livelihoods that yield higher rewards (Arlikatti et al., 2010). The household that had large collateralizable assets and was free from borrowing constraints were able to maintain their consumption level by borrowing, whereas households subject to binding and borrowing constraints before the disaster were unable to cope up with the losses inflicted by the earthquake (Sawada & Shimizutani, 2008). Similarly, financial factors such as ownership of the residential unit and household income were identified as vulnerable to earthquake hazards both at the community and household level in Quetta city of Pakistan (Ainuddin & Routray, 2012).

In addition to sufficient household income and access to financial institutions, the overall economic development of the community (trade, business, and economic resources), tends to ensure better management and capacity to restore and rehabilitate the damaged community and property (Dynes & Quarantelli, 2008; Peng et al., 2013). The role of economic development on disaster recovery was evident in the study conducted by Cao and Xiao (2011) in which an index to measure the potential of reconstruction and recovery in 31 provinces in China showed that economically developed provinces had a higher capacity to recover and reconstruct after a catastrophe than the poor economic provinces.

2.4 Institutional domain

The institutional domain had five factors: policy affecting recovery, governance; disaster management; politics, external aid and donor organizations. Literature reveals Central Government's primary role in disaster management functions included the construction of plans and policies; establishment of fair and equitable processes for channelling funds; coordinating and managing external organization activities; mobilizing local resources and authorities; facilitating the restoration of public facilities; and prioritizing vulnerable groups (Chamlee-Wright & Storr, 2010). Interviews conducted with various disaster officials and stakeholders following the Sichuan earthquake in China revealed Governmental guidance was one of the three critical factors in the development of concentrated rural settlement for the affected population, along with earthquake survivors' willingness to be involved in the settlement project and economic development of the region (Peng et al., 2013). Conversely, weak institutional support was one of the critical reasons for the delay in the reconstruction of houses in the aftermath of the super cyclone in Orissa (Chhotray & Few, 2012). A study conducted in Iran in the aftermath of the 2012 East Azarbaijan earthquakes revealed that the earthquake-affected people felt a reduced sense of community belonging, greater dissatisfaction, and were more dependent on Government assistance because of the negligence of the Government in involving the public in the reconstruction process (Alipour et al., 2015).

The role of aid and grants is critical in the reconstruction process, especially for poor communities (Wang et al., 2012). Both Government and non-Governmental support are jointly crucial for household recovery (Balgah et al., 2015), however, the availability of aid and grants does not always guarantee satisfactory recovery. For example, in the aftermath of the Indian Ocean Tsunami in Aceh province Indonesia, although foreign aid played a vital role in the relief and reconstruction phase, it was not used effectively in the recovery phase due to a lack of coordination from the Government and excessive competition among aid organizations (Athukorala, 2012). A study conducted with the help of literature reviews and interviews with the key stakeholders identified twelve critical success factors to establish community-based post-post-disaster housing reconstruction projects (Ophiyandri et al., 2013). The continuous coordination and monitoring of aid and grants are required throughout the reconstruction and recovery phases.

The lack of effective governance of the central authority in involving local organizations, local communities, and international donor agencies both in the planning and implementation of the recovery processes can hinder the effective utilization of aid, thereby impacting the reconstruction and recovery. For example, a study conducted in a village in India in the aftermath of the Indian Ocean Tsunami revealed that participation or non-participation of the local community in the disaster reconstruction process depended upon the trust, legitimacy, or power status of stakeholders (characteristics of effective governance) (Divya Chandrasekhar, 2010).

Evidence reveal that the excessive centralized policy and bureaucracy of the state Government hinder the disaster management process, as the administrative burden and processes can delay the recovery process (Wang et al., 2012). The role of local authorities can be undermined and reconstruction works adversely impacted if the power and essential authorities are centralized by the Government. For example, a study focused on recovery governance following the 2011 earthquake and tsunami in Japan revealed that the central Government did not transfer the reconstruction authorities to the local Government and the local authorities had to focus on central programs thus preventing the rapid recovery process (Cho, 2014). Local authorities play significant role in the management of disaster if they are equipped with proper authority and resources from the centre.

Unfavourable Government policy before or after the disaster event can act as a barrier in the recovery progress and can contribute to increased vulnerability. While the disaster studies discuss constructive policy during recovery in the aftermath of a disaster, there has also been a phenomenon termed "disaster capitalism" where Governments undemocratically impose policies such as private land appropriation, impractical displacement, and exploitation of

natural resources, taking advantage of the disaster to cause added burden to the population already devastated by a catastrophe (Harrison, 2008; Klein et al., 2003). For example, a case study conducted in Goluck Turkey, after the 1999 earthquake, revealed that the district Government did not ensure full replacement costs to those whose lands were appropriated for the reconstruction of housing and that the expropriation process was delayed leaving the people discontented with the housing recovery process (Ganapati, 2013). Similarly, the recovery programs in both Bhuj in India and Bam in Iran favoured homeowners in their policy provisions while engaging in a trial-and-error policy development for housing recovery of non-landowners. The implications of these policies were lack of affordable rental units in these cities and late recovery and displacement of tenants (Tafti & Tomlinson, 2013).

The role of the central Government in the coordination and management of disaster, good governance, developing and implementing practical and favourable disaster policies, effective coordination with donor agencies and local counterparts, and equitable and transparent delivery of grants are the influencing factors affecting disaster recovery (Hsu et al., 2015; Matanle, 2013; Peng et al., 2013). Evidence also reveals the importance of fair, trustworthy, transparent, and effective action of non-Governmental organizations in the recovery process (Chandrasekhar, 2010; Cho, 2014; Hsu et al., 2015). A study conducted to compare the resource availability and management during the reconstruction process among Indonesia, China and Australia revealed the competence of construction professionals (contractors and builders) and Government response and intervention (in terms of legislation and policy, Government support, and assistance) were identified as common approaches determinants to resourcing disaster recovery projects although resourcing approaches were different in the three cases (Chang et al., 2012a).

2.5 Preliminary integrated pathways model of disaster recovery

Based on the factors identified from the literature (Table 1) that affect disaster recovery, a preliminary integrated pathways model of disaster recovery was developed. It was evident from the literature that the domains, factors, and variables discussed above interacted with one another to influence disaster recovery. The word preliminary is used to denote that the model has not yet been validated which will be the next step undertaken by the researcher. This preliminary pathway model of disaster recovery is built on the assumption that the broad domains of recovery determinants do not act as watertight compartments. Rather, the factors within the domains often combine and interact within themselves or factors out of the domains to impact the recovery as the recovery process is a multidimensional phenomenon. Therefore, this model anticipates their interaction effect and emphasizes that the combination of factors can produce different outcomes in disaster recovery.

This assumption created difficulty for the authors as they attempted to represent the finding and concepts from past studies and create a model that accommodated what was known. For example, a single domain, such as social capital, has been represented by 12 variables, and yet this may not fully capture the term in the broad sense. Trying to capture the dynamic interactions between the domains and variables was difficult and numerous models were drafted and dispensed with before the authors opted for a model that was succinct, simple, and yet accommodated all the interactions identified in the literature. The model (Figure 1) starts from the premise that there has been a disaster, the impact of which depends on the intensity and nature of the event, however, the consequence of which is mediated or exacerbated by the four domains (physical/environmental, social, economic, and institutional/procedural) and their associated factors. These domains are represented as acting at an individual/household level and at a community level (which depending on the size of the disaster could be a local community or refer to the broader community/region or even nation). The model assumes that progress and path of disaster recovery are not only dependent on the damage intensity of the disaster but also pre-existing factors such as vulnerability and resilience at household and community levels. The way the domains and factors interact contributes to the consequence of the disaster. These same domains and factors then mediate or exacerbate the process of disaster recovery. Depending on the endpoint, the recovery process could strengthen or weaken the domains and factors and influence the consequence of the next disaster.

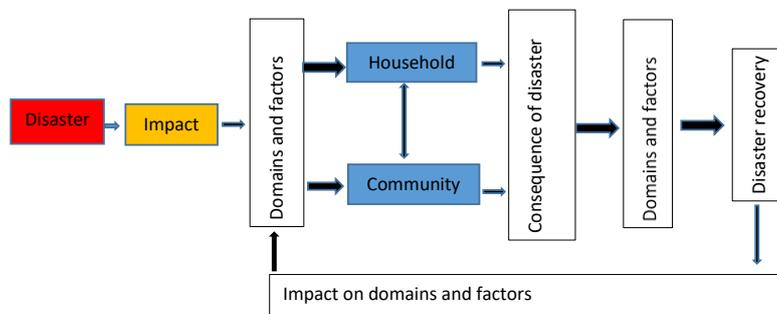


Figure 1 An integrated pathways model of factors affecting disaster recovery. The next phase in the model development would be to examine the combined roles of domains and variables adjusted for each other and the characteristics that contribute to better recovery. (Please refer to the article ‘Development of comprehensive survey instrument designed to capture the factors impacting the disaster recovery’ in Appendix II for the details) This preliminary model will test the assumption via analysis of household, community, and Government data collected before and after a large natural disaster.

The thematic content analysis of the peer-reviewed disaster recovery literature identified four broad domains (Social, Economic, Physical/Environmental, and Institutional/ Procedural)

which are integral to disaster recovery. The integrated pathways model based on empirical evidence describes the possible interactions of variables and pathways that lead to a successful recovery after a catastrophe. The aim will be to produce a data-driven model in order to better understand the factors that impede or enhance disaster recovery.

Chapter 3 : Methods

3.1 Study design

Due to the complexity and scope of the study objectives it was determined that a mixed-method design would best enable the researcher to explore the issues, design the instruments, capture the data and develop the research sensitivity and knowledge to provide valid explanations of the variables under investigation. Mixed methods research draws upon the strengths of both quantitative and qualitative approaches and provides an innovative approach for addressing contemporary issues in health services (Fetters et al., 2013). The mixed method approach was used to explore the complex and sensitive nature of information especially in the context of Nepal, to best facilitate the free flow of true information from the target population.

A range of factors such as, ethnicity and class discrimination, corruption in the bureaucracy, naivety of country residents, deference towards influential people in the villages, and literacy were the issues researcher had to consider when attempting to gather the data from the vulnerable population in the context of villages of Nepal. A significant level of illiteracy was expected in the region (UN Women, 2016) which could increase the difficulty of extracting the relevant information using quantitative research methods only. So, qualitative data collection methods and processes were included in the research project to ensure that the research question was explored with both breadth and depth.

Qualitative data was collected both sequentially and in parallel with the quantitative data to provide both exploratory and explanatory capacity. During the exploratory phase the qualitative data was used to inform the development and refinement of the quantitative instruments, and to generate hypotheses for testing in the quantitative component (O’Cathain et al., 2010). During the explanatory phase the qualitative data was used to provide plausible and valid explanation of the quantitative findings (Creswell, 2018).

Sequential steps were followed, and comprehensive data collection methods were included to correlate and corroborate the findings from all possible aspects. These included a systematic literature review, formal and informal interviews (with government officials, local leaders, council representatives and general people), observations, discussions, and field visits to collect qualitative data and a household survey to collect the quantitative data. The researcher spent approximately five and a half months in the field site in Nepal and was involved throughout the whole data collection process. This section describes the methods of data collection, data management and data analysis.

The first phase of the data collection involved a series of sequential exploratory methods. First, a comprehensive review of the peer-reviewed literature on disaster studies was done, informing the development of a survey instrument and a community resilience tool to capture the factors of disaster recovery. Then, based on the findings of the literature review a preliminary model on the integrated pathways of disaster recovery was developed to explain the progress of disaster recovery (Bhattarai et al., 2020). Then a survey instrument and community resilience tool were developed, pre-tested, pilot tested, and re-tested in two separate places before being administered to 744 households in a community survey. Qualitative data collection was done in parallel to quantitative household survey to enable explanation.

To conduct the study, the researcher categorized the (VDCs) and municipalities (an administrative division of local Government) into most and least recovered VDC/municipalities in the most-affected Sindhupalchowk district of Nepal as an indicator of disaster recovery two and a half years following the mega earthquake in 2015. The researcher also conducted 28 in-depth interviews with Government and non-Government officials, leaders, and key persons such as hotel owner, teachers, ward coordinator/secretary involved in managing the disaster recovery. Furthermore, 10 informal discussions, chats and unstructured interviews, and two focus group discussions (FGDs) were conducted among the general population of earthquake survivors to obtain in-depth knowledge of the issue and to cross-verify and triangulate with the quantitative findings. Figure 2 shows the schematic diagram of the stepwise method used in this research study.

Figure 2 Research methods (Mixed Methods: Qualitative and Quantitative)

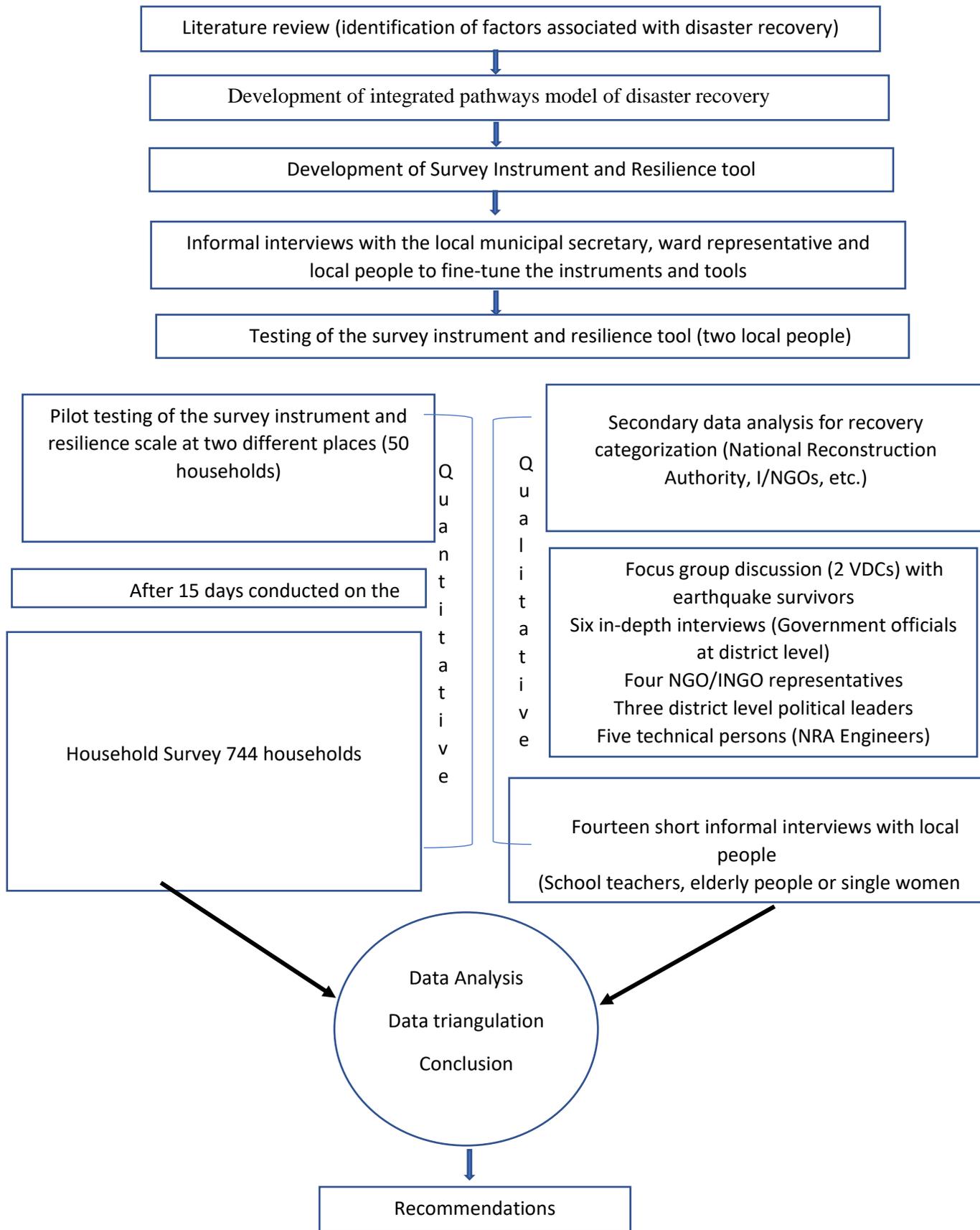


Fig. 2 Schematic diagram of the research methodology of the study.

3.2 Literature review

A review of the literature on disaster recovery was undertaken using the comprehensive framework of factors of disaster recovery identified by Aldrich and his research team in different studies at different places as a guideline (Aldrich, 2011a, 2011b, 2012b; Aldrich & Crook, 2008; Aldrich & Meyer, 2014). The factors and items thus identified by the literature review were included to develop a survey instrument designed to identify the crucial factors of disaster recovery for this study. Thematic content analysis was done to identify a list of determinant factors of disaster recover from the literature. This included coding for references to factors that facilitated or impeded the process and progress of disaster recovery. The items were further grouped under emerging broad categories. The identified factors and items under the broad categories were later compared with previous frameworks and theories of disaster recovery for consistency.

3.3 Categorization of the most and least recovered VDC/municipalities

Determining indicators of disaster recovery is essential to identify and compare what factors are crucial in disaster recovery. The reconstruction of private houses was taken as the primary indicator of reconstruction progress in this study because the damage related to housing and human settlements accounted for almost half (49.6%) of all the damage/destruction from the 2015 earthquakes (National Planning Commission, 2015). Housing stock in Nepal is considered the most critical factor for daily life in the community because it not only helps to redefine the built environment, but also helps to reshape the social fabric of the communities affected by disasters for years to come (Ganapati, 2013; Tatsuki & Hayashi, 2002). The Post Disaster Recovery Framework 2016-2020 (National Reconstruction Authority GoN, 2016) had put the housing reconstruction at utmost priority emphasizing its importance in Nepalese society. It stated that the owner-driven housing reconstruction programme will support local livelihoods, businesses and products thereby strengthening the local economy.

The researcher used the reconstruction and rehabilitation of essential service infrastructures such as school buildings, health centres, and detached toilets as secondary indicators of disaster recovery in this study. The percentage of damage effects of school buildings, health centres, and toilets accounted for 4.4%, 3.0%, and 1.6% of all the damage/destruction respectively as per the report of Post Disaster Need Assessment 2015 (National Planning Commission, 2015). The researcher could not collect the data regarding the reconstruction progress of essential services and facilities such as water, electricity, and transportation due to

inadequate and incomplete data in the concerned offices. Hence these services were not included in the development of indicators of disaster recovery.

The long-term disaster recovery indicators, such as livelihood regain, flourishing of local trade and business, market reestablishment etc., could not be used as an indicator of disaster recovery because only three years had elapsed since the beginning of post-earthquake reconstruction works when this study was undertaken. In this study, the progress of housing reconstruction was assessed by tracking the housing grants received by the affected households from the Government as support to reconstruct individual houses.

Method used in categorization of VDCs/municipalities: The researcher categorized 79 VDC/municipalities (village or urban development committee, local councils) of Sindhupalchowk district into “most” and “least” recovered VDC/municipalities as an indicator of disaster recovery. Data collection occurred two and a half years after the earthquake. The progress of the reconstruction of residential buildings, school buildings, health centre buildings, and detached toilets was used as indicators of disaster recovery. The number and proportion of damaged facilities were obtained from the Post Disaster Need Assessment 2015 report (National Planning Commission, 2015).

First, the proportion of reconstruction was calculated for the residential facilities for each 79 VDCs/municipalities in the district by dividing the number of reconstructed facilities by the total number of damaged facilities obtained from the Post Disaster Need Assessment 2015 (National Planning Commission, 2015). This was taken as the housing score. Similarly, school score was calculated by dividing the number of rooms built in the school by the total number of damaged rooms in the school in that VDC. The health score was calculated by allotting higher number to more permanent type of buildings compared to temporary structure or 0 score to unbuilt facilities. Toilet score was calculated by dividing of the number of toilets built in a VDC by the total number of damaged toilets. Then the proportion of reconstruction for each type of facility was weighted based on the severity of the disaster impact on each facility in a ‘higher damage higher weightage’ fashion based on the PDNA 2015 report. For example, out of all the damage and destruction housing facilities accounted for 87% hence the housing score was multiplied by a factor of 0.87 for each VDC/municipality. Similarly, the health score was multiplied by a factor of 0.02, school score by 0.08 and toilet score by 0.03 in each VDC/municipality.

After assigning the weights, the proportion of reconstruction of all the four facilities was then added up to get a single composite 'recovery score' for each of 79 VDCs/municipalities. Then the VDCs/municipalities were ranked based on their total score with a higher score indicating

better recovery (Please see Appendix III for the scores on the damaged facilities and residential buildings). The VDCs/municipalities in the highest 10% were considered as the ‘most recovered’ whereas those in the lowest 10% were considered as ‘least recovered’. The 10% of the sample population tentatively covers 28,500 population in eight VDCs/municipalities. The rank assigned to each VDC/municipalities was later verified by officials of the National Reconstruction Authority office, NGO/INGOs, and district offices involved in reconstruction management. Four from highest ranking and four from lowest ranking VDCs/municipalities were randomly selected for this study and will be known as least and most recovered VDCs/municipalities or areas throughout this study.

Table 2 The list of top and least ranking VDCs/municipalities as per the scoring of reconstruction in four facilities after the earthquake, Sindhupalchowk, Nepal, 2017/2018

Score Rank	VDCs/municipalities	House score	Health score	School score	Toilet score	#Final score
3	Fatakshila	0.009	0.667	0.162	0.824	0.059
5	Marming	0.038	0.333	0.064	0.756	0.067
6	Baruwa	0.042	0.5	0.01	0.719	0.069
8	Jyamire	0.061	0.667	0.081	0.250	0.081
75	Kadambas	0.511	0.667	0.084	1	0.494
76	Kalika	0.513	0.833	0.141	0.793	0.498
78	Jalbire	0.548	0.667	0.231	1	0.552
79	Irkhu	0.569	0.833	0.128	1	0.552

#Final Score = House score * 0.87 + Health Score * 0.02 + School score * 0.08 + Toilet score * 0.03

Table 2 provides the reconstruction progress information on selected facilities in the four most and four least recovered VDCs/municipalities in ascending order. Fatakshila, Jyamire, Baruwa, and Marming were the four least recovered VDCs/municipalities selected randomly among the eight-low scoring VDCs/municipalities. Kadambas, Irkhu, Kalika, and Jalbire were the four most recovered VDCs/municipalities selected randomly among the eight-high scoring VDCs/municipalities. The ‘least recovered’ was taken as a category of interest in the outcome variable in the univariate and multivariate analysis.

3.4 Qualitative survey and analysis

Qualitative methods of data collection were utilized to explore and explain the development and refinement of the quantitative instruments, and to provide plausible and valid explanation of the quantitative findings. The qualitative component of this research study comprised semi-

structured interviews, FGDs, informal interviews, and field observations to capture economic, logistic, family, or administrative difficulties or problems of the earthquake-affected people during the reconstruction of their houses. Additionally, the qualitative methods were used to explore the positive aspects that had facilitated the process of reconstruction in those areas. The interviews were conducted two and a half years after the earthquake occurred allowing sufficient time for the reconstruction works to commence, and so enabling the interviewees to be able to comment on the adequacy of progress.

Sample selection: The participants of the interviews and informal discussions were selected using a purposive sampling method as the nature of this study demanded specific disaster stakeholders (government officers, reconstruction authorities, council representatives, general people, key informants, local leaders, etc.) as participants. Some of the interviews were conducted as a result of feedback from prior participants.

3.4.1 In-depth interviews: The face-to-face in-depth interviews were conducted among officials from the Nepalese Government, non-Government organisations, and other authorities directly involved in the reconstruction process in the district. Six Government officials were interviewed at the district level: two from the District Coordination Committee (DCC) office, two from the National Reconstruction Authority (NRA) district office, and two from the district emergency operation committee. Five Government-employed engineers who were deployed by the NRA in the field to verify if the structure of the houses being built in the community were earthquake resistant, were also interviewed. Three district-level political leaders from the national parties (Nepalese Communist Party Maoist, Nationalist Democratic Party Nepal, Communist Party of Nepal United Marxist Leninist) were interviewed as community representatives. Four executives of international and local non-Government organizations in the district supporting the reconstruction works other than the housing was interviewed as partner stakeholders in recovery. Four NRA engineers, two I/NGOs engineer, and one Microfinance manager were also interviewed to clarify and validate some of the issues raised in the preceding interviewees and conversations.

Ten in-depth interviews were conducted with local Government officials in the previously identified 8 VDCs/municipalities from the most and least recovered areas. Fourteen short and informal interviews were also conducted with local people such as schoolteachers, elderly residents, and single women in the study area during the household survey. These interviews gave an overview of the process, practical difficulties, and procedures of on-going reconstruction work. They helped to refine, generate, and consolidate the draft survey instrument.

Before going into the field in the selected VDCs/municipalities, the researcher interviewed a ward chairman (the elected local Government official from Chautara Municipality) and a district-level political leader. The researcher also conducted several informal conversations with an officer from the NRA, an officer from the District Emergency Operation Centre (DEOC) and a manager for local microfinance from Chautara Municipality (district headquarter of Sindhupalchowk). These interviews helped to explore the geography of the area, identify the relevant contexts and the factors impacting on house reconstruction process and reasons behind variation in the recovery status in the villages. These interactions helped the researcher sensitivity (Creswell, 2018) and assisted them to become familiar with the field sites and also guided the final in-depth interview guidelines. These conversations were not included for final analysis.

All the in-depth interviews were conducted face-to-face and lasted for 30-45 minutes. The informal conversations and interactions lasted for 5-25 minutes. The interviews were mostly conducted in the offices of the disaster officials, or in a secluded place with general people at a time convenient for them. Confidentiality was strictly maintained, and the interview was stopped whenever a third person entered the interview room for official affairs in all the interview sessions conducted in office settings. This arrangement allowed each participant the freedom of expressing their views without hesitation or feeling of being judged, enough time to clear their perspectives and ensured confidentiality. The information regarding the purpose of the study, the participant's expected role and contribution, time required for the interview was provided by sending prior information to the officials. Written consent was obtained. All the interviews were audio-recorded and later transcribed by the researcher. The interviews were conducted in a conversational manner. A non-judgmental and unbiased gesture was maintained throughout the interview.

A semi-structured method was undertaken as it allowed for the exploration of the main issues while enabling flexibility for follow-up questions, probing questions, questions that sought clarification, further explanation or examples. Additionally, the sequence of questions asked in semi-structured interviews varied to take into account how the conversation unfolded with each participant and to explore convergence with data collected from other resources (Alipour et al., 2015). This flexibility in the interview schedule enabled the participant to understand the issues sequentially and logically which led to a natural flow of conversation during the interview.

Two different in-depth interview guides were developed to conduct the in-depth interviews for participant groups; one for the Government and non-Government officials involved in disaster recovery in the district headquarters. The second one was for the key persons in the

villages. The in-depth interview for officials of disaster management inquired about the issues regarding the progress of reconstruction in their official view and the practical experiences of the problems they were facing. Progress in the distribution of house grants, reconstruction of water and sanitation, roads, schools, health centres, etc., and the problems they were facing in managing this were explored. The interview guide also explored the facts and figures regarding the villages doing better and villages lagging in reconstruction works and their visible reasons, the expectation from other stakeholders and end-users in the reconstruction work. Similarly, the interview guide for the key persons in the village inquired about issues such as evaluation of the progress of reconstruction, hurdles in the reconstruction of houses, things that facilitated progress, examples of good and unsatisfactory progress and its causes, problems in receiving house grants, support from the organizations. It also inquired about collaborative works between the Government and non-Government authorities in the reconstruction works, such sharing of engineers, resources and projects. They were also asked about their perception of the Government and non-Government management of grant and aid distribution.

3.4.2 Focus group discussions (FGDs): Two FGDs one each in the most and least recovered villages were conducted with members of the general village population to explore the factors that they believe could have impacted the pace and progress of disaster recovery. Each focus group was held with 10-12 adult participants, 18 years and older from across the social spectrum. The participants included literate, illiterate, senior citizens, single women and people from marginalized communities. This was done to provide equal opportunity and encouragement to involve all the participants in the conversation. The researcher identified a key person from the VDCs/municipalities to help select and invite the participants to the FGD. Written consent was obtained after explaining the purpose, the implication of the research, and their expected role in the discussion. Participants were informed that they could withdraw at any moment with or without reason. They were assured of confidentiality. Both FGDs were conducted in a secluded place, away from onlookers.

The FGDs dealt with issues regarding receipt of house grants; reconstruction works in the village and its progress; expectation from the Government and non-Government stakeholders of disaster recovery; possible suggestions or demands they want to put up to the stakeholders of recovery; the problems that occurred during the reconstruction works; the positive aspects which motivated and facilitated the reconstruction works; the role and expectations from the district and local Government representatives. The FGDs were moderated by the researcher and the trained research assistants took notes. The discussion was audio-recorded by the researcher and later transcribed by a professional expert along with the help of notes provided. All the transcriptions were checked again by the researcher to ensure the meaning of

conversations were in line with field notes prepared during the data collection. The discrepancies found were corrected to ensure the validity of the transcripts. The sessions took around 45 minutes to one hour. All the participants were provided with snacks and tea after the sessions. The FGDs were limited to two places only because the participants were hesitant to open up to provide real information in the group setting. This was revealed when some of the FGD participants had different versions of their stories when interviewed individually. The information regarding general people's views was later compensated by increasing the number of informal interviews with individual residents at different places during the household survey.

3.4.3 Informal conversations: The researcher had multiple informal conversations with the ward secretary, ward chairman, local businessman, political leaders and the general population around issues such as the house grant process and the relevant disaster recovery factors in the local context. Along with the house reconstruction process, individual problems and sensitive issues such as corruption at Government offices, bribery, unfair treatment, and discrimination based on caste, also emerged during these informal interviews. The researcher also made several visits to the villages in the affected areas of Sindhupalchowk district during the fieldwork to observe the reconstruction works directly and to have some preliminary discussions. In the initial visits, a series of discussions were held with the local Government officials, and officials of non-Governmental agencies and the general population. These discussions were used to formulate the research strategy and prepare the questionnaires. These informal sessions varied in time from 5 minutes to half an hour depending upon their content. All the informal sessions were voice recorded with the consent of the interviewees.

3.4.4 Data Analysis of qualitative studies: The process of data analysis started in the field itself with every subsequent interview and discussion. It was performed continually and simultaneously (Alipour et al., 2015). Few modifications were made on issues, such as house grant provision (questions regarding three instalments instead of one), problems faced during reconstruction (options like road and transportation, and shortage of construction manpower and materials were added) and financial support in house reconstruction were added after these issues emerged in early interviews and discussions. Sensitive issues such as corruption among the disaster Government officials and caste/ethnicity-based discrimination were added in subsequent interviews and discussions after these were raised in informal conversations but denied by Government and non-Government authorities. All the voice recordings of qualitative interviews, discussions, observations as well as notetaking were transcribed by a professional expert and translated into English by a professional translator for the analysis.

NVivo software(Banks et al., 2016) was used to store, sort, and assist in the management of the emergent data. The majority of the data was analysed using the inductive method to develop the themes because of the flexible data collection design. The researcher only did the data management and coding to avoid interobserver bias. The transcribed texts were read several times by the researcher to become familiar with the issues before the coding process was undertaken.

First, issues that emerged during the interviews and discussions related to reconstruction was coded with related concepts. A constant comparative approach was used, consistent with the grounded theory approach(Banks et al., 2016). This allowed to club the codes that explained common characteristics under the categories, which were further clubbed under the broad emerging themes based on common characteristics. The findings were summarized as per the categories under the emerging themes, such as coordination among the stakeholder, government policy and house grants. The findings of the qualitative study were used to assist in the development of the quantitative survey instrument and resilience tool in the field. Finally, the findings of all the qualitative studies were triangulated with the findings of the community household survey to help the researcher understand the issues in-depth and make justified conclusions. The findings of the qualitative study were also incorporated into the final recommendations and conclusions.

3.4.5 Validity of qualitative data: Qualitative research has been facing challenges over the legitimacy issue of validity for decades (Maxwell, 1992). Studies with validity problems can impact adversely the programs, policies and predictions based upon it (Creswell, 2018). The issue of descriptive, interpretative and generalizability validity (Maxwell, 1992) was ensured in the current study by all means as far as possible. All the qualitative interviews, discussions and observations were done by researcher himself to avoid inter-interviewer bias, as well as understanding and interpretation of the data. All the interviews were audio-recorded to avoid recall bias on the part of the researcher. In addition, the context was noted down side by side to avoid any kind of bias related to interpretation. Generalisability bias was reduced by including interviews from all VDCs. Any doubtful statements were clarified in the next interviews. FGDs were replaced with individual interviews in order to restrict reporting bias as outlined above.

3.5 Quantitative survey instrument

Informed by the findings of the literature review, items that were most commonly identified in real disaster studies plus some local contextual factors related to Nepal that could potentially affect the disaster recovery were included in the survey instrument. Care was taken to reduce the items to a manageable number. Items and questions in each section belonged to one among

the broad domains social, economic, physical/environmental, and institutional/procedural identified in the literature review. The variables and items were placed in sequential order in the survey instrument and care was taken not to repeat the questions and issues in the questionnaire.

The researcher adapted some sections of validated instruments (Nepal Demographic Health Survey and Nepal Central Bureau of Statistics), developed community resilience tool, and used validated tools CCRAM, Women empowerment scale, and social support scale to design the survey instrument informed by the systematic review of literatures. The total items in the survey instrument were divided into ten sections for the sake of convenience. These sections are described below in the subsequent paragraphs. (Please see ANNEX I for the complete survey instrument).

I. Social: The literature review revealed over 30 items and representatives of factors that impacted the disaster recovery under the social domain. These items were grouped under four broad headings: household characteristics, community resilience, social vulnerability, and social capital. Each factor had multiple items and indicators that represented them.

A. Demographic and household characteristics: To assess the impact of household demographics on reconstruction, the items from the National census and the Demographic and Health Survey instrument of Nepal were adapted. Questions about the general socio-demographic characteristics of the household members such as age in completed years, sex, ethnicity, family size, completed education, membership of social and welfare organizations, number of family members living out of the house were adapted from the Nepal Demographic Health Survey (Central Bureau of Statistics, 2011a, 2011b; Population Division, 2012). The ethnicity categories were adapted from the Health Management Information System (HMIS) classification of caste ethnicity reported in the analysis of the 2006 Demographic Health Survey and modified to suit the local situation. (Bennett et al., 2008).

Caste ethnicity categorization: The researcher adapted the Government caste/ethnicity categorization criteria into three broad categories for meaningful interpretation; *Brahmin/Chhetri, Janajati, and Dalits* (Bennett et al., 2008). The first group was the privileged caste group which comprised of *Brahmin* and *Chhetri* caste groups, traditionally placed on the top tier of caste hierarchy. This group is the biggest caste/ethnic group in Nepal, covering almost 32% of the population and considered the dominant caste group (17%-55% falling in the highest quintile, Source: Bennet 2008/CBS).

The second group was formed from the hill *Janajati* group (henceforth referred to as *Janajati*), which belonged to the middle to lower privileged caste groups in Nepal (29.1% in the lowest

quintile and 19.0% in the highest quintile, source: Bennett 2008/CBS) and are reported to be indigenous groups having their own culture, language, and traditions. This category was further divided into three subcategories of the *Janajati* group for two reasons- first, this was the largest group in the district (covering 70%), and second, there was a likelihood of shadowing the independent impact of subcategories within this big group. The first group *Tamang* was subcategorized from *Janajati* due to its majority population in the district (approx. 34% in the district, source CBS 2011). *Tamang* caste groups are considered to have a low socio-economic condition in Nepal (Bennett et al., 2008). The second sub-category in *Janajati* belonged to the '*Janajati other than Tamang*' group which reported to have a slightly better socio-economic condition compared to the *Tamang group*. This group consisted mostly of castes such as *Magar, Gurung, Newar, Sherpa, and Bhujel*.

The third sub-category of *Janajati* was the 'underprivileged *Janajati*' caste group which distinctly consisted of two castes: *Danuwar* and *Pahari*. Socioeconomically, both caste groups were poor (field observation) compared to other ethnic groups in the district, but *Pahari* living in the most recovered neighborhood had the worst economic condition compared to *Danuwar* living in the least recovered neighbourhood. Almost none among both underprivileged ethnic groups had started to build their house at the time when the survey was conducted (since two and half years after the quake).

The last category in the caste/ethnic group was *the Dalit* category, which reportedly is considered to be the least privileged in the caste hierarchy system owing to their untouchability status in the Nepalese society (Bennett et al., 2008).

B. Community Resilience: A new psychometric scale was developed to assess community resilience in the context of developing countries as a potential determinant of disaster recovery (Cutter et al., 2008; Leykin et al., 2013; Fran H. Norris et al., 2008; Pfefferbaum et al., 2012). The community resilience scale contained six sub-scales (Details of the development of Community resilience is described in '3.5 Community Resilience Tool' in this Chapter below).

C. Social vulnerability: Informed by the literature, women's empowerment was assessed to represent social vulnerability as a potential determinant of recovery: The researcher included the 18-item scale that have been developed by group of researchers in Bangladesh and tested for ability to measure gender attitudes and predict behaviours of interest used to measure assess the status of women's empowerment (Nanda, 2011). The tool contained three domains that assessed women's mobility, their freedom from family dominion, and economic security and contribution to their households. A women's empowerment tool (Nanda, 2011) developed and tested in Bangladesh (Schuler et al., 1997), a neighbouring country of Nepal that shares somewhat similar socio-cultural outlooks towards women, was included in this instrument to

assess women's vulnerability and its role in reconstruction. The tool contained 18 items under three domains; the first domain 'women's mobility' assessed women's capacity to visit places like a market, clinic, and festivals or out of their village. Every positive response was scored 1 and negative 0. The second domain 'freedom from family dominion' assessed whether women had the freedom to keep and utilize their personal property in the family and if they had any restrictions working outside the home or visiting parent's home from the husband or the in-laws. Similar scoring was done in this domain and finally categorized as empowered and not empowered. The third domain 'economic security and contribution' assessed whether women could own property, commodity cash savings, and how much that would contribute to the family. This domain also had the final binary category as empowered and not empowered. Few contextually irrelevant items were modified in the Nepalese context. (Please see ANNEX I for the detailed scoring procedure under 'J. Women's Empowerment').

D. Social Capital and support: This sub-section included two broad factors that represented social capital; social participation and social support.

Social Activity/participation: The social participation of the earthquake-affected population was assessed by their participation and involvement in four social events or activities; Social, political, religious and cultural. The social participation was also assessed by their voting status in the recent local council elections. The section 'social activity and social support' included items measuring the frequency and participation of household members at public events or activities such as welfare programs, clubs or cooperative programs, social functions, religious gatherings, and political activities. The frequency of participation was recorded on a five-point Likert response with 1 representing never and 5 representing very frequently. Social participation was also assessed by asking whether the household members voted in the local council election.

Social Support scale: The social support of the earthquake-affected family was measured by assessing the level of individual social support of the respondents (especially the head of the household). For this, a 12-item multidimensional scale of perceived social support scale (Zimet et al., 1988) was included in the instrument. The scale had 12 items that inquired about the support and help people perceived to get from their family, friends, and significant others. The response was recorded on a five-point Likert scale where 1 represented strongly disagree and 5 represented strongly agree, a higher score indicating high social support.

II. Economic: The items in this section were adapted and modified from the instrument of the National Population and Housing Census (Central Bureau of Statistics, 2011b) and Central Bureau of Statistics (Central Bureau of Statistics, 2011a). All the available sources of monthly

or yearly income from an individual (e.g., wages, salary, pension, remittance, etc.), and household (like business, industry, shares dividend, agriculture production, etc.) were included to assess the income of the family. The primary source of income in the household was also included with the items adapted from Central Bureau of Statistics census 2011 to assess which group of people are progressing well in the reconstruction.

III. Physical/Environmental: The literature review revealed over 10 items under the physical/environmental domain that had impacted the disaster recovery in the past. These items were grouped under three broad factors: impact of the disaster, and natural/geographical vulnerability and infrastructure.

A. Impact of Disaster: The impact of the disaster as a potential impacting factor of reconstruction was assessed by exploring the burden of damage on human lives and property due to the earthquake. The information regarding the impact of the earthquake on the physical property and essential facilities such as a residential house, electricity supply, water supply, cooking fuel supply, and toilet facility were collected by items on an ordinal scale ranging from 'no impact at all' to 'heavy damage/destruction'(Central Bureau of Statistics, 2011b). The physical impact of a disaster on human lives was assessed by three primary questions: the number of deaths, injuries, and disabilities caused by the 2015 earthquake. The section 'impact of disaster' included questions about the burden of damage on human lives and property due to the earthquake. The information about the impact of the earthquake on the individual house and essential services such as electricity, water supply, cooking fuel supply and toilet facility were collected by items on an ordinal scale ranging from 'no impact at all' to 'heavy damage/destruction'. The evaluation of progress made on the reconstruction of each facility was assessed with a five-point Likert scale, ranging from totally disagree with score 1 to totally agree with score 5, to measure the perceived level of satisfaction of reconstruction progress. The physical impact on human lives was assessed by three primary questions about the number of deaths, injuries, and disabilities caused by the 2015 earthquake.

B. Accessibility: The section on 'accessibility' sought information on the time required to travel to reach essential services (e.g., marketplace, nearest health facility, etc.), irrespective of the mode of transport (Central Bureau of Statistics, 2011a). Accessibility to these facilities was assessed by the level of difficulty perceived by the earthquake survivors measured on a five-point Likert scale score with 1 representing very difficult and 5 representing very easy.

C. Natural/Geographical Vulnerability: To assess the natural and geographical vulnerability of the house, the respondents were asked to rank the severity of the risk they perceive from natural disasters. It included earthquakes, landslides, windstorms,

thunderstorms, floods and heavy precipitation/snowfall/hailstone. Similarly, severity of the risk they perceive due to the topographical location of the house such as a house located close to rivers or located on slopes or landslide risky zone etc. were also examined in the same process. The response was recorded on a five-point Likert scale with 1 representing severe risk and 5 representing no risk at all.

IV. Institutional/Procedural: Over 25 items and variables were identified under institutional/procedural domains and grouped under five broad factors in the literature review: policy, governance, disaster management, political leadership, external aid and aid organizations. The items under disaster management and aid and aid organizations were represented and assessed in the relief aid and grant section in the survey instrument. The factors governance, leadership and Government policies were captured under the governance section by assessing the trust held by the affected population towards various Government and non-Government stakeholders of disaster recovery.

A. Relief Aid and Grants: The section 'relief, aid and grant' included items regarding the extent of relief, three instalments of house grant and training or support received in cash or kind by the earthquake survivors to assess the role of external grant and support from organizations (Aldrich, 2011a; Liu & Fellowes, 2006; Wang et al., 2010). The adequacy of the aid and grants among the earthquake survivors were assessed by their perception regarding whether the house grant amount provided by the Government was adequate to progress the reconstruction of their house. To capture the role of governance (Aldrich, 2011a), The researcher included items that measured people's level of trust towards the stakeholders directly involved in the reconstruction process in the district. These were officials from the National Reconstruction Authority; DCC; VDCs; NGO/INGOs; and political party leaders. The question assessed the level of trust they have in each stakeholder measured on a five-point Likert scale with 1 representing no trust at all and 5 representing a high level of trust.

B. Governance: As an indicator of governance, the researcher included the items that measure the people's level of trust towards the stakeholders who were directly involved in the reconstruction process in the district. They were officials from the National Reconstruction Authority, DCC, VDCs, NGO/INGOs, and local representatives of political parties. The response was collected from the household members regarding the level of trust they have in each reconstruction stakeholder measured with a five-point Likert scale.

3.6 Community resilience tool

As the last section in the survey instrument, the 27-item resilience tool was included to capture the community resilience after a disaster. A review of literature on development and validation

of resilience scale using a combination of keywords ‘resilience’ and ‘disaster recovery’ revealed that prominent scholars of disaster resilience and recovery had included physical, social, institution and economic dimensions, also known as constructs, to build their theoretical frameworks of community resilience (Aldrich, 2012a; Arbon et al., 2016; Cutter et al., 2008; Leykin et al., 2013; Fran H Norris et al., 2008; Pfefferbaum, Van Horn, et al., 2015; Price-Robertson & Knight, 2012; Sherrieb et al., 2012). Based on the four theoretical dimensions of community resilience mentioned above, the researcher adapted the validated Community Advancing Resilience Toolkit CART-E 27 (Sherrieb et al., 2012) and added items from various other community resilience tools and frameworks, as appropriate. For example, constructs related to leadership and place attachment (relevant to Nepal) were added from the Conjoint Community Resilience Assessment Measure (CCRAM) tool (Leykin et al., 2013). The researcher included some local and contextual factors since the meaning and definition of resilience varies across cultures and may be contextually and culturally dependent (Ungar, 2011). Therefore, mountain-specific variables like inaccessibility, fragility, marginality, (Jodha, 1992) that were thought to affect the resilience capacity in Nepal (Mishra et al., 2017) were added to the tool.

Altogether 46 items were collected from all the sources but reduced to 27 items after pilot testing. Please see ANNEX I under ‘4. Adapted and modified community resilience Tool (Pilot Version) Community Resilience’ for the full version. The items sought information on the strength of community members in their cohesiveness, disaster preparedness within the community, accessibility to various resources, information and communication, and the feeling of community attachment. The tool had items such as ‘people in my community feel like they belong to the community’ which were ranked on a 5-point Likert scale with 1 representing strongly disagree, 3 representing neither disagree nor agree, and 5 representing strongly agree. All the items were positively worded and hence a higher score indicated better community resilience capacity.

3.7 Language translation and validation of the survey instrument

The survey instrument was translated into the Nepali language and was translated back to English and compared with the original English version until both versions matched consistently in meaning. The face validity of the community resilience tool was obtained by consulting with the supervisor and fine-tuned after the pre-testing of the instrument and tool in the field. Content validity of the community resilience tool was ensured by including items and factors guided from the established theories and frameworks of disaster recovery and community resilience from the literature review and inputs from the findings of qualitative

information in the field. The details of qualitative information are described in the following paragraph.

Before the start of fieldwork, the developed instrument was tested with two local people in Chautara (headquarter of Sindhupalchowk district) in Nepali to make sure that the questions were clear and could be understood by the respondents and were culturally acceptable in the local setting. Reviewers were a ward secretary at the council office and a local farmer from a nearby village. The instrument was modified and rephrased until the questions were understandable and acceptable to general people. Three items that were difficult to comprehend, one item determined irrelevant to the context and three items that had a similar meaning in the community resilience instrument were dropped. For example, item ‘what emergency provision does your community have to tackle the natural disaster?’ was removed since there were no emergency provisions like ambulance, fire engines, or rescue equipment in the VDCs/municipalities except for district centre and some municipalities.

3.8 Study area

The Sindhupalchowk district of Nepal was selected as the study area since this was the most impacted district of the 2015 earthquake in terms of destruction of physical infrastructure and loss of human lives (National Planning Commission, 2015). Sindhupalchowk is a hill district covering 1.73% of the total area in Nepal with a population of 287,798. The district has 77 VDCs (now incorporated into rural or urban municipal councils) and two municipalities (urban municipal council) which are the lowest level of local Government in Nepal. The average population being 3600 in each VDCs/municipalities with municipalities being slightly more populous than the VDCs. The district is inhabited by diverse ethnic and caste groups such as *Tamang, Chhetri, Newar, Brahmin, Dalit, Sanyasi, Sherpa, Majhi, Magar, Danuwar, Pahari* etc. (Central Bureau of Statistics, 2011b). *Tamang* caste which belongs to indigenous *Janajati* group having their own culture, customs and language is considered to have low socio-economic condition in Nepal (Bennett et al., 2008). The group is reported to have highest population in the Sindhupalchowk district, almost covering 34% of the population in 2011 census (Bennett et al., 2008). The privileged caste group which comprised of *Brahmin* and *Chhetri* is traditionally placed on the top tier of caste hierarchy in Nepalese society. This group is the biggest caste/ethnic group in Nepal, covering almost 32% of the population and considered the dominant caste group (17%-55% falling in the highest quintile, Source: Bennet 2008/CBS). The caste groups Magar, Gurung, Newar, Sherpa and Bhujel also fall in *Janajati* group but these castes are reported to have better socio-economic status than that of *Tamangs*. The caste groups *Danuwar* and *Pahari* were among the most underprivileged caste groups among all *Janajati* caste groups. The other distinct caste group *Dalit* is reportedly considered

to be the least privileged in the caste hierarchy system owing to their untouchability status in the Nepalese society (Bennett et al., 2008)

3.9 Data collection

Ten local people who had completed high school were trained by the researcher to conduct the face-to-face interviews in the household survey. Five were female. After briefing the purpose, aims and objectives, each trainee asked the questions in the survey instrument to their fellow trainee until the meaning intended by questions was the same and understood by all the members. The researcher conducted 50 face-to-face interviews among the households in the pilot survey accompanied by one trainee at a time in some houses to familiarize the real experience of the interviews. The researcher then followed each research trainee into 10 consecutive houses during the interviews in the final household survey. Each trainee was corrected after interview sessions for the inconsistencies and left to conduct the sessions independently after they were thought to be good enough to interview the people in an intended way. The household survey interviews were conducted one at a time in the eight identified VDCs/municipalities along with qualitative interviews and discussions. The trainees were accompanied by the researcher at all the survey sites and the researcher himself was involved in the face-to-face interview. All the qualitative in-depth interviews, informal discussions, and interviews, FGDs, site visits and observations, and secondary data collection were done by the researcher himself. He is a faculty member of BP Koirala Institute of Health Sciences and has experience in teaching research, guiding research thesis and conducting field surveys to master's students of Public Health, Medicine, and Nursing for over 12 years period. He has published over 20 articles in various national and international peer-reviewed journals and presented his research in several national and international forums.

3.9.1 Pilot testing and re-testing

Pilot survey: To evaluate the appropriateness and clarity of the questionnaire and for cultural acceptability, a pilot survey was conducted at two different places: one within the district centre and the other two hours walking distance away from the city. These places were identified with a local informant who was a ward secretary (council secretary) in the area where the primary researcher was stationed. A face-to-face interview was conducted on a sample of 25 households in each place by the researcher using convenience sampling.

The interview was conducted with earthquake-affected household members above 18 years of age in Chautara and Simpani and were preferably the head of the household or senior member. The study unit was an individual household. Care was taken to enrol women and elderly people. The interviews were conducted at the interviewees' convenient time. The aim and

objectives were clearly explained in brief. It was made clear to them that the survey interview was in no way related to the relief and grant distribution process. This was explained since the misunderstanding as a representative of disaster stakeholders could lead to bias of information. The respondents were assured that the information collected would be purely used for academic purpose and would not reveal their identity. The respondents were also informed about the tentative time to complete the survey and the areas to be explored were briefly described. The respondents' queries and concerns regarding the utilization of information and the impact it might have in their house grant process were answered. The respondents were asked to sign the consent form if they consented to participate and the other members from the house were asked to sign on the behalf of people who were unable to sign.

Families whose members were not living permanently in the communities and individuals coming to live for a short period were not included in the study. Altogether seven houses were excluded; three houses had no eligible members, and four household members did not consent to participate. The adjacent households were taken for the survey interview for these houses. The questionnaire items were explained three times after paraphrasing with different wording when the respondent did not understand. For every 5-point Likert question the researcher provided the additional score option close to the response given by the responder just to confirm that that was the responder's correct choice. For example, if the response was 'disagree' then the researcher would ask if he or she meant just 'disagree' or 'strongly disagree'. The second response was taken as valid. Four questions on language clarity, length of time, difficulty to understand the meaning of questions, and the section and items that were difficult to understand were also asked.

The pilot study feedback helped determine the response rate needed for the larger survey, the time taken to complete the interview. Moreover, constructive comments and suggestions on the format and structure of the questionnaire were also received from the respondents. The items understood after paraphrasing were included in the instrument. The items that were considered too complex (if respondents were unable to understand after three attempts) were dropped from the instrument. The pilot interview took one to one and a half hours to complete.

To assess the reproducibility of the survey instrument, the survey was repeated among the same households with the same respondents 15 days later. The contact number and convenient available time were noted down in the previous survey. Five questions with Likert response from factors of disaster recovery and six questions from community resilience scale was repeated in the re-testing. Altogether, 34 items were included in the re-testing questionnaire and it took around 15-20 minutes to complete. All the options in the items had a Likert response ranging from 1-5 scores. The researcher added two open-ended questions at the end

of the re-testing tool which asked about the factors that were hindering or facilitating the ongoing reconstruction process. These questions were kept open to capture any unexplored factors of local context not included in the survey instrument and to incorporate them into the final survey instrument.

3.9.2 Pilot study data analysis: All the data of the pilot and re-test survey were entered into an Excel worksheet cleaned and checked for inconsistencies. Data were analysed using statistical software STATA version 14. Descriptive tables were produced for the information on feedback regarding language, length of time, clarity of questions, and any sections difficult to understand. The reliability of the resilience tool was examined using Cronbach's alpha and was found to be consistent (alpha, 0.883). After the pilot and re-testing, the two single-item questions adapted from the CCRAM tool (Leykin et al., 2013) rating their resilience status as an individual or community on a 5-point scale (1-strongly disagree, 5-strongly agree) were excluded from the final survey as it was found to be incomprehensible from the feedback of the respondents. Every item of feedback on the survey instrument from the participants of the pilot study was properly addressed and some items were modified, some were reworded, and some were dropped based on it.

Test-retest reliability was assessed to ensure the level of agreement by the intra-class correlation coefficient (ICC) comparing the few five-point Likert items in the survey instrument and resilience tools obtained at two time periods. The Intra-Class Correlation coefficient (ICC) values of all items of the survey instrument including the community resilience scale showed a strong correlation between pilot and re-testing survey (ICC ranging from 0.72-0.97). This indicated that the instrument would produce fairly consistent results and was considered good enough to use in the final survey. Finally, the questionnaire was improved by making corrections and modifications in the sections appearing to be irrelevant or difficult for the local people to understand as per the feedback.

3.10 Community household survey

After the modification of the survey instrument in the pilot survey and inputs from literature and qualitative study findings, a community survey was undertaken in the villages identified as most recovered (4 VDCs/municipalities) and least recovered (4 VDCs/municipalities) in November 2017.

3.10.1 Sample size: The sampling unit for the household survey was the household. The sample size calculation was based on a recent study done in Nepal among the post-earthquake population in three districts to develop the resilience framework where the findings revealed that infrastructure emerged as an early recovery dimension with 83.9% recovery, followed by

psychological dimension 71%, social dimension 58% and economic dimension 54.9%. (Mishra et al., 2017). The economic dimension with 54.9% as the smallest proportion of estimated recovery with a Cronbach alpha value of 0.05 was taken to calculate sample size with the following formula.

Sample size (n) = $z^2 p^*q/e^2 = 381$,

Where 'z' value = 1.96 at 95 % CI, 'p'=proportion of recovery = 0.549, 'q' is a complement of 'p' = (1-p), and 'e' is desired precision (half desired CI width).

To account for the clustering effect, the sample size was multiplied by a factor of 2, thus making the sample size to be 762. Adding 10% non-response and rounding off, the researcher had initially planned to include 840 samples, 420 in each arm (most and least recovered villages), but due to non-response, members not at home, and topographical difficulty data could be collected from only 744 households.

3.10.2 Sampling: At the first stage, four VDCs/municipalities were selected randomly from the 8 most recovered VDCs/municipalities of the district and four from among the 8 least recovered VDCs/municipalities. At the second stage, households were selected conveniently from four separate clusters in each selected VDCs/municipalities, and an almost equal number of households were surveyed in each cluster. The random selection of households was not feasible because of geographical difficulty, transportation difficulty, weather, and not finding people at their houses. The households were scattered, and some would take a day's walk to reach. The number of households in each VDC/municipality was determined corresponding to its population size. To capture the marginalized ethnic population, the researcher stratified every selected VDC/municipality into the privileged and the underprivileged population and included at least 7% of the samples of the underprivileged population corresponding to the proportion of the underprivileged population (7.4%) in the district. (Central Bureau of Statistics, 2011b). Care was taken to enrol a female respondent for every male respondent as far as possible in all the sites as far as possible. For this, five females among the ten trained interviewers encouraged female respondents in the household to respond to the survey.

3.10.3 Data analysis:

The quantitative data of the household survey was entered into an Excel worksheet and cleaned, coded, and then imported in the statistical software STATA version 14 for further analysis. The categorical independent variables were summarized in frequency and percentages with the dichotomized dependent variable recovery status; 'least recovered' and 'most recovered'. The continuous data were summarized descriptively with means and standard deviation.

A Chi-square test was used to examine the association between categorical independent variables and the dependent variable in the descriptive analysis. P-value less than 0.05 was considered statistically significant for all the tests. A univariate analysis was performed to explore the association between the independent variables and recovery status dichotomized into most and least recovered households. The independent variables included items on demographic characteristics, social vulnerability, financial status, the impact of the disaster, accessibility to the facilities, external aid and grants, governance, social participation, social support, community resilience, and women's empowerment in the community. Crude odds ratio was used to interpret the strength of association with 95% CI.

Composite Likert scores: In the case where a construct was measured using multiple indicators, a composite measure was created using the mean score of indicators (i.e., individual questions). For example, the composite score 'impact on facilities' was computed by averaging the Likert scores of four items that measured impact on facilities, including residential buildings, water supply sources, toilet facilities, and electric supply. Similarly, process was applied to 'evaluation of the reconstruction and restoration', 'time to reach essential facilities', 'evaluation of accessibility to essential facilities', 'social participation'. Similar process was also followed to create a composite score with newly developed 'community resilience tool, and established tools 'mobility domain of women empowerment scale' and 'social support scale'. In all the composite variables, the multiple Likert or ordinal score items that formed it were checked for acceptable consistency with Cronbach's Alpha value above 0.70 (de Vet et al., 2017; Pfefferbaum et al., 2012) of data distribution before averaging them into a single score. All the composite scores were treated as a continuous variable for inferential analysis. For all the continuous data, a student t-test was used to explore the mean difference between the groups of recovery status. The data were presented with 95% CI and a P value less than 0.05 was considered statistically significant for all the tests.

Logistic regression: Binary logistic regression was used to identify the critical factors that determine recovery reconstruction status. The dependent variable was recovery status with the most and least recovered groups, least recovered being the variable of interest and was coded 1 for the all the analysis. Data were checked for multicollinearity. All the variables significant in the univariate analysis with a P value less than 0.2 were included in the model. The stepwise backward elimination process was used to conduct the logistic regression where the variable with the highest P-value was eliminated one at a time in each subsequent model until a parsimonious model was reached with the P value less than 0.05 for all variables. The findings were interpreted by the adjusted odds ratio including 95% confidence interval.

3.10.4 Factor analysis: Exploratory factor analysis (EFA) was performed to identify orthogonal constructs in the 27-item community resilience scale. Principal component analysis was used as a method of extraction with Varimax rotation. All the factors with an Eigenvalue greater than 1 were retained in the model. The minimum factor loadings to be included in the study were set at 0.40. No individual items with high correlation were found. Initially, the factorial analysis identified 7 factors in 27 items, but one item was dropped as it represented a factor in which it was the only loading ≥ 0.4 . The factor analysis was repeated with 26 items with the same process and identified an item with cross-loading over two factors (difference smaller than 1.5 in loadings were dropped) and had factor loading value less than 0.39, and hence was dropped (Cohen et al., 2013s; Leykin et al., 2013). Finally, the EFA was repeated with 25 items with the same process which identified six factors with distinct constructs.

The constructs were interpretable in their meaning with common characteristics. The first factor had six items representing community connectedness; the second factor had five items and represented disaster management and planning; the third factor had three items that represented information related to means of communication in the community; the fourth factor had five items that represented trust towards leadership and the local governance; the fifth factor had three items that were close to the meaning of community accessibility to resources and facilities and sixth had three items which represented the community's attachment to their place. The reliability of each construct and the whole scale was tested using Cronbach's Alpha. These constructs were correlated with the established literature on frameworks and theoretical models of resilience and the findings of the qualitative study. Pearson correlation coefficient was used to see the correlation between the final community resilience scale with 6 factors and 10-item community resilience scale (CCRAM) and 12-item social support scale. This was done to see how close the newly developed scale would correlate with the already tested and validated CCRAM scale to establish the concurrent validity of the new scale.

3.11 Ethical issues

Ethical clearance was obtained from the Human Research Ethics Committee, Curtin University (HRE2017-0596). Permission to conduct the research was obtained from the host institute BP Koirala Institute of Health Sciences, Nepal. Permission was also sought from all the VDCs and district administrative authorities before the field survey. Informed consent was obtained from each respondent and Government and non-Government offices. All the participants were informed about the objectives of the study, the time duration expected from them, and their right to withdraw at any point in the study clearly before the interview. The

respondents were assured of confidentiality and clarified that the information collected would only be used for research purposes. The ethical approval for all the qualitative in-depth interviews, focus group participants, and formal conversation was also obtained from Curtin University (HRE2017-0596). Permission was obtained from the host institute BP Koirala Institute of Health Sciences, Nepal. Written consent was obtained from the participants of all the qualitative interviews and discussion after explained the objectives of the study. Verbal consent was obtained for informal conversations. Confidentiality was ensured to all the participants before the interview and conversation.

Chapter 4 : Results

This section describes the results of the household survey undertaken to identify the determinants of reconstruction status. The results chapter is described in five sections listed as follows:

1. Development of the survey instrument
2. Qualitative interviews and discussions
3. Descriptive tables of potential determinants of the progress of disaster reconstruction
4. Univariate analysis of potential determinants of the progress of disaster reconstruction
5. The factors that determine the progress of disaster reconstruction

4.1 Development of the survey instrument designed to capture the factors impacting the disaster recovery

This section describes the process of the development of a comprehensive set of survey instruments informed by a literature review designed to capture the factors impacting the progress of disaster recovery in the context of developing countries.

4.1.1 Development of comprehensive survey instrument

The development of the survey instrument started with a systematic review of the literature. The review of the literature led to the revelation of over 60 variables representing 14 factors that were found to be influential in facilitating or impeding the progress of disaster recovery which were not only independent but also interactive. These factors were further grouped under four broad domains included physical, social, economic and institutional factors of individual household and community (for details on systematic review and model development, please see the article attached in Appendix II). The survey instrument was pilot-tested and validated by re-testing in the field and refined before using it in the household survey among the disaster-affected population.

4.1.2 Identification of factors impacting disaster recovery

The systematic literature review identified 60 items categorized into 14 factors and four broad domains: social, physical/environment, economic, and institutional/procedural. A survey questionnaire was then developed to include questions about the 14 factors. Previously used and validated questions provided in the literature or from Government and NGO surveys were used where possible. Other questions were newly developed to ensure that all factors identified in the literature review were covered in the questionnaire. Best effort was made to represent these identified factors by suitable items and tools in the survey instrument to make it comprehensive.

4.1.3 Content Validation

After the collection of basic items from the literature and conceptual frameworks, multiple discussions were held among the researchers to ensure the representation of the identified factors by the individual items collected from the different sources. The international frameworks of disaster recovery (Council of Australian Governments, 2011; Federal Emergency Management Agency, 2011; Global Facility for Disaster Reduction and Recovery et al., 2015; Price-Robertson & Knight, 2012) and disaster recovery framework of Nepal (Authority, 2016) and theoretical frameworks and models (Abramson et al., 2015; Cutter et al., 2008; Gould, 2014; Miles & Chang, 2011; Tatsuki & Hayashi, 2002) were taken as references to validate constructs and items included in this instrument.

4.2 Qualitative interviews and discussions

This study conducted 36 semi-structured interviews, two FGDs, seven informal interviews, and multiple field observations to capture the economic, logistic, family, or administrative difficulties that earthquake-affected people were directly facing during their house reconstruction. These qualitative methods also explored the positive factors that had facilitated the process of reconstruction in those areas. The interviews and discussions were conducted by the researcher, during his four and half months stay in the study area. Participants included various officers from disaster recovery Government and non-Government stakeholders and local residents, political party leaders, vulnerable people, engineers, and many relevant key persons from both the recovered and non-recovered VDC/municipalities and district centre of Sindhupalchowk. The most recovered VDC/municipalities selected for this study were Kadambas, Irkhu, Jalbire and Kalika and least recovered VDC/municipalities were Fatakshila, Jyamire, Baruwa and Marming. Brief demographic characteristics of the participants are given in the tables below.

Table 3 Participants of focus group discussion in the most recovered VDC/municipalities of earthquake-affected households, Sindhupalchowk, Nepal, 2017/2018

Gender	Occupation	Remarks	Participants Code
Male	Agriculture/Mason		FGD1
Female	Household chores	Single woman	FGD2
Male	Agriculture		FGD3
Female	Agriculture	Single woman	FGD4
Male	Agriculture/Mason		FGD5
Male	Agriculture	Literate	FGD6
Male	Mason	(Problem in speaking)	FGD7
Male	Agriculture	Resident	FGD8
Male	Agriculture	Resident	FGD9

Table 4 Participants of focus group discussion in the least recovered VDC/municipalities of earthquake-affected households, Sindhupalchowk, Nepal, 2017/2018

Gender	Occupation	Remarks	Participants Code
Male	Agriculture/cooperative	literate	FGD10
Female	Household chores	Single women/illiterate/underprivileged caste	FGD11
Male	Agriculture/cooperative member	Literate/privileged caste	FGD12
Male	Agriculture (Single Women)	Literate/privileged caste	FGD13
Male	Agriculture	Resident	FGD14
Male	Small business	Illiterate/underprivileged caste	FGD15

Female	Agriculture/household chores	Women's group member/privileged caste	FGD16
Female	Agriculture	Single women/illiterate/privileged caste	FGD17
Male	Agriculture/cooperative member	Literate/privileged caste	FGD18

Table 5 Participants of in-depth Interviews (District Government officials and political leaders), Sindhupalchowk, Nepal, 2017/2018

S.no.	Stakeholders	Designation	Institution	Participants Code
1	District Government Office	Senior Executive Officer Focal person: District Disaster Relief Committee: DDRC	Internal Auditor's Office (DCC)	P1
2	District Government Office	Section Officer	DCC	P2
3	District Government Office	Computer/Administrative personnel	NRA	P3
4	District Government Office	District contact person and head	NRA	P4
5	District Government Office	Information Officer	Disaster Emergency Operation Centre (DAO)	P5
6	District Government Office	Information Officer	Disaster Emergency Operation Centre (DAO)	P6
7	Political Leader	Advisor and member: General administration of the ruling party	Nepal Communist Party	P7
8	Political Leader	District Secretary	National Democratic Party	P8
9	Political Leader	District Leader	Nepal Maoist Centre Party	P9

Table 6 Participants of in-depth Interviews (I/NGO and technical staff), Sindhupalchowk, Nepal, 2017/2018

S.no.	Stakeholders	Designation	Institution	Participants Code
1	I/NGO	Manager	OXFAM	P10
2	I/NGO	Manager	World Vision	P11
3	NGO	Executive Director	CDECF	P12
4	NGO	Project Coordinator	Janahit Gramin Sewa Samiti	P13
5	Reconstruction Engineer	NRA Engineer (Kalika)	Urban Development Office	P14

6	Reconstruction Engineer	NRA Engineer (Irkhu)	Urban Development Office	P15
7	Reconstruction Engineer	NRA Engineer (Kadambas)	Urban Development Office	P15
8	Reconstruction Engineer	NRA Engineer (Jalbire)	Urban Development Office	P16
9	Reconstruction Engineer	Engineer OXFAM	OXFAM	P17
10	Reconstruction Engineer	Engineer JICA	JICA	P18
11	Social Mobilizer	Social Mobilizer JICA	JICA	P19
12	Financial institution	Manager	Manusi Microfinance	P20

Table 7 Participants of in-depth Interviews (Local Government Office representatives, VDCs/municipalities) in the most and least recovered VDC/municipalities, Sindhupalchowk, Nepal 2017/2018

S.no.	Stakeholders	Designation	Institution	Participants Code
1	Local Government Office	Social Mobilizer (Kadambas)	Ward Office (most recovered VDC)	P21
2	Local Government Office	Ward Chairman (Irkhu)	Ward Office (most recovered VDC)	P22
3	Local Government Office	Ward Chairman (Jalbire)	Ward Office (most recovered VDC)	P23
4	Local Government Office	Ward Chairman (Kalika)	Ward Office (most recovered VDC)	P24
5	Local Government Office	Ward Member (Fatakshila)	Ward Office (Least recovered VDC)	P25
6	Local Government Office	Ward Chairman (Marming)	Ward Office (Least recovered VDC)	P26
7	Local Government Office	Ward Secretary (Marming)	Ward Office (Least recovered VDC)	P27
8	Local Government Office	Ward Chairman (Jyamire)	Ward Office (Least recovered VDC)	P28
9	Local Government Office	Community Coordinator for LGDCP (Baruwa)	Ward Office (Least recovered VDC)	P29
10	Local Government Office	Mayor	Chautara Urban Municipality	P30

Table 8 Participants of in-depth Interviews (Local residents and key persons), Sindhupalchowk, Nepal 2017/2018

S.no.	Stakeholders	Designation	Institution	Participants Code
1	Local Residents	Hotel/Restaurant Owner (Jalbire)	Most recovered VDC	P31
2	Local Residents	Farmer/Past Ward Coordinator (Jalbire)	Most recovered VDC	P32
3	Local Residents	School Teacher (Kadambas)	Most recovered VDC	P33
4	Local Residents	School Teacher (Baruwa)	Least recovered VDC	P34
5	Local Residents	School Teacher (Marming)	Least recovered VDC	P35

Table 9 Informal interviews and talks (Local residents), Sindhupalchowk, Nepal 2017/2018

S.no.	Stakeholders	Designation	Institution	Participants Code
1	Local Residents	Homeless (Jalbire)	Most recovered VDC	P36
2	Local Residents	Farmer/Bribery victim (Jalbire)	Most recovered VDC	P37
3	Local Residents	Single Women (Homeless)	Most recovered VDC	P38
4	Local Residents	Farmer (Jalbire)	Most recovered VDC	P39
5	Local Residents	Farmer/Underprivileged caste group (Jyamire)	Least recovered VDC	P40
6	Local Residents	Farmer/Victim of caste discrimination (Jyamire)	Least recovered VDC	P41
7	Local Residents	Farmer/ road land dispute (Kadambas)	Least recovered VDC	P42

As discussed in method section, a flexible semi-structured interview transcript was used. This proved to be useful as it enabled the exploration of emergent data. For example, when the positive role of the financial cooperatives was elaborated by a Ward chairman, the researcher then interviewed a manager of Microfinance in the district. Similarly, when some Government representatives and local residents complained about the NRA engineers that they did not attend the village reconstruction sites very often, the researcher then interviewed both engineers employed by NRA as well as engineers employed by I/NGOs to explore this issue. Since this method was explorative, the findings were summarized as per the emerging themes relevant to disaster recovery. Quotes were used frequently to provide evidence for deeper interpretation and to illustrate or provide a more concrete example of an idea along with the thoughts, feelings, or moods of the persons quoted (Sandelowski & Barroso, 2002). The findings of the qualitative survey were described under emerging sub-headings summarized

under the six headings. The following section will describe the experience and mental state of the people immediately after the earthquake and a month following the event. This is followed by the discussions of factors that hindered and facilitated the house reconstruction progress, as per the account of Government, non-Government, and the earthquake-affected residents in both the least and most recovered population.

4.2.1 Coordination among the stakeholders of disaster recovery

The delayed coordination among the stakeholders of disaster recovery was one of the important reasons for the delay in the reconstruction process. The coordination referred to in this study means the coordination between central and local Government, local Government and I/NGO, local Government representative and opposition political party leaders, and these stakeholders with residents.

4.2.1.1 Local Government and I/NGO: The lack of coordination between agencies is indeed problematic as it results in wasted effort and poor long-term outcomes. The interviews from the representatives of the local Government suggested that I/NGOs did not properly liaise with the community representatives. This information somehow suggested that I/NGOs were serving their own interest and did not get the best deal for the community. The responses from the residents and local Government representatives revealed that there was a lack of transparency in the working procedures of I/NGOs in the villages. They considered I/NGOs work as doing for their self-interest only. For example, residents were not informed about the amount and allocation of budget in projects, although they were asked to participate in the meetings just to have their documented presence. A schoolteacher in the most recovered VDC vented his feeling regarding the self-serving nature of I/NGOs while installing the water taps in the village. He pointed out (P33): *“they bring in small projects. They buy their materials; that is not right. The community must be able to buy the materials.... We do not get to see actually how much they spent. But we do not know how much they received for it.... A resident would look for cheap and durable materials, whereas the organizations would not look for such kind.”* As per his account, the organization failed to liaise with the community people as per their expectations. There could be some policy limitation on sharing budget information to consumers on the I/NGOs side, however, the knowledgeable people complaining about the transparency indicated that I/NGO had failed to explain this fact properly. They did not properly involve the community people in the project who were meant to benefit from it. This could lead to apathy towards the program and community people will not take ownership after it is handed to them. This fact revealed that there was some doubt among the residents regarding the donor agencies’ motives and their working procedures.

Lack of coordination between the stakeholders especially INGOs and local Government bodies (ward committees) were also observed while supporting residents in building their houses. At some places, the houses were built before the Government had released the house grants to the affected people and these houses were built by INGOs and individual donors from overseas without the coordination and knowledge of the Government authorities. As one of the council members in the least recovered VDC recalled, (P25): *'There are two houses that have been built in Danuwar. But a few days ago, NRA engineers came and said that these houses do not meet the standard requirements of quake-resistant houses. It is like a box from inside and lined with plywood and outer walls are brick and cement. So, they say it does not meet the criteria.'* Similar instances were reported in the restoration of damaged facilities such as water supply due to incoordination among the stakeholders (P27): *'There was also another organization that was ready to support in the construction of a community residence with drinking water and other facilities. But there were some conflicts about the land, so that has also not been done. So there hasn't been much of help from the organizations regarding reconstruction.'* The residents could not wait for bureaucracy to catch up and so built the house by themselves as they needed shelter immediately. Several other instances of incoordination between the local government authority and NGOs were reported during the interviews, such as INGOs built houses, taps, water tanks or road construction without the knowledge of VDC authorities.

District Coordination Committee and INGO: The findings revealed that local Government representatives were not very convinced with International non-Governmental organizations working procedures. They had an impression that the resources utilized initially in the reconstruction process by the non-Governmental organizations could serve many more houses than they did, had they utilized it in delivering the services and resources and not distributing the cash support equivalent to Government house grants. The district Government authority explained, (P1): *'They spent approximately of about rupees 250 to 300 million worth project to reconstruct 400 houses. Instead of telling Save the Children to rebuild 400 homes if we asked them not to distribute 3 lakhs but instead carry on their support (mobilization, engineers, and 30000-40000 rupees support) in other places too, then that would cover a lot of other VDCs too'*. The human resources were also not properly managed and utilized by NGOs and INGOs as he put up, (P1): *'I think there might be up to 20 engineers in a single village; there are engineers appointed by UNDP, by Oxfam; engineers for WASH; engineers for shelter; engineers for building drinking water supply and so on. If only we could combine all these engineers and make them work systematically, then work would have been possible. But all that manpower was wasted. If our policymakers would think a little differently in this way, then there could be a drastic change.'* This fact was informed by few other rural municipal

and ward committee chairmen too. This finding tends to indicate that proper coordination in the utilization of resources (manpower and material) among the donor agencies and local Government would have brought down the cost and expedited the process of reconstruction recovery.

4.2.1.2 NRA and other stakeholders: Almost all the stakeholders of disaster recovery, such as NGOs, I/NGOs, local Government authorities, and local residents were unsatisfied with the National Reconstruction Authority (NRA), particularly in the issue of coordination of the reconstruction process. A local Government representative exhibited his frustration, (P22): *'In fact, we have never had any meetings with NRA. They never invite us. They think we are people of a lower level.'* Similarly, the authorities in DCC (district level local Government authority assigned to distribute house grants to the residents) blamed NRA for not aligning the programs of the reconstruction as per the local needs, thus delaying the reconstruction process. A higher official in DCC pointed out, (P1): *'we proposed for continuing the works run by DCC through the functional units and NRA should strengthen them. But they decided to work according to NRA's way. This incoordination from the centre broke the speed with which we were working. It caused some delay, but we are continuing our works.'*

The authority from NRA justified the allegations of incoordination made by other stakeholders including local Government bodies by saying that there were shortcomings and a wrong approach from the local Government authorities while dealing with the house grants process, and hence could not go exactly the way they had expected. As he explained referring to the local Government representatives, (P4): *'It would appear like we are against the local authority personnel (municipalities) if we say this. But the thing is that they even recommend and authorize the buildings that are not under the set standards. Their statement that all the buildings must be considered to be meeting the standards, how do you take that?'*

The NRA official also admitted that the authority was aware of I/NGOs' discontent towards NRA guidelines and manuals regarding the house building criteria. However, he was not very convinced with it as he mentioned, (P4): *'What I am trying to relate here is that we must satisfy the donors as well.... regarding the correction manual that we made, they are complaining that if we construct according to the correction manual, the buildings will be weakly structured. (laughs)....'* It meant some of the donor agencies did not agree to the correction manual put forward by NRA. This could have taken some time to revise it before implementing it in the field, indicating the delay in the reconstruction process. Also, the household who had already built the house as per this manual would need to redo their construction causing a waste of economic resources and time. The information suggests that the recovery authority and the donor agencies were not in a good synchronization in finalizing the policy of house

building criteria, and hence were not completely convinced with each other about their working process. The lack of trust among the stakeholders might have caused unintentional delays in the allotment of resources and manpower in the reconstruction process.

4.2.1.3 Political Leaders and local Government authorities: Conflicts between the politicians from different political parties and Government authorities were observed during the initial relief and rescue phase due to the incoordination of donor organizations in the distribution of the relief materials. As per the account of the DCC officer (local Government official in the district), there were inconsistencies in the distribution of relief materials to the earthquake-affected people as various organizations were working on small clusters of the neighborhood such as the size of tents, canopies, food items, hygiene items. This was how some residents in the villages compared and complained regarding the relief materials, (P2): *'Others got better ones and we didn't. Some of them received a very small size whereas some of them received as big as a house.'* So, this led to the conflict between political leaders from different parties. It became a local political issue as people who received less started complaining against the political leaders. This resulted in political leaders calling the CDO and complaining about the situation saying, *'Why were those services provided to this area and not the others?'* So, the evidence collected so far suggested the political parties did not agree to the decisions of local Government complaining that the relief distribution was not fair.

4.2.1.4 Political Leaders and I/NGOs: Similarly, it was found that some local political leaders did not have a positive attitude towards NGOs and their working procedures. An NGO personnel turned politician himself revealed this, (P7): *'In fact, the politicians do not have a good attitude towards NGOs, although I am also a politician'*. The NGOs and I/NGOs were also not properly coordinating among themselves. Resources were being wasted and centred in one place whereas it could be otherwise utilized to cover many other needy places had it been used in a coordinated way. The officials at the DCC, as mentioned earlier, had pointed out how I/NGOs engineers' potentials were underutilized and how the work got overlapped when both the Government and NGO's engineers were working in the same place. Although this kind of incoordination was observed in the initial phase, it was later corrected at some places. However, the interviews with I/NGOs representatives and the information provided by the National Reconstruction Authority revealed that major I/NGOs were still working on the same area as they had been working before the earthquake. This fact somewhat supported the doubt of local political leaders against the I/NGOs.

4.2.1.5 Local Government involvement and support: Although the data revealed that the coordination among the stakeholders was not very encouraging, there was some evidence of

good coordination between local Government and other stakeholders of disaster recovery at some places. For example, the Government engineer employed in one of the most recovered villages explained how the conflict between the local people and technical personnel was resolved, (P14). *“When people come to me, the local council representative first explains the rules and regulations to them, and they readily understand it and cooperate with us. The local representative is very helpful and collaborates with us in every reconstruction process”*. As per the account of an officer working in an NGO in the district centre, the political parties were in line with the reconstruction works and they were involved in every program in some way. He explained, (P11): *‘After the newly elected personnel came into office, they have shown a sense of ownership; they ask us for all the documents related to what we want to do. In the past, there was no ownership. If there was something wrong with anything we did, there was nobody to take ownership of. But now they take the ownership.’* Taking up ownership by newly elected local Government was also corroborated by residents, and this was mostly observed in the interviews conducted in the most recovered areas.

A good collaboration was observed between the local council (ward office) and the non-Governmental organizations. The social mobilizer in the ward office recalled, (P29): *‘In the Wards at the upper-level areas, we have 6 projects with a campaign called “Ek Ghar Ek Dhara” (One House One Tap) in collaborations with Care Nepal and CSRC’*. The coordination was maintained and admitted from non-Governmental organizations, however, they also believed that the targeted people had not been reached. An officer from an I/NGO working in the emergency period and continued working in some aspects of the reconstruction admitted, (P10): *‘we only deploy according to the areas assigned by District Coordination Committee (DCC) and those areas happened to be the areas assigned to us. We have worked collaboratively with the District Agriculture Development Committee (DADC). But considering the perspective of beneficiaries, it appears that we or the Government neither of them has been able to reach to them.’*

In one of the most recovered villages, the I/NGOs and local ward committees were found to have good coordination in reaching the beneficiaries. The engineer working in that ward council gave an account of how the engineers deployed from NGOs help and coordinate with them to carry out their job in the villages, (P14): *‘They have their group of engineers. We coordinated with them and organized two mason training. Since then, we have been getting help from the organization for field mobilizations and house applications, otherwise, it would not have been possible for just two of us to yield the output we have now. Without the involvement of this organization, it would not have been possible for us to yield this much of output’*. This tends to indicate the NGOs had played a collaborative effort in the reconstruction

process in some of the most recovered villages. This could be one of the probable reasons for the early recovery in these areas.

Although the local Government and residents did not seem very happy about the working procedures of NRA, the role of the local Government representatives was appreciated by the NRA regarding responding to the reconstruction authority in the district. The NRA official shared opinions that the local Government authorities were helpful, cooperative, and attentive to the reconstruction process and complying with the NRA regulations. He also further explained that he had not experienced any political pressure or hassle since he took over the office, (P4): *'I have invited the people of political parties a few times. They have been very cooperative with me. All the mayor and deputy mayor also recognize me on the phone, and they respect what I say. I also frankly tell them my obligations and the things I cannot do.'* This was also further supported by another officer from NRA, (P4): *'There is coordination and people do come and ask us and inquire about their problems; especially the newly elected ward representatives. They come to us to understand our policies and borrow the books related to the operational policies. So, we have good relations with them. They ask us the things they don't understand, and we explain it to them'.*

This revealed that NRA had communication at the level of mayors and deputy mayors but not at the ward levels with chairmen. Hence, this data tends to indicate that the local Government authorities were complying with the NRA guidelines and manuals despite their grievances. The newly elected local Government authorities had a positive impact on the reconstruction process. The active Government authorities were found in the most recovered areas, although the earlier interim local Government had left a bad impression among the residents. The role and responsibilities of the newly elected Government were appreciated by all the stakeholders of disaster recovery.

4.2.2 Government Policy

Multiple flaws were observed in policy formulation and implementation from the early rescue and relief phase to the mid-reconstruction phase. The reconstruction works were seriously impacted by the late formation of the National Reconstruction Authority (NRA) which was established to oversee the sole purpose of reconstruction works. The nine-month delay in the reconstruction authority followed by the delay in the selection of its chief executive officer (CEO), as per the National news media, was due to internal conflict in the central coalition Government where all the parties wanted their favoured man to handle the project with a budget as big as 7 billion Nepalese currency. In the earlier phase of reconstruction, even when the residents could build their own house, the Government stopped due to a lack of

reconstruction policy coming from the centre in the absence of the central Reconstruction Authority (NRA) and its CEO. An official from the district local Government office explained, (P1): *'If people were told, those who can rebuild their homes go-ahead by getting the approval from this particular engineer, then about 10% of houses would have been rebuilt within a time of 6 months to a year.'* This delay from the centre had impacted many aspects of the reconstruction process including the house reconstruction process.

4.2.2.1 Centralized NRA policy: There were indications of centralized policy being imposed on local authorities after the NRA was formed to oversee the reconstruction works, which the local Government authorities were not so happy about. When the NRA office took over the role and responsibility of reconstruction works in the district from the local Government authorities, the strategies, and structures of disaster recovery with which the DCC office was running until then were dissolved. The reconstruction authority started its job with a completely new structure, new line of command, and new responsibilities which were decided from the central NRA office. This top-down central policy of NRA and disregard of the feedbacks from local Government caused confusion and ultimately delayed the implementation of the reconstruction programs. For example, the head of the housing grant distribution program was allotted to the senior engineer of the urban development office instead of the head of the DCC office. A Government official in the district office shared his feelings, (P1): *'Actually, the head of DCC should have been the head of District Level Program Implementation Unit (DLPIU) or Local Development Officer (LDO) should be the head. But what happened was that the District Engineer became the chief whereas the main work was being done by us. All the works are assigned under your name, and you are the one who is responsible for it then why should we work when we do not get the credit for it! The works must be done transparently!'*

Also, the feedback from local Government authorities to continue with the established sector-wise handling of problems was ignored completely by the newly formed NRA. This sector-wise handling of district problems during the early relief and rescue phase was formed under the coordination of district Government offices (DCC) and INGOs and NGOs under the leadership of the district administrative office (DAO). The district NRA office took over all the roles and responsibilities previously undertaken by various leads (INGOs) of nine sectors. This was reported to be one of the reasons for the delay in the process because it took time for a single office with less manpower to understand the reconstruction works done by multiple organizations.

4.2.2.2 Damage survey: The policy problems from the early relief and rescue phase continued in the reconstruction phase. For example, the Government failed to collect information on the

disaster-affected population and damage structures in the first survey since they had not included the right experts in the team. Hence the whole survey had to be repeated after 6-7 months which delayed the whole reconstruction process. As an officer in the DCC explained, (P 2): *'Right after the earthquake, first data collection was done which brought in the record of tentative 75000 affected households. The data was collected by the Government team of staff led by a gazetted Government officer in each VDC (now wards). They brought only rough data and it was a mess when it had to be entered into the computers. So, the Government had to send in another team for data collection. There were an engineer and an office assistant/social mobilizer in each of them who went to recollect and resurvey for another phase of data collection in VDCs. This team completed the survey.'* The Government had wasted resources as other local Government officials who had closely worked in the coordinating initial relief rescue phase explained, (P1): *'What happened is, in the beginning after the earthquake struck, a team of 50 members was deployed from the central level to collect data; before the second earthquake.... The Government spent a lot on that data collection, but the data was not of any use at all. Then later they asked help from CBS (Central Bureau of Statistics) and sent in a team of engineers in collaboration with the team from CBS and complete the survey.'* Ultimately, this delay impacted the poor population who were desperately waiting for immediate relief.

4.2.2.3 Beneficiary identification: Another policy issue identified by the research participants was the discrepancy in identifying the right beneficiary of the earthquake house grant. The survey conducted to identify the earthquake-affected households could not cover all the target population, as the team was sent in rush without an expert from the statistic department. This survey missed almost 13000 affected population and the information gathered was inadequate. The focal person of disaster risk reduction in the DCC office pointed out, (P1): *'I am saying that we still don't have the exact data until now. Ninety thousand were issued the card, we have a data of 78,000 in the record.... If they had only told the people to rebuild their homes in consultation with the appointed engineer of their municipalities, at least 10 to 15 percent of the homes would have already been built within one year.'* This indicated that the delay in the whole reconstruction process in the early phase was due to a lack of central reconstruction policy, and this was accepted by almost all the Government officials interviewed. An account of a manager from an INGO further supported this discrepancy in identifying the total number of the affected families, (P11): *'To tell you the truth, according to the NRA record of previously affected houses there were 77,000 households, but there appeared 82,000 affected families after the earthquake. That means that the affected families were more than the number of houses.'* This indicated there were still confusions regarding who the eligible beneficiaries were.

However, at the local population level they felt that the beneficiary selection criteria were not uniform as a resident from an urban area pointed out. (P31): *'In my case, we have four brothers. I and my oldest brother got the money, but my two younger brothers did not.....in the similar case of two people whose concrete houses have cracked but not collapsed; one of them got his money whereas the other did not. We don't know whose mistake it is, whether an engineer or somebody else.'* The data from various sources tend to indicate that the incomplete beneficiary identification in the initial phase, the growing number of beneficiaries than the household damaged, and people's grievances regarding unfair selection might have caused a delay in the early identification of beneficiaries. This caused a delay in the release of the reconstruction policy from the centre, hence delaying the whole process.

4.2.2.4 House grant information: Barely 5% of the houses utilized the first house grant for the right purpose which was meant to utilize in their damaged house reconstruction. This was because of two reasons: first, they did not believe the Government that sufficient house grant was coming to them, and second, the first instalment of house grant was distributed just before the biggest festival 'Dashain' Nepal, and most of the beneficiaries spent the first tranche of house grant on it. When asked if the grants were misused, one of the residents in most recovered VDC recalled that the house grant money, whatever purpose it was meant for, brought some relief and good feeling among the residents, (P36): *'Yes, because it was issued right before the Dashain festival and even I used up that money for the festival purpose. After all, the most important thing after the disaster is to be able to eat, wear, and be alive, isn't that so sir? Rest all got buried in the debris. If we had been unlucky, I would not be able to talk to you right now.'*

The amount was small, and people were not convinced that it could support substantially in the house reconstruction, and they were uncertain whether or not they will be further supported by anymore cash. As one of Ward's chairman in most recovered VDC voiced the resident's opinions, (P24): *'some people say this will not be enough even to install DPC (Damp Proof Course, foundation level)! So, some of them spent it on paying off their loans, some spent it on drinking or gambling as it was the Dashain festival. Since the timeline for 5 years is a pretty long period and they thought they have enough time to worry about it.'* This led to the using up of house grants by residents for a completely different purpose than it was targeted for. This data tends to indicate residents believed that the Government failed to tap their emotions and hence could not fulfill their primary need at the time of crisis. The best strategy would be to provide a small amount to celebrate upcoming festivals just to boost the morale of miserable residents and then provide grants afterward.

4.2.2.5 House building guidelines: The house building criteria (earthquake resistant) were

considered too rigid by residents, village representatives, and even the Government representatives who had earlier coordinated all the relief and rescue works. The DCC officer explained, (P1): *'If one makes a house by simply four pillars and up to only one storey, if the house is made of mud, then it would be approved. This is the kind of guideline we have. But if someone unknowingly builds one pillar of 9 by 12 (standard says 12 by 12), then it will not be approved.'* A local restaurant owner from the most recovered village explained his difficulty, (P31): *'I have somehow built this truss and corrugated galvanised iron (CGI) sheets house by taking loans and other ways within my capacity. Now, the Government is saying that it does not meet the required standards. It would not be fair for me to demolish this house for the sake of a 3 lakh rupees grant, right? So, what should people like us do?'* A similar story was shared by a local Government representative in the least recovered VDC, (P29): *'In a place called Salme, 18 houses that were rebuilt supported by an individual Italian donor were stopped for the second tranche of house grant, because they did not meet the criteria.'* These experiences indicate that the residents felt the Government house grant criteria were rigid and were somewhat discouraged to initiate the house reconstruction.

There were instances of house grants stopped for the households which did not meet NRA reconstruction criteria. The reason for such rigid building criteria was to ensure safety as mentioned by the NRA authority. The NRA officer explained, (P4): *'we also have many difficulties and obligations. Some people say, "why is NRA so restrictive? Let the people have the money, who cares whether they build the house or not?" What if the building collapses again when there is another earthquake? Well, that's not what reconstruction is meant to be like!'*

The Government policy of house reconstruction criteria led residents to build houses smaller than their requirement. This was because the criteria of building a concrete roof house with more than two rooms would incur higher expenses which were difficult for the residents to afford. Hence, they resorted to building the two-room house with a tin roof, for which the cost would be low and had easier earthquake-resistant criteria. Participants in FGD explained (FGD6): *'If we build four rooms then we have to build concrete roof which has various other standards which is expensive. That is why we have built stone and mud houses with damp-proof course (DPC) and a tie beam'*. This revealed that the housing grant provided to support the building of the house was taken up by the residents as a complete cost to cover the full expenses. This was one of the confusions why the residents were not so eager to build their house until the Government set the deadline.

4.2.2.6 Government deadline to build the house: The Government deadline to start the house reconstruction, on the other hand, also created an acute shortage of reconstruction manpower and materials. All the residents started the reconstruction at the same time giving rise to a huge

demand for materials and manpower. As the National Reconstruction Authority official points out, (P3): *'now during the reconstruction period, 80,000 to 90,000 houses need to be built right! So, it is obvious that there would be a shortage of working manpower'*. As a resort, manpower from faraway places had come there to do the reconstruction works, but still, the demand was high. But this Government timeline to rebuild the house restarted the process of the long-standing reconstruction process. Almost all the Government and non-Government representatives mentioned that there had been a surge in the rebuilding process since the notice of the Government timeline. One ward chairman from most recovered reveals, (P23): *'If this mandatory timeline was not made, then the number of buildings that have been rebuilt until now may not have been built yet.'* So, the data indicates the Government timeline had played a positive impact on the reconstruction process, although some residents had problems due to a shortage of manpower and materials.

4.2.2.7 Vulnerable population: From the interviews and interactions, it was revealed that there were no distinct policies to help the vulnerable people and groups although, the Government mentioned that priority will be given to vulnerable populations such as single women, pregnant women and disadvantaged groups. The local resident in FGD vents her frustration, (FGD4) *'I am a single woman. My husband died long ago but I have not got money from the Government. Government officials did all the measurements and surveys of my house. They even took photos, but I do not know why they have not given me grants..... I am still living in that damaged house covering it on top with tin sheets.'* Interviews with the residents and Government authorities also revealed that there were no provisions to address the vulnerable population even in the crisis period, especially when they would be needing help the most. A district-level political leader shares his experiences of the early relief and rescue phase, (P7): *'The disabled, Dalits, single women, and elderly faced great difficulty in receiving relief; the relief didn't reach to them. While distributing relief, they distribute at a central point; the stronger ones seize all of them and the weaker vulnerable ones do not get a chance to reach them at all. Also, it was not possible to distribute house to house.'*

The Government authorities clearly admitted that they do not have a specific policy to help out these vulnerable groups other than just a verbal assurance that they will be prioritized, (P1): *'If we want to give the money, we must give it to all of them because they are all the ones whose houses have collapsed, regardless of whether they are single women or not. But later DDRC made this policy that we would prioritize single women, women-headed family, elderly persons, and family with a breast-feeding baby.'* Even the reconstruction authority NRA admitted their inability to do any further regarding vulnerable populations due to a lack of specific instruction and guidelines from above, although they claimed the matter was taken seriously by NRA. As one of the officers from NRA pointed out, (P3): *'There is one big issue*

I found out that in Sindhupalchowk, the underprivileged, single women, old people, and people without any family have difficulty rebuilding their homes. It is also found in reports.... I have not seen any organizations working on that. This indicated that there is some sort of lack of real understanding of the need and situation; a disconnect between those working on the front line and those in the central office making policies.

Some activities by an NGO were noted in a village that focused on providing small monetary help to children and senior citizens, but this was small scale. The NGOs and I/NGOs which were primarily meant to support the vulnerable population also showed their inability to help them substantially and tend to put up these responsibilities on the Government. As one of the NGO representatives even mentioned all the claims were not genuine, (P11): *'Well, the Government has given some priority to them. NGOs and I/NGOs also select the most vulnerable ones and prioritize accordingly for relief and recovery efforts. However, the voices are of the people like you and me rather than that of the vulnerable people.'* So, they just become topics of discussion but do not conclude in any decisions.' So, it was clear from all the stakeholders that vulnerable populations were prioritized verbally in words but not in practice. Only a few cases of houses built for the vulnerable population were observed and reported during the interviews and talks with residents and Government officials. This indicated the disconnect between what is promised and what actually happens.

4.2.3 House Grants

4.2.3.1 House reconstruction progress: Close to three years after the mega earthquakes of 2015, the house reconstruction works were not satisfactory. Only three percent of houses had been built at the time when this interview was conducted (National Reconstruction Authority, Sindhupalchowk). However, NRA sources revealed that around 95% of the houses will be built by the end of the Government allotted five-year plan of reconstruction. The local ward committee members and residents from one of the most recovered areas were hopeful about completing it on time. Most of the participants except single women in the FGD in this place had their houses almost completed. But the scenario was very different when it was the least recovered areas. In the FGD conducted in the least recovered village, most of the participants revealed that they had not started to build their houses. Around 90% of the whole VDC had not started their house reconstruction. They had problems regarding water, transportation, and primarily the land ownership disputes with religious trust. In another least recovered area, a resident shared his feeling about the reconstruction progress in this way, (P41): *'Just watch! They will do nothing in these five years! It will just pass by without doing anything!'* The NGO representatives, political leaders, and residents all doubted that the house reconstruction would go as planned. Two least recovered VDC/municipalities had delayed the reconstruction works

due to roads closed throughout the rainy season which caused difficulty in procuring reconstruction materials.

4.2.3.2 Complicated grant process: Most of the residents and local Government representatives complained about the house grant process as time-consuming and not resident-friendly. The process of house grant distribution was centralized from the district office DCC under the coordination of NRA. Looking after the affairs of the whole district with limited staff from one office was noted to delay the process of distribution. This authority was not allotted to local rural and urban municipalities. A local Government representative from the least recovered village shared his feelings, (P29): *' It would have been better if the rural municipalities had taken the responsibility of their regions instead of district office taking responsibility of the whole Sindhupalchowk.'* There were dispersed offices through which a beneficiary had to pass to get through their house grant instalment process. The local political leader explained that although people do not have to wait in the later period, they still had to pass through different offices in the district.

The DCC office representative went a step further to explain how difficult the process would seem, (P1): *'firstly, the person needs to go to the Building Construction Division and get a letter from the engineer. Then he must come here. We look at a list and prepare a payment order for him. He then must proceed to the Nepal finance Comptroller Office. Who knows where that is? This way, he ends up going from one place to another.'* A general person would have to go through multiple offices to get his job done with every office crammed up with a queue of people. The process would become more complicated if the beneficiary had to be changed in case of the absence of the primary beneficiary. The DCC official pointed out the practical difficulty in this process, (P1): *'The bank does not recognize Ward Office's recommendation for any kind of changes in beneficiary status.... The Ward office writes a recommendation, and we write a letter and based on that, the bank accepts it. This is not yet; they might face the same problem again in the third tranche because the name may not have changed in the NRA record.'* This gives us a picture of how complicated the house grant process was and how much difficulty people would have gone through before getting hold of their house grant instalment. These people are the ones who may be living without a house, may have experienced the death of loved ones, and probably have faced many unpleasant circumstances in their daily life. The culture of bureaucracy in circumstances such as this adds to the people's grief and pain.

The other reason for the delay in the house grant distribution as per a local leader in the district head mentioned, was the lengthy house map authorization process from the recognized engineers, preferably Government engineers. This was followed by structural analysis for the

big concrete residential buildings. The cost of map authorization at around Rs. 8000 (USD 69) was another issue which people were not very happy to pay. This map authorization was only found in urban municipalities as the rural municipalities did not require map authorization to build a house. The unavailability of a grievances form in the VDC office was also one of the reasons pointed out by the residents for the delay in the process of house grants.

The delay in the house grants was also caused due to beneficiaries' application files getting stuck in the district offices due to long queue. This complaint was from both the most and least recovered Government representatives, however the problems were more revealed in the least recovered VDCs/municipalities during the interviews. This is how a government representative at a 'least recovered VDC complained about the long holding of beneficiaries' files, (P29): *'It would have been better if the NRA had the whole set of people in one place including the engineers, then the work would have been faster. Instead, the NRA does not have its own staff to work and the people working for it have all other district issues to deal with. Therefore, there is a problem in the whole structure of the system.'* There were instances of files getting stuck in the district offices for days for small mistakes in the names of the beneficiaries. But these kinds of delays due to spelling mistakes in the name of beneficiaries were less evident in the most recovered VDC/municipalities. Almost all the local Government representatives from the most recovered areas did not face these problems of files getting stuck at the district offices. The reason could be because the most recovered villages were accessible and close to the district, or maybe they were in frequent contact with the district people compared to remote places.

The grant was also delayed in the least recovered village due to disputes related to trust land. Around 90 families of landless people were residing in the trust's land for generations. They had built houses on *Guthi* land, and it was not problematic as they were also harvesting crops (paying back some amount as rent) on its land until the earthquake flattened their houses. The Government criteria needed the land to be in their name and so would not allow the building of a house on the trust's land. They were hopefully in the process of getting compensation from the *Guthi* with the help of the Government to pass the land in their name. This was the major reason for the delay in the reconstruction and no one in this village had started to rebuild their house.

4.2.4 The role of NGOs and I/NGOs in the reconstruction

The role of non-Government organizations had a mixed impact on the reconstruction recovery as observed from the field visits and interviews with various participants in the least and most recovered VDC/municipalities. People had mixed feelings towards these donor agencies. Most of the I/NGOs working in the reconstruction had reduced responsibilities after the relief and

rescue phase of six months was over and reconstruction and rebuilding started. The primary role of house grants was provided by the Government. The I/NGOs were focusing on the building infrastructures such as restoring damaged water lines, setting up spring water collection tanks where there were none, helping building schools, building roads, health centres, and building detached toilets in their catchment area. As per the interviews with the Government and I/NGO authorities, they were working in coordination with local Government and working as per the guidelines of the Disaster Relief Committee (DRC). The house reconstruction and support works were run by only a few I/NGOs at limited places.

The DDRC focal person mentioned in the early phase of disaster recovery that there were many I/NGOs with questionable authenticity. At the time of chaos, no one questioned their motives and interests. This is how an I/NGO manager revealed his opinions, (P11): *‘There were some NGO/I/NGOs that appeared at that time which were not known to exist in the past.’* A local NGO personnel who became a politician mentioned that an NGO from a faraway place in the Eastern Hill region of Nepal came for relief distribution and took children who had lost their parents with them. They said they will educate and take care of these children, but instead, used them as farm labour to look after cattle. Finally, these children had to be rescued with the help of the Child Welfare Committee and the Women and Child Care Office. So, fake I/NGOs were common and no one knew their interest; however, this was not the case in the reconstruction phase. This fact from the residents and their representatives indicated that not all the I/NGOs could be confidently trusted, and their real intentions revealed until the program is over. This also demands the need for strict surveillance and continuous monitoring on the I/NGOs activities from the Government authority.

Although I/NGOs were found to be working efficiently on their target area and population, there were a few adverse charges laid against them by the local people, administrators, and political people during the reconstruction period. First, they considered that I/NGOs have big administrative costs. Second, they chose the area of their interest and did not prioritize the needy population seriously in need of external support. Third, these donor agencies were not transparent about their program cost and expenses. The last complaint was I/NGOs cover limited areas; some neighbourhoods benefited from their services whereas many others were left out. These allegations against the I/NGOs and their justification by their representatives are discussed in the subsequent paragraphs below.

4.2.4.1 I/NGOs administrative high costs: To explain the first point, I/NGOs representatives were interviewed about the reason behind their high administrative expenses. But an I/NGO representative working in the district centre denied the fact. He hinted that these were just

mere allegations and expenses incurred were justified given the nature of long hours of work. He explained, (P11): *'We don't just work 10-5 schedule, we work even overnight. I/NGOs personnel goes empty-handed left after the work is done. We must evaluate how much of output is yielded from the input of the Government body and that of an NGO/I/NGOs and then compare. Only if we compare in this way, then we will be fair. Otherwise, it would be a bias.'*

4.2.4.2 I/NGOs choosing their working area: The second criticism against I/NGOs regarding choosing the area they were interested in was only partly true. Most I/NGOs were allotted working areas by the DCC office upon the decision of DDRC. But some of the I/NGOs that were already there before the earthquake had been continuing in the same area. However, during the field observations by the researcher, it was clear the I/NGOs had not reached where people were in most need. For example, one of the least recovered VDC/municipalities had none of the houses built and they had serious problems with water and other resources. The majority of the village population belonging to underprivileged caste were landless people. However, the presence of I/NGOs in this village was non-existent.

The FGD held in the least recovered VDC revealed there was no presence of any I/NGOs in the area. No one in the discussion had seen or heard of development works done by some donor agencies. The district political leader explained the fact behind I/NGOs choosing a working area, (P7): *'Mostly, NGOs target to work in the areas where there are more minority people to be able to show their work outcomes more significantly. Hence most of them chose to work in Bhimtar. Many organizations-built homes there; many temporary ones and currently many concrete permanent ones too.'* This fact was almost admitted by all the local Government and NRA officials except for I/NGOs themselves. So, choosing the project area only based on the organization's interest and their limited capacity seemed to be unfair. However, the organizations working pre-earthquakes sticking on the same area seemed somehow reasonable as they knew the people and places better than any new organization.

4.2.4.3 I/NGOs not transparent on budgets: The third point that I/NGOs were not transparent was explained by a local Government representative in a most recovered VDC. He explained that an NGO working on building water tanks formed an I/NGO-local people committee to run the project but never revealed their budget to the residents. The local people had the feeling that the budget was higher than expected. This is how he related the incident, (P21): *'The engineer decides on what items to purchase. They transport the materials here after they have been purchased. Then the only thing done here is assigning the labour. We don't get to see actually how much they spent. But we don't know how much they received for it.'* Another incident experienced by ward chairman from the most recovered VDC in the different villages revealed that I/NGOs representatives openly admitted that their budget

cannot be revealed to local Government authority although they could not run the program without the local Government's authority, (P23): *'there was one organization that showed their budget. When I asked them about something; he said it was their internal matter.* Similarly, one I/NGO was not clear with their budget plan, and when asked they said, *"As we proceed, we don't know how much it will cost!"* Although the representatives revealed that the incidents happened earlier in the process, this indicated I/NGOs were not transparent in budget matters.

4.2.4.4 I/NGOs cover a limited area (inequitable distribution): The donor's support and aid are expected to be distributed equitably. The discussion and interviews with the stakeholders revealed that they acknowledged it is not about equality, however evidence from the field indicates that their assessment of need is poor so people that need are missing out. Both I/NGOs and Government representatives, as well as local residents, admitted that NGOs were covering only a limited area. This was due to their limited budget, (P11): *'We train the local carpenters and workers on BBB (Build Back Better). They work to build those homes. We have completed 50 such homes. Then we have Retrofitting in which we have completed 10 out of the 40 targeted homes.'*

It was found that people who were benefitted from I/NGOs service were happy and residents whose community did not get benefitted were the ones to complain. One such resident shared his experience, (P33): *'Many organizations would build a drinking water facility for one community whereas the next community would just watch them. They do not agree to share the facility even if we say we are going to contribute resources to it. After all we all affected people in problems.'* There was one incident as recalled by the district DDRC focal person, (P1): *'When we asked them not to miss any affected people while distributing the blanket, some of them also told us, "We don't do a census distribution". But in our case, we considered all of them to be needy ones because if someone's house has been destroyed, that is a needy person, so we distribute it to all of them.'* These facts and evidence indicated that in the process of not reaching those that need it, the Government and I/NGOs actually were increasing the inequity.

4.2.4.5 Training: Training provided by I/NGOs was a big issue among the residents and Government representatives. As per the DCC officer, I/NGOs did not conduct training as per the objectives in the disaster-affected area. He mentioned that the agencies were just completing the task of finishing up their budget. The organizations did not follow up to see if the trainee of skill-enhancing vocational training, such as masons and carpenters were utilizing their skills in daily life after getting trained. When the official mentioned that the training was just a waste of budget and did not work as per I/NGOs targeted outcome, they stopped inviting

him to the programs but continued their training. Participants in the least recovered VDC admitted getting mason training that spanned 7 days, but it did not help much in practice. The NRA official hinted that organizations were not prioritizing vulnerable populations as promised and were enrolling members from their network recommendations. People and political party leaders were attracted as they could help people get some allowances during the training. The training was not useful in practice which was clear from the shortage of skilled manpower and masons coming from as far as two days travel to meet the workforce requirement.

The district head of the NRA office mentioned that about 50 women got 45 days mason training. This was conducted in three districts and the women were certified as trained mason workers, but the organization had no further plan as to how to put women in real work. None except one found a labouring job. This indicated that I/NGOs had wasted resources and money in training, which could be utilized to do more important jobs in the reconstruction. The training programs were almost the same and the researcher could find almost no evidence that the training was utilized for the house reconstruction. For the residents, attending training programs was like attending some kind of feast, (P4): *'Let's go to have the training. It was just like let's go to have a feast or dinner party. They do not say "let's go to get the training". That is because when they go for it, they get allowances there! They get refreshments in the training.'* In summary, the interviews and field evidence indicated that the training provided by I/NGOs was not utilized as aimed. It seemed a large sum of money and resources got wasted while providing training.

It needs to be acknowledged that many I/NGOs were effective at building infrastructures and that damaged water supplies were quickly restored. The target population benefited from their reconstruction works. Some of the VDCs/municipalities were getting full support for house reconstruction. I/NGOs were supplying the villages with engineers to help in the house building criteria. Social mobilizers were employed to inform the local residents and monitor the reconstruction works. Two of the most recovered villages which had almost 75% houses built were supported by I/NGOs. This indicated the community looked after by I/NGOs in house reconstruction were the most recovered ones.

4.2.5 People and community in the reconstruction

The major problems the residents were facing in the reconstruction were the reconstruction manpower and materials. The least recovered villages had added problems of bad roads which would remain open only six months in a year. Some of the villages in the least recovered VDC/municipalities had the acute problem of a lack of water even for drinking purposes, let alone building a house. For this reason, the house building was pending until the water source

as promised by ward committee members would arrive.

The practice of religious and caste discrimination was found to be in practice in the remote villages in the study area. The Government and non-Government representatives admitted that there was a feeling of caste belongingness and a sense of high and low caste, but they denied that it was in practice. People from a least recovered village denied accepting the relief just because it was donated from an overseas Church organization. This was because the local residents were advised by some people that donor agency will later convert their religion if they accept the donations from them. So, the donations coming from the church were only distributed among the Christians.

A Christian pastor and a participant of FGD vented his frustration, (FGD10): *'Aren't the Christians and we Hindus the same brothers and sisters? Why is there such discrimination? Aren't we from the same village?'* This is how a Ward committee member from the least recovered VDC gracefully mentioned the practice of caste discrimination, (P29): *'Even though they may not let them enter their homes, they are still respectfully welcomed to stay outside. They do not say it directly anymore.'* This caste-based discrimination was openly admitted in a neighbourhood of another least recovered VDC. A higher caste family faced a social boycott after his son married a *Dalit* woman. This family went through mental trauma and finally when he agreed to spend the amount of money as demanded by a local priest to conduct some religious cleansing process then he was allowed to participate in the public ceremonies. His son had to live away from the village with his wife.

There was also another incident shared by a *Dalit* caste young man who said his childhood friend from the village discriminated against him and did not allow him to remain in the same room and hit him just because he was from lower caste, (P40): *'You are of lower caste! You must not touch!'* Even while returning, he kept saying that I should not stay in the same room. The other friends tried to make him understand but he would not understand. He also hit me.' He also explained that touching the water source while the higher caste is filling their pot would defile their water, but it would not defile if the lower caste would repair the tap. Similarly, once they had the dispute over water pipelines that supplied water, (P40): *'Yes. If they step over our pipe, then they say that it doesn't matter because they say that they are of a higher caste. It's just that we shouldn't step over theirs.'* However, almost all the ward committee chairs and members mentioned that there had not been any instances of discrimination based on the house reconstruction process and grant distribution. All the people were treated equally from the ward office. The researcher could not find any local Government representatives from the *Dalit* caste to interview, hence was not very convinced by the statements made by the local Government representatives.

4.2.6 Conclusion

The evidence from all the interviews and discussions and the field observations revealed that all the authorities and resources were baffled by the scale of the disaster in the initial phase of the disaster. The place suffered heavy damage and destruction to lives and properties. Almost 90000 people died, around 22000 people were injured, almost half a million people became homeless in this event leaving many vulnerable people behind, especially if a significant earner of the household had died. With the help of active local authorities and residents, the relief and rescue were managed orderly amidst the fear and uncertainty. The house reconstruction got delayed and some villages lagged in the reconstruction. Besides the delay from the centre in formulating disaster policy and establishing the apex authority to oversee the whole disaster process in Nepal, there were local reasons for the delay in reconstruction at the community level.

The primary reasons for delays in the house reconstruction were mostly related to procedures and process of house grant distribution, such as late arrival of house grant, uncertainty regarding the house grant, complicated process to receive the grant instalments, centralized grant distribution process, and stringent house construction policy. The intricate bureaucracy and impractical policies in the grant distribution process causes a lot of grief and pain for the residents. The residents in the rural area were facing the problems of shortage and difficulty of manpower and human resources because of bad roads and high prices.

There was evidence of lack of coordination between agencies in implementing programs and sharing of resources which could have avoided wasted effort and potential delays in reconstruction works. The newly elected Government representatives were actively involved and taking ownership of reconstruction works in some places especially in the most recovered villages, but it was not the case in the least recovered villages. Some sort of disconnect was observed between those working on the frontline and those in central office: what had been promised for a vulnerable population and what was in practice in the field; and the Government talk regarding discrimination against *Dalits* and what was evidenced in the field.

Examples of bad practice, such as child trafficking under the cover of NGO's work, incidents of caste discrimination, and instances of bribery in the Government offices were also revealed during the field study, which indicates the vulnerability of the residents in the society and how it could impact the recovery and their rehabilitation. The NGOs were effectively providing their services and facilitating the reconstruction process in some areas. However, their presence in the least recovered VDC/municipalities were found to be almost non-existent and the vocational training was not much of a help to the residents. Financial cooperatives and

active local Government representatives were key to early reconstruction and recovery which were mostly found in most recovered VDC/municipalities.

4.3 Descriptive tables of potential determinants of the progress of disaster reconstruction

The descriptive tables include a comparison of the household characteristics and the potential determinants of the reconstruction status between the least and most recovered VDC/municipalities. The reconstruction progress status of the community, whether least and most recovered, was taken as an indicator of disaster recovery in this study. The information is presented in tables with frequency and proportion for categorical variables and mean and standard deviation for continuous variables.

a. Demographic characteristics of the earthquake-affected households

Table 10 shows the demographic characteristics of the family members of the questionnaire respondents by reconstruction status. This study surveyed a total of 744 households covering 3595 household members. The symbol N reported in the title bar in each cell represents the total population count of variables, respectively. The total population count of variables that reported less than the title bar in any cell is reported with their respective group totals.

Table 10 Demographic characteristics of family members of earthquake-affected households by most and least recovered VDC/municipalities, Sindhupalchowk district Nepal, 2017/18

Demographic Characteristics	Most Recovered Number (%) N=1867	Least Recovered Number (%) N=1728	Total Number (%) N=3595	P-value
Age				
Mean (SD)	29.8 (18.56)	28.5 (18.75)	29.2 (18.66)	0.005
Min-Max	0.17-92	0.08-96	0.08-96	
Age Category				
Up to 18 years	582(31.2)	566(32.8)	1148(31.9)	0.438
19-40 years	809(43.3)	756(43.8)	1565(43.5)	
41-60 years	348(18.6)	288(16.7)	636(17.7)	
Above 60 years	128(6.9)	118(6.8)	246(6.8)	
Gender				
Female	931(49.9)	817(47.3)	1748(48.6)	0.121
Male	936(50.1)	911(52.7)	1847(51.4)	
Education level				
Can't read and write	410(23.2)	505(32.1)	915(27.4)	<0.001
Can read and write only	330(18.7)	252(14.3)	555(16.6)	
Primary(1-7)	421(23.8)	451(28.7)	872(26.1)	
Secondary(8-10)	370(20.9)	252(16.0)	622(18.6)	
Higher Secondary(11/12)	211(11.9)	116(7.4)	327(9.8)	
Bachelors and above	25(1.4)	25(1.6)	50(1.5)	
Total	1784	1604	3341	

Occupation				
Agriculture/Farming	755(45.5)	788(54.8)	1543(49.9)	<0.001
Service/wages/daily job	228(13.8)	245(17.0)	473(15.3)	
Own business/shops	46(2.8)	29(2.0)	75(2.4)	
Non-working	629(41.3)	375(32.1)	1004(36.9)	
Total	1658	1437	3095	
Organizations involvement				
Social welfare	120(6.4)	5(0.3)	125(3.5)	<0.001
Cooperatives/management commit.	131(7.0)	168(9.7)	299(8.3)	
No membership	1616(86.6)	1555(90.0)	3171(88.2)	

The population distribution of family members of households of the least and most recovered VDC/municipalities was similar. The average age of the family members of the study households was 29 years with a similar distribution of mean age in both types of community. The highest proportion of the members of households belonged to 19-40 years followed by children under 18 years. The least recorded proportion of the population group was over 60 years old. Almost half of the household members of the households were females although males were slightly higher in proportion. Almost similar proportions of men and women were distributed in both least and most recovered areas. The overall literacy rate of household members of the study population was very low. Almost half of the population could not read and write, and a significant proportion was just able to read and write (without formal education), however, almost one-third of the population had formal schooling (Table 10). The higher illiteracy was observed among the family members of the least recovered VDC/municipalities compared to the most recovered VDC/municipalities. Almost half of the family members of the respondents were involved in farming as their major occupation followed by non-working family members.

Less than 15% had a regular job and very few were involved in business activities (Table 10). A higher proportion of family members were involved in agricultural and daily job activities in the least recovered VDC/municipalities compared to most recovered whereas, the non-working population was more prevalent in the most recovered VDC/municipalities. The result showed a large proportion of the sample population were not involved in any kind of social, political, or financial organization. Only around 8% of the population were a member of some kind of multipurpose financial cooperatives or management committee such as school and forest management committees. The distribution of organizational attachments was similar in the household members of both the least and most recovered VDC/municipalities except that household members from least recovered VDC/municipalities were less involved in social welfare organizations compared to most recovered VDC/municipalities.

Table 11 Demographic characteristics of the respondents of earthquake-affected households by most and least recovered VDC/municipalities, Sindhupalchowk district Nepal, 2017/18

Demographic Characteristics	Most Recovered Number (%) N=373	Least Recovered Number (%) N=371	Total Number (%) N=744	P-value
Age				
Mean (SD)	43.60(15.05)	43.59(14.74)	43.60(14.89)	0.983
Min-Max	16-90	18-88	16-90	
Age Category				
18-40 years	171(45.8)	183(49.3)	354(47.6)	0.220
41-60 years	155(41.6)	132(35.6)	287(38.6)	
Above 60 years	47(12.6)	56(15.1)	103(13.8)	
Sex				
Female	176(47.2)	136(36.7)	312(41.9)	0.004
Male	197(52.8)	235(63.3)	432(50.1)	
Education level				
Can't read and write	159(42.6)	193(52.0)	352(47.3)	<0.001
Can just read and write(informal)	117(31.4)	65(17.5)	182(24.5)	
Primary(1-7)	36(9.7)	56(15.1)	92(12.4)	
Secondary(8-10)	31(8.3)	41(11.1)	72(9.7)	
Higher Secondary(11/12) and above	30(8.0)	16(4.3)	46(6.2)	
Occupation				
Agriculture/Farming	277(74.3)	299(80.6)	576(77.4)	0.031
Service/wages/daily job	53(14.2)	47(12.7)	100(13.4)	
Own business/shops	13(3.5)	13(3.5)	26(3.5)	
Non-working	30(8.0)	12(3.2)	42(5.6)	

Table 11 shows the demographic information of the respondents by reconstruction status. The information is compared between the most (N=373) and least recovered (N=371) communities as reported in the title bar. The average age of the respondents was around 43 years. Almost half of the respondents belonged to the younger age group (18-40 years) slightly over one-tenth of the respondents were over 60 years. The literacy pattern of the respondents reflected their family's literacy status which revealed almost two-thirds of the population were either unable to read and write or had only preliminary reading and writing skills. More respondents were unable to read and write in the least recovered VDC/municipalities compared to most recovered VDC/municipalities. Least recovered VDC/municipalities had more respondents involved in farming, whereas the most recovered VDC/municipalities had more respondents involved in regular earning jobs as well as non-working members.

Table 12 Household characteristics of the respondents of earthquake-affected households by most and least recovered VDC/municipalities, Sindhupalchowk district Nepal, 2017/18

Characteristics	Most Recovered Number (%) N=373	Least Recovered Number (%) N=371	Total Number (%) N=744	P-value
Family Size				
Mean (SD)	5.01(2.00)	4.66(1.97)	4.83(1.97)	0.016
Min-Max	1-14	1-14	1-14	
Family size category				0.090
1-2 members	38(10.2)	43(11.6)	81(10.9)	
3-4 members	127(34.0)	153(41.2)	280(37.6)	
5-6 members	139(37.3)	125(33.7)	264(35.5)	
More than 6 members	69(18.5)	50(13.5)	119(16.0)	
Family Type				0.755
Nuclear	219(58.7)	222(59.8)	441(59.3)	
Joint	154(41.3)	149(40.2)	303(40.7)	
Ethnicity				<0.001
Privileged (<i>Brahmin/Chhetri</i>)	85(22.8)	90(24.3)	175(23.5)	
<i>Janajati</i> (other than <i>Tamang</i>)	148(39.7)	62(16.7)	210(28.2)	
<i>Dalit</i>	39(10.5)	8(2.2)	47(6.3)	
Majority <i>Janajati</i> (<i>Tamang</i>)	78(20.9)	117(31.5)	195(26.2)	
Underprivileged <i>Janajati</i> (<i>Danuwar/Pahari</i>)	23(6.2)	94(25.3)	117(15.7)	
Religion				<0.001
Hindu	283(75.9)	201(54.2)	484(65.1)	
Buddhist	90(24.1)	170(45.8)	260(34.9)	
Dependency ratio (age less than 18 and more than 60yrs)/(age 18 to 60 yrs)				0.160
Mean (SD)	66.089(60.749)	72.358(60.859)	69.21(60.84)	
N	373	371	744	
Membership to any organization				<0.001
Social welfare	52(13.9)	4(1.1)	56(7.5)	
Cooperatives/management committees	60(16.1)	89(24.0)	149(20.0)	
No membership	261(70.0)	278(74.9)	539(72.5)	

Table 12 shows the descriptive characteristics of households of the respondents by reconstruction status. Around 5 people on average lived in a family in the study population. Smaller size families were found in households of least recovered VDCs/municipalities whereas bigger family size was found in most recovered VDCs/municipalities. A higher proportion of the households belonged to a nuclear family and this pattern was similar among both types of community. The highest proportion of caste/ethnic groups belonged to a combination of caste/ethnic groups falling under ‘*Janajati*’ category (mid-level caste hierarchy) as categorized by Government authority of Nepal. More ‘*Janajati* (other than *Tamang*)’ group lived in most recovered VDCs/municipalities. *Tamang*, which was the majority caste/ethnic group in the whole district, was the second biggest group and had higher

population distribution among the households of least recovered VDCs/municipalities. Similarly, the distribution of underprivileged '*Janaajati*' caste/ethnic was found more in the least recovered VDCs/municipalities.

However, the most recovered VDCs/municipalities had a higher proportion of '*Dalit*' caste/ethnic group compared to the least recovered ones (8 households). The majority of the households followed the Hindu religion, and this religion was slightly more common in the most recovered VDCs/municipalities. Buddhism was common in the least recovered VDCs/municipalities due to the higher proportion of caste groups such as Tamang and some *Janaajati* caste/ethnic groups in this area that follow Buddhism.

To assess the strength of the household in terms of ratio of dependent age group members to potential earning age groups members, a dependency ratio was calculated. The ratio was calculated dividing all the dependent household members (aged less than 18 years and those above 60 years) by members of productive age (18-60 years) calculated per hundred. The dependency ratio was found to be higher in the least recovered VDCs/municipalities (table 12). Low involvement of household members was observed in social, financial, and other organizations. Almost three-quarters of the households had no involvement or connection with any type of organization. Results revealed that the household members from the least recovered VDCs/municipalities were more involved in cooperatives and management committees such as school and local forest management committees etc., whereas members from most recovered VDCs/municipalities were found to be involved more in social welfare organizations such as rotary, lions, and local clubs etc.

4.4 Development of Community Resilience Scale

The community resilience scale included 25 items structured with positive statements. The higher scores represented better resilience capacity. The responses were recorded in five-point Likert items where 1 represented totally disagree and 5 represented totally agree. The items of each sub-scales were averaged to get a single composite score for the final regression model. The information of Likert scores is presented in graphs to have a visual understanding of the distribution of data representing six subscales of community resilience scale determined by exploratory factor analysis.

Table 13 Mean comparison of community resilience 25 items composite scale of earthquake-affected households by most and least recovered VDC/municipalities, Sindhupalchowk district Nepal, 2017/18

Community resilience scale 25 items	N (Cronbach Alpha Value)	Most Recovered Mean (SD)	Least Recovered Mean (SD)	Total Mean (SD)	P-value
Composite mean score	739 (0.89)	3.70 (0.42)	3.46(0.49)	3.58(0.47)	P<0.001
Min-Max		2.29-4.83	2.13-4.46	2.13-4.83	
N		369	370	739	

Table 13 shows the overall mean score of resilience scale was better among the most recovered VDCs/municipalities indicating better resilience capacity compared to least recovered VDCs/municipalities.

Table 14 Community resilience scales with six-sub scales by reconstruction status of earthquake-affected households by most and least recovered VDCs/municipalities, Sindhupalchowk district Nepal, 2017/18

Characteristics	CCRAM 10 items	Total resilience 25 items	Connectedness 6 items	Disaster Management 5-items	Community communication 3 items	Trust towards local Government 5 items	Accessibility to administrative facilities 3 items	Place attachment 3 items
Cronbach Alpha Value	0.83	0.89	0.79	0.80	0.74	0.68	0.70	0.56
N	739	739	739	739	739	739	739	739
Recovery category(mean)								
Most Recovered	39.08	3.69	3.89	3.34	3.70	3.47	3.72	4.32
Least recovered	38.02	3.44	3.67	2.87	3.24	3.33	3.67	4.16
P Value	<0.001	<0.001	<0.001	<0.001	<0.001	0.0034	0.2180	<0.001

Table 14 provides the information regarding the six sub-scales of community resilience. All the resilience sub-scales had acceptable internal consistency (Cronbach Alpha >.70) except for ‘trust towards local government’ (Cronbach Alpha =0.68) and ‘place attachment’ (Cronbach Alpha=0.56). The cross tabulation of each resilience construct with recovery category demonstrated that overall community resilience and all the sub-scales except ‘accessibility to administrative services’ were found to be significantly higher among the most recovered VDCs/municipalities indicating the households from the most recovered VDCs/municipalities had better resilience capacity compared to the least recovered VDCs/municipalities.

Development and validation of Community resilience tool

After an iterative process of items refining during pre-testing pilot, and re-testing along with the feedback of residents, 46-item community resilience tool was reduced to 27 items and tested among 744 households in the earthquake-affected communities in Sindhupalchowk district of Nepal (Fig 3).

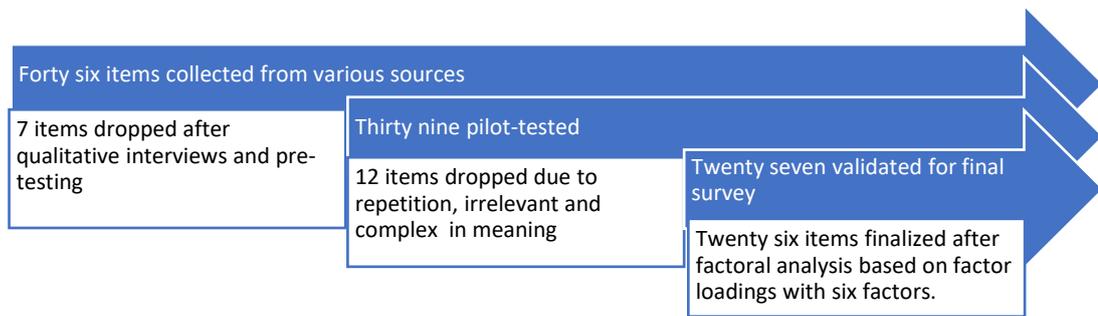


Figure 3 Steps of finalization of community resilience tool items

Table 15 Exploratory factor analysis on community resilience scale (25-items) with factor loadings, of earthquake-affected households by most and least recovered VDCs/municipalities, Sindhupalchowk district Nepal, 2017/18

	Variable	Factors						Uniq.
		1	2	3	4	5	6	
1	People in my community feel like they belong to the community.	0.7618						0.3608
2	People in my community help each other in their daily life.	0.7014						0.3304
3	People in my community are committed to the development and well-being of the community	0.6793						0.3730
4	My community also collaborates with organizations and agencies outside the community to get things done.	0.4913						0.5944
5	People in my community can be trusted	0.4216						0.5004
6	People in my community discuss issues so they can improve the community.	0.4099						0.6595
7	My community has services and programs to help people after a disaster or community crisis. (during the relief and rescue)		0.8004					0.2966
8	My community has programs to support the care and safety of handicapped, pregnant, women, old age, and children after a disaster.		0.6543	0.4025				0.4039
9	My community can provide emergency services during a disaster. (Services like rescue, ambulance, health, etc.)		0.6352					0.4646
10	My community actively prepares for future disasters and community crises.		0.6124					0.4042
11	If a disaster or community crises occur my community provides information about what to do.		0.5271					0.4373
12	My community has effective leaders			0.7206				0.3737
13	My community looks at its successes and failures so it can learn from the past.			0.6359				0.4586
14	My community people trust municipal council representatives			0.5781				0.4445
15	Municipal local council treats people fairly no matter what their background is.			0.5144				0.4682
16	The road and transportation in my community are accessible to essential services like hospitals and emergency services.			0.4108				0.5081
17	People in my community are able to get the services they need				0.8505			0.2467
18	People in my community know where to go to get things done.				0.8151			0.2917

19	Communication sources used by my community are effective in reaching residents. (Communication sources may include, for example, television, radio, newspaper, internet, telephone, local organizations)	0.4567		0.5658
20	Local information about issues in my community is generally accurate and fair	0.6568		0.3768
21	My community keeps people informed about issues that are important to them.	0.6053		0.4121
22	My community holds meetings to voice views, opinions.	0.5571		0.4623
23	I am proud to tell others where I live.		0.8296	0.2651
24	I would be sorry to leave the community where I live.		0.8077	0.3105
25	My remaining in this community is connected to beliefs and values which are common to community members		0.4032	0.4212

The exploratory factor analysis with varimax rotation conducted on the 27 items determined the items were represented by seven factors based on Eigen cutoff value 1. One item was dropped since the last factor had only one item and the whole process of analysis was repeated with 26 items, resulting in six factors. Bartlett's test of sphericity ($P < 0.001$) and Kaiser-Meyer-Olkin measure of sampling adequacy value ($KMO=0.888$) both indicated the suitability of the data for structure detection.

Table 19 reveals the final factor loadings of a 26-item community resilience tool after the factor analysis which yielded six distinct constructs, explaining 57.6% of the variance. One item regarding the utilization of local internal resources by the community was excluded due to factor loading < 0.4 , therefore only 25 items were used in this scale. Overall, the community resilience scale with 25 items as a whole, and its subscales showed good internal consistency on the Cronbach alpha test. The Cronbach alpha value of the whole scale was 0.89.

The first construct ($\alpha=0.79$) had six intercorrelated items representing the concepts of community connection, organization, and mutual help and support, so this latent construct was labeled as "community connectedness". The second construct ($\alpha=0.80$) was composed of five intercorrelated items representing the issues related to disaster management capacities and abilities of the community, so it was labelled "disaster management". The third construct "leadership/governance" ($\alpha=0.68$) was composed of five items mostly related to trust towards Government and leadership, accessibility of infrastructure, and fairness of and good governance. The fourth construct "administrative services accessibility" ($\alpha=0.70$) was composed of 3 items that represented the knowledge and accessibility of community people to the essential administrative facilities and resources. The fifth construct "information and communication" ($\alpha=0.74$) composed of 3 items and represented the issues regarding the local community communication and trustworthiness of the information. The last construct "place attachment" ($\alpha=0.56$) was composed of three items that dealt with the issues regarding how well the community people identify and attach themselves to the community.

The overall community resilience tool was highly correlated with its sub-scales (Pearson correlation coefficient ranging from 0.57-0.83) except for place attachment (correlation coefficient=0.37). Similarly, the whole resilience scale and its subscales were significantly correlated with validated 10-item community resilience tool with moderate to high correlation indicating satisfactory convergent validity.

The independent student t-test result revealed that community resilience (mean score) was observed significantly higher among the households from recovered VDCs/municipalities compared to least recovered except for administrative accessibility construct ($p\text{-value} = 0.218$). This finding further supports the convergent validity of the tool.

4.5 Univariate analysis of potential determinants of the progress of disaster reconstruction

A univariate analysis was done to examine the relationship of all potential predictor variables with reconstruction status, measured as ‘most recovered’ and ‘least recovered’ communities. After excluding predictors that were not endorsed by many participants, 27 potential predictor variables were identified from the univariate analysis (Tables 16-21). These potential predictors were indicators of household demographic characteristics, economic status, impact and loss due to the earthquake, reconstruction and accessibility to essential facilities, accessibility to facilities and services, risk topography, social support and participation and six subscales of community resilience namely, community connectedness, disaster management, information and communication, leadership/governance, administrative services accessibility and place attachment. The most recovered VDC/municipalities in the outcome variable was used as the reference category.

Table 16 Comparison of demographic characteristics of earthquake-affected households by most and least recovered VDCs/municipalities, Sindhupalchowk district Nepal, 2017/18

Characteristics	Most Recovered Community	Least Recovered Community	Total	Crude Odds Ratio (95% CI)	P value
Family Size Mean (SD) Min-Max N	5.01(2.00) 1-14 373	4.66(1.97) 1-14 371	4.83(1.97)	0.91 (0.85, 0.98)	0.016
Age in years Mean (SD) Min-Max N	43.60(15.05) 16-90 373	43.59(14.74) 18-88 371	43.60 16-90 744	0.99(0.99, 1.00)	0.983
Gender Female Male	176(47.2) 197(52.8)	136(36.7) 235(63.3)	312(41.9) 432(58.1)	1.00 1.54 (1.15, 2.07)	0.004
Education Can read and write-school going Can't read and write	214(57.4) 159(42.6)	178(48.0) 193(52.0)	392(52.7) 352(47.3)	1.00 1.46 (1.09, 1.95)	0.010
Occupation Agriculture/Farming Service/wages/daily job Own business/shops Non-working	277(74.3) 53(14.2) 13(3.5) 30(8.0)	299(80.6) 47(12.7) 13(3.5) 12(3.2)	576(77.4) 100(13.4) 26(3.5) 42(5.6)	1.00 0.82 (0.54, 1.26) 0.93 (0.42, 2.03) 0.37 (0.19, 0.74)	0.365 0.849 0.005
Dependency ratio (age less than 18 and more than 60yrs)/(age 18-60 yrs) Mean (SD) Min-Max N	66.09(60.75) 0-300 373	72.36(60.86) 0-400 371	69.21(2.23) 0-400 744	1.00 (0.99, 1.00)	0.161

Table 16 compares the demographic factors among 744 households affected by the 2015 Nepal earthquake by reconstruction status. The odds ratio with 95% Confidence Interval (95%CI) relates the demographic characteristic with most/least recovered VDCs/municipalities. Family size was smaller in size in least recovered than most recovered VDCs/municipalities but the mean age distribution of the respondents in years were similar in both the areas. Proportion of female were higher, but literacy was better among the respondents of the most recovered VDCs/municipalities compared to least recovered. Higher proportion of non-working respondents were from most recovered than least recovered VDCs/municipalities, however the dependency ratio of the household were almost similar in both the places.

Table 17 Comparison of household characteristics and income of the respondents by reconstruction status, Sindhupalchowk district Nepal, 2017/18

Characteristics	Most Recovered Community	Least Recovered Community	Total	Crude Odds Ratio (95% CI)	P Value
Membership to any organization					
Membership	112 (30.03)	93(25.07)	205(27.55)	1.00	
No membership	261(69.97)	278(74.9)	539(72.45)	1.28 (0.93, 1.77)	0.130
Caste/Ethnicity					
Privileged (<i>Brahmin/Chhetri</i>)	85(22.8)	90(24.3)	175(23.5)	0.26 (0.15, 0.45)	<0.001
<i>Janajati</i> (other than Tamang)	148(39.7)	62(16.7)	210(28.2)	0.10 (0.06, 0.18)	<0.001
<i>Dalit</i>	39(10.5)	8(2.2)	47(6.3)	0.05 (0.02, 0.12)	<0.001
Majority <i>Janajati</i> (Tamang)	78(20.9)	117(31.5)	195(26.2)	0.37(0.21, 0.63)	<0.001
Underprivileged <i>Janajati</i>	23(6.2)	94(25.3)	117(15.7)	1.00	
Monthly Family income range (in Rs.)					
> Rs. 10,000	235 (63.3)	198 (53.9)	433(58.7)	1.00	
≤Rs.10,000	136 (36.7)	169 (46.05)	305(41.3)	1.475 (1.10, 1.98)	0.010
Agricultural land owned (in <i>Ropani</i>)					
Mean (SD)	8.42(5.61)	6.63(9.28)	7.54 (7.68)	0.961 (0.94, 0.99)	0.003
Min-Max	1-35	0.5-100	0.5-100		
N	347	335	682		
Estimated financial loss *000 in Rs.					
Mean (SD)	25.84 (38.78)	33.80 (63.7)	29.81(52.8)	1.00 (1.00,	0.044
Min-Max	0-240	0-460	0-460	1.000064)	
N	373	370	744		

Table 17 compares household and economic characteristics by reconstruction status. The univariate analysis revealed that all the privileged and underprivileged ethnic groups had the lower likelihood of living in least recovered VDCs/municipalities when compared to underprivileged *Janajati* ethnic group. The household with family income less or equal to Rs. 10,000 had higher likelihood of residing in the least recovered VDCs/municipalities compared to household earning more than Rs. 10,000 per month. The agriculture land holding measured in *Ropani* (1 *Ropani*=5476 Square Feet). The lower land holding among the household family

was associated with residing in the least recovered VDCs/municipalities. Similarly, higher likelihood of financial loss due to earthquake were found among the household of least recovered compared to most recovered VDCs/municipalities. There was no significant difference in the organization membership between the household of least and most recovered VDCs/municipalities.

Table 18 Comparison of information on impact on households due to earthquake, reconstruction progress and accessibility to essential facilities, Sindhupalchowk district Nepal, 2017/18

Characteristics	Most Recovered Community	Least Recovered Community	Total	Crude Odds Ratio (95% CI)	P value
Impact on the facilities Mean (SD) Min-Max N	3.11 (0.58) 1.75-4 370	3.22 (0.61) 1.5-4 370	1.69 (0.46) 1.5-4 742	1.37 (1.07, 1.74)	0.012
Time to reach essential facilities Mean (SD) Min-Max N	2.51(0.60) 1-4.13 370	2.71 (0.56) 1.36-3.98 368	2.61 (0.59) 1-4.13 738	1.81 (1.41, 2.34)	<0.001
Accessibility perception Mean (SD) Min-Max N	2.41 (0.82) 1-4.5 370	2.52 (0.64) 1.25-3.75 368	2.46 (0.74) 1-4.5 738	1.22 (0.99, 1.48)	0.051

Table 18 examines the impact of the earthquake on the facilities and accessibility of the households to essential facilities and services by reconstruction status. Greater severity of the impact of earthquake on households were associated with the increased the likelihood of residing in the least recovered VDCs/municipalities (Table 18). Similarly, increasing severity of difficulty in accessing the listed essential facilities and services (marketplace, school, health centre, council office, DCC office, bank, security, and emergency service) increased the likelihood of households being in least recovered VDCs/municipalities but had only marginal difference statistically (P-value 0.051).

Table 19 Comparison of topographical risk to the households and Aid/grant information of earthquake-affected households by most and least recovered VDCs/municipalities, Sindhupalchowk district Nepal, 2017/18

Characteristics	Most Recovered Community	Least Recovered Community	Total	Crude Odds Ratio (95% CI)	P value
Location of house before quake					
Low risk	258(69.5)	207(56.6)	465(63.1)	1.00	
High risk	113(30.5)	159(43.4)	272(36.9)	1.75 (1.30, 2.37)	<0.001
Location of house after quake					
Low risk	257(69.3)	200(54.8)	457(62.1)	1.00	
High risk	114(30.7)	165(45.2)	279(37.9)	1.86(1.38, 2.52)	<0.001
Time first tranche of the grant received (in months)					
Mean (SD)	1.27(0.53)	1.80(0.63)	1.53 (0.64)	4.70 (3.44, 6.41)	<0.001
Min-Max	0.5-2.9	0.58-2.9	0.5-2.9		
N	334	322	656		
Any vocational training received?					
Yes	32(8.6)	52(14.1)	84(11.4)	1.00	
No	338(91.4)	318(85.9)	654(88.6)	0.58 (0.36, 0.92)	0.022

Table 19 shows comparisons of topographical hazards, house grants and aide information by reconstruction status. Households from the communities that were situated in hazardous locations, for example, on a riverbank or in a landslide-prone area, before the earthquake were more likely to be least recovered and this was true for the households situated in the hazardous locations after the earthquake.

The delay in the receipt of house grants had a significant impact where households from the communities that received late house grants were more like to be least recovered than households that received grants earlier. But contrastingly, family members from households that received vocational training were more likely to be in less recovered VDCs/municipalities compared with the family members from the households that did not receive training (Table 19).

Table 20 Comparison of social capital and governance information of earthquake-affected households by most and least recovered VDCs/municipalities, Sindhupalchowk district Nepal, 2017/18

Characteristics	Most Recovered Community	Least Recovered Community	Total	Crude Odds Ratio (95% CI)	P value
Trust towards disaster officials Mean (SD) Min-Max N	3.06 (0.45) 1.25-4.25 368	3.21(0.52) 1.67-4 368	3.14 (0.49) 1.25-4.25 736	1.91 (1.41, 2.59)	<0.001
Social support scale Mean (SD) Min-Max N	3.65 (0.54) 1.83-4.83 369	3.55 (0.49) 1-4.83 370	3.60 (0.52) 1-4.83 739	0.66 (0.50, 0.88)	0.005
Social participation Mean (SD) Min-Max N	1.95 (0.31) 1-3 368	1.99(0.28) 1-3.75 370	1.97 (0.30) 1-3.75 738	1.14 (1.01, 1.29)	0.036

Table 20 compares trust towards the officials involved in the disaster reconstruction and social capital and social activities of the household members by reconstruction status. Higher level of trust towards the disaster officials was associated with being in the least recovered VDCs/municipalities. Household exhibiting higher social capital had a higher likelihood of being in the most recovered VDCs/municipalities. However, the households with frequent social participation tended to be in least recovered VDCs/municipalities.

Table 21 Comparison of community resilience constructs of earthquake-affected households by most and least recovered VDCs/municipalities, Sindhupalchowk district Nepal, 2017/18

Characteristics	Most Recovered VDCs/municipalities	Least Recovered VDCs/municipalities	Total	Crude Odds Ratio (95% CI)	P value
Community connectedness Mean (SD) Min-Max N	3.89 (0.50) 1.83-5 369	3.67 (0.63) 1.67-4.83 370	3.78 (0.58) 1.67-5 739	0.49 (0.37, 0.65)	<0.001
Disaster management Mean (SD) Min-Max N	3.34 (0.68) 1.4-5 369	2.87 (0.82) 1-4.4 370	3.10 (0.79) 1-5 739	0.44 (0.36, 0.54)	<0.001
Information and communication Mean (SD) Min-Max N	3.70 (0.62) 1.67-5 369	3.24 (0.79) 1-5 370	3.47 (0.74) 1-5 739	0.39 (0.31, 0.49)	<0.001
Leadership/governance Mean (SD) Min-Max N	3.47 (0.66) 1.4-5 369	3.33 (0.61) 1-4.8 370	3.40 (0.64) 1-5 739	0.71 (0.56, 0.89)	0.004
Administrative services accessibility Mean (SD) Min-Max N	3.64 (0.60) 1.67-5 369	3.65 (0.66) 1-5 370	3.64 (0.63) 1-5 739	1.02 (0.81, 1.28)	0.875
Place attachment Mean (SD) Min-Max N	4.32 (0.47) 3-5 369	4.16 (0.46) 2.33-5 370	4.24 (0.47) 2.33-5 739	0.49 (0.36, 0.685)	<0.001

Table 21 compares the information regarding the six components of the community resilience tool by reconstruction status. All the sub-scales exhibited a significant positive relationship with reconstruction progress, except administrative services accessibility. This implied better community connectedness, local disaster management, information and communication, leadership and governance, and attachment to the place, resulted in a higher probability of being in the most recovered VDCs/municipalities. The people having knowledge and access to administrative services did not differ on the progress of reconstruction between the communities.

4.6 The factors that determine the progress of disaster reconstruction

A multivariable logistic regression model was used to identify the factors influencing the disaster recovery. All the variables obtain a p-value of <0.200 in univariate analysis (Table 16-21) were included in the regression model. Three variables from the women's empowerment scale were excluded due to low response rates (response rate: family dominion 59%, Economic independence 66%, and women mobility 66%). One composite Likert scale prepared by combining four variables to assess the risk to the households from various imminent disaster was not included in this model also because of low response. These variables will be described separately. Three variables, including 'when was the house built', 'the progress of reconstruction of house and other essential facilities', and 'receipt of house grants', were not included in the model because they were surrogate measures of the outcome.

Risky location of house before the quake ($p=0.994$), total family size ($p=0.721$), gender ($p=0.725$), literacy of the respondent ($p=0.490$), Occupation (services/daily job/wages, $p=0.380$), mean service accessibility evaluation score ($p=0.410$), membership of organization ($p=0.252$), mean social participation score ($p=0.214$), dependency ratio ($p=0.189$), age (0.129), mean social support score ($p=0.107$), estimated loss due to quake in Rupees ($p=0.068$) and agricultural land holding ($p=0.055$).

The final regression model resulted in 14 significant predictors of reconstruction status. Table 26 shows the significant predictors of disaster recovery measured in 'least' and 'most' recovered households as dependent variables. The variables are presented with crude and adjusted odds ratio with their respective 95% confidence intervals.

Recovery status varied by caste and ethnic group (Table 22). This relationship persisted after adjusting for the other predictor variables. Similarly, the financial status of the households remained a significant predictor after adjusting for other predictors in the final regression model, indicating the communities with well-off households were the ones to recover quickly. This association increased after adjusting for the other predictors in the multivariable regression. The holding of agricultural land had a positive role on reconstruction. The regression analysis reported the odds of household being least recovered reduced by 3% per every '*Ropani*' increase in agriculture landholding after adjustment in the final model. The households holding more agricultural land seemed to do well in the reconstruction. (1 *Ropani*=5476 Square Feet).

Table 22 Crude and adjusted odds ratios of predictors of most and least recovered VDCs/municipalities among the earthquake-affected households, Sindhupalchowk district Nepal, 2017/18

Group	Crude odds ratio 95% CI	Adjusted odds ratio 95% CI
Caste/ethnicity		
Privileged (<i>Brahmin/Chhetri</i>)	0.26 (0.15, 0.45) ***	0.83 (0.35, 1.96)
<i>Janajati</i> (other than <i>Tamang</i>)	0.10 (0.06, 0.18) ***	0.19 (0.08, 0.44) ***
<i>Dalit</i>	0.05 (0.02, 0.12) ***	0.10 (0.02, 0.39) **
Majority <i>Janajati</i> (<i>Tamang</i>)	0.37(0.21, 0.63) ***	0.56 (0.24, 1.30)
Underprivileged <i>Janajati</i>	1	
Monthly income (Rupees)		
> 10000	1.00	1.00
≤ 10,000	1.48 (1.10, 1.98) *	2.20 (1.32, 3.67) **
Severity of Quake Impact on the facilities	1.37 (1.07, 1.74) *	3.00 (1.89, 4.76) ***
Time to reach essential facilities	1.81 (1.41, 2.34) ***	3.56 (2.14, 5.92) ***
Location of the house after quake		
Non-risky topography	1.00	1.00
Risky topography	1.86 (1.38, 2.52) ***	3.77 (2.18, 6.51) ***
Time first tranche of grant received in years	4.70 (3.44, 6.41) ***	12.11 (7.24, 20.26) ***
Any vocational training received?		
Yes	1.00	1.00
No	0.58 (0.36, 0.92) *	0.33 (0.15, 0.71) **
Trust towards disaster officials	1.91 (1.41, 2.59) ***	3.74 (2.08, 6.70) ***
Community resilience		
Community connectedness	0.49 (0.37, 0.65) ***	0.37 (0.19, 0.71) **
Disaster management	0.44 (0.36, 0.54) ***	0.44 (0.30, 0.65) ***
Information and communication	0.39 (0.31, 0.49) ***	0.30 (0.19, 0.48) ***
Leadership/governance	0.71 (0.56, 0.89) **	3.08 (1.84, 5.16) ***
Accessibility	1.02 (0.81, 1.28)	3.50 (2.06, 5.93) ***
Place attachment	0.49 (0.36, 0.68) ***	0.26 (0.15, 0.47) ***
Constant	-	0.002 (0.00003, 0.14566) ***

*p<0.05, **p<0.01, ***p<0.001

There was a positive relationship between the severity of quake impact on households and facilities and reconstruction status. For every unit increase in the quake impact score, the odds of being least recovered increased (Crude odds ratio=1.37; 95% CI=1.07, 1.74). The odds of being least recovered increased after adjusting for other predictor variables. Similarly, the odds of the households being the least recovered were found to be higher among the households located in the risky topography after the earthquake compared to the households in a comparatively safe location and the risk of odds doubled when adjusted with other predictor variables (Adjusted odds ratio=3.77; 95% CI=2.18, 6.51). However, this relationship turned out to be non-significant after adjustment with the other predictor variables when the risk to

the household was assessed before the quake although, it was significant in the univariate analysis.

Receiving the house grant on time was a significant determinant in the reconstruction progress. For every one-year delay in receiving the first instalment of the house grant from the Government, the odds of being in the least recovered group increased by over four times and the odds almost tripled after the adjustment with other predictors (Adjusted odds ratio=12.111; 95% CI=7.24, 20.26). In contrast, not receiving the skill enhancement vocational training during the reconstruction period decreased the odds of being in the least recovered group, and this decreased further after adjustment with the other predictor variables in the multivariate variables (Adjusted odds ratio=0.329; 95% CI=0.15, 0.71). The households that trusted the disaster officials and their local leaders were more likely to be in the least recovered group (Adjusted odds ratio=3.74; 95% CI=2.08, 6.70).

All six sub-scales of community resilience were found to have a significant relationship with disaster reconstruction progress. Except for two (leadership/governance and accessibility to administrative services), all the subscales in the community resilience scale showed a positive relationship with better recovery progress in the multivariable analysis. The final model revealed there was reduction of odds of being least recovered with every unit increase in the scores of the mentioned resilience subscales. The stronger the community connectedness, the better the community disaster management provision, better information and communication means, and better identification with the community higher the likelihood of community recovery. But contrastingly, the leadership/governance score had increased likelihood of being least recovered with the per unit increase in its score (Adjusted odds ratio=3.08; 95% CI=1.84, 5.16) although, it had the decreased odds of being least recovered in univariate analysis (adjusted odds ratio=0.71; 95% CI=0.56, 0.89). However, the accessibility to administrative services which did not have significant relationship with reconstruction (adjusted odds ratio=1.02; 95% CI=0.81, 1.28) in the univariate analysis, became negatively related to reconstruction progress after adjustment in the final model. The households with higher scores had higher likelihood of being least recovered after adjusting with the other predictor variables (Adjusted odds ratio=3.50; 95% CI=2.06, 5.93).

Chapter 5 : Discussion

Lack of comprehensive approaches and survey instruments at the household level to assess factors affecting disaster recovery makes it challenging to tailor effective disaster recovery programs due to limited evidence. The planning of recovery programs becomes even more complicated when a disaster recovery program is planned and implemented in the context of developing countries like Nepal with deeply rooted culture and traditions. In this context, this study used a mixed-method approach to develop an evidence-based survey instrument and a community resilience tool and tested them in a natural disaster scenario to explore the complexity of the disaster recovery process and to identify the crucial factors affecting it. The study identified that the components of community resilience, such as community connectedness, disaster management, information and communication, leadership and governance, accessibility to administrative services, and place attachment all play a vital role in disaster recovery. Together with community resilience other physical and social factors, such as age-old societal traditions of caste/ethnicity hierarchy, household income, geographical difficulty in accessing essential facilities, the receipt of house grants, and trust towards disaster officials were identified as crucial factors that impacted the disaster reconstruction process in Nepal. These findings were further supported by findings from qualitative interviews, discussions, and observations.

This chapter is described in two parts. The first part starts by explaining the process and need for identifying the indicators of disaster recovery. The second part is followed by the discussion of significant factors that impacted the disaster recovery in the earthquake-affected population in Nepal. In this part, the chapter discusses how the study findings have contributed to explaining the complex path and progress of disaster recovery in the context of Nepal. This section also includes the description of the development and validation of a resilience tool and its future implications. The discussion and synthesis of the results are juxtaposed against the published literature.

The mega earthquakes of April 25 and 12 May in 2015 Nepal earthquake claimed over 9000 lives, over 22000 people sustained injuries, and over half a million houses were destroyed (Ministry of Industry Government of Nepal, 2016). The damage incurred to life and property was enormous, rural areas were more adversely affected compared to urban, and disadvantaged population groups suffered the highest damage (National Planning Commission, 2015). There were indications that the rehabilitation work was not managed as

it ought (National Planning Commission, 2015). Despite the similar provision of internal and external resources to manage the crisis, some communities rebound, and some lag.

Research scholars have argued that to obtain the desired recovery after a disaster; the Government should shift its attention from the conventional approach (e.g. raising homes, repairing damaged facilities) and instead focus on understanding the local community involved (Dynes, 1993) to enhance their social fabric by empowering local networks (Aldrich, 2011b, 2012a; Aldrich & Meyer, 2014; Oteng-Ababio, 2014). Hence, this study incorporated local contextual factors in addition to already established aspects of disaster recovery and compared them among the least and most recovered villages to explain the recovery variation among the earthquake-affected population of Sindhupalchowk district in Nepal.

5.1 Indicator of disaster recovery: Categorization of disaster communities based on reconstruction progress

Various indicators have been used to measure disaster recovery in the past, depending upon the phases of disaster recovery in which the study was conducted. This study sought to develop a quantifiable indicator of disaster recovery by assessing the progress of disaster recovery in the intermediate phase of recovery management (Federal Emergency Management Agency, 2011). The researcher used weighted composite score assigned to reconstruction progress of private houses, school buildings, health centres, and household detached toilets to develop an indicator of disaster recovery and used this to identify four most and four least recovered VDCs/municipalities.

The literature reveals that population-based disaster recovery indicators (e.g., repopulation, resettlement, population growth rate, etc.) were suitable for explaining the long-term recovery where a sufficient amount of time has passed since the event. But, since this current study was conducted in the middle of the reconstruction period (over two and half years after the 2015 Nepal earthquake), the population-based recovery indicator was not suitable. The other reason for not using the population-based indicator in this study was because there was a significantly less displaced population after the earthquake in Nepal. Instead, most of the earthquake-affected population were living in tents by the side of the debris of their damaged structures.

The reconstruction of physical infrastructures such as residential buildings and other essential infrastructure (Bassett et al., 2017; Chang et al., 2012b; Matanle, 2013; Mishra et al., 2017; Nakagawa & Shaw, 2004; Raju, 2013; Rozdilsky, 2001; Sadiqui et al., 2012; Tafti & Tomlinson, 2013) and repopulation or population returning after a disaster (Aijazi, 2015; Airriess et al., 2008; Aldrich, 2011b, 2012b; Aldrich & Crook, 2008; Chamlee-Wright & Storr,

2010; Chang, 2010; Dash et al., 2007; Finch et al., 2010; Kaushal & Piyatadsananon, 2013; Nejat et al., 2016; Wang et al., 2015) were the two most common measures widely used in earlier disaster studies to represent the recovery progress and to identify its impacting factors. Other complex quantitative indicators and indices were also developed and used in these earlier disaster studies, such as the Modified Domestic Index (Arlkatti et al., 2010), sustainable livelihood framework (Balgah et al., 2015), and critical element model of life recovery (Tatsuki & Hayashi, 2002). But these tools were limited to only a few studies in actual disaster scenarios as they require an up-to-date record of household items such as shelter, drinking water lighting, human waste, food preparation, and transportation at the household level. This data is challenging to obtain, especially in the context of a developing country like Nepal due to its weak recording system.

5.2 Factors affecting the disaster recovery

The factors affecting the disaster recovery will be discussed with the findings under four domains; Social, Economic, Physical/geographical, Institutional. Under each domain, factors and variables will be discussed in sub-headings.

5.2.1 Social aspects affecting the disaster recovery

Social vulnerability

This study identified caste/ethnicity hierarchy as a social vulnerability that might impact the path and progress of disaster recovery along with other household characteristics. The pre-existing vulnerability within society limits the ability of a household, community, and society as a whole to cope and adapt to the external impact during a crisis. Past disaster literature has provided ample examples of social vulnerabilities that had adversely impacted disaster recoveries, such as race (Ai et al., 2011; Zottarelli, 2008), ethnicity (Bolin & Bolton, 1986), gender (Kusumasari, 2015; National Planning Commission, 2015), structural inequity (Aijazi, 2015; Dash et al., 2007) as well as factors including age (Tatsuki & Hayashi, 2002), education (Wang et al., 2015), religion (Airriess et al., 2008), and social isolation (Nejat et al., 2016).

The aspects of social vulnerability dispute that the consequences of natural disasters are not indiscriminate events, but instead, are socially constructed (Peacock et al., 2014). The vulnerability within a household could be demographic, such as big family size, uneven sex ratio, low literacy, and more aged members or children. It could be the family's economic status, such as low income, fewer working members, and a high dependency ratio. It could also be the traditional stratification system of society, such as caste, ethnicity, race, and class, where the minority population is discriminated against by the majority group. The communities and individual households with pre-existing vulnerabilities struggle and suffer during the crises as they must deal with internal and external problems. Although, we cannot

change the long-rooted social structure that carries the seeds of social vulnerability such as caste/ethnic discrimination and the status of women in Nepal, special attention should be given to these groups especially during crises.

Caste/ethnicity

This study found that recovery status varied by caste and ethnic group (Table 26). The 'underprivileged *Janajati*' group was taken as a reference group in the statistical models since the effect of this group on recovery was hidden when either high privileged caste group *Brahmin/Chhetri* or least privileged *Dalits* were taken as a reference group. Compared to the 'underprivileged *Janajati*' group, all other privileged and other underprivileged ethnic and caste groups were less likely to live in the least recovered neighbourhood in the univariate analysis. However, this relationship was not statistically significant among privileged caste *Brahmin/Chhetri* and majority ethnic group *Tamang* after adjustment, although they still had a decreased likelihood of residing in the least recovered VDCs/municipalities. This finding indicated the 'underprivileged *Janajati*' ethnic group was the most vulnerable to disaster recovery compared to other ethnic groups and had the highest likelihood of inhabiting the least recovered neighbourhood. This hinted that the population group with less societal privileges were the ones to suffer most during the crises and were vulnerable to imminent disasters.

These findings were in line with many other study findings (Ai et al., 2011; Aldrich, 2011a; Bolin & Bolton, 1986; Zhang & Peacock, 2009). For example, a study in the aftermath of Hurricane Andrew 1992 in Miami-Dade County in the US revealed slower housing recovery trajectories in ethnic minority areas, especially Hispanic and Black neighbourhoods compared to their Anglo counterpart (Zhang & Peacock, 2009). Similar findings were observed wherein African American identity was related to greater racism attribution and European American identity was associated with more executive-responsibility attributions after controlling for demographics, faith factors, and cognitive-emotional reactions to the hurricanes (Ai et al., 2011). Dominant groups restrict ethnic minorities to get access to the resources to adapt during crises. This was evidenced in a qualitative study conducted in the aftermath of the Indian Ocean Tsunami in Tamil Nadu, India, wherein the dominant groups having membership of *Uur* panchayats (hamlet councils) and parish councils, sped up their recovery by connecting them to aid organizations, but at the same time excluded minority groups, such as women, *Dalits*, migrants and Muslims from the assistance process (Aldrich, 2011a).

The caste hierarchy system is one of the age-old cultural traditions in Nepal that influences every aspect of social life. Evidence revealed the ethnic minority groups (for example, especially blacks and Hispanics in the United states and underprivileged castes in Nepal and India) are the ones to suffer the most due to low privilege and subordinate status in the society (Ai et al., 2011; Bennett et al., 2008). The ethnic minority groups are the ones to have the most

trouble acquiring adequate aid and are consequently more vulnerable to disaster (Bolin & Bolton, 1986). The disaster impact gets compounded when the ethnic minorities come with pre-existing vulnerabilities such as low income, large family, more significant numbers of non-productive dependents, inadequate or no insurance coverage, less money in savings, and fewer personal resources. Consequently, the minority ethnic group becomes underprivileged and struggles to cope with the additional burden of the disaster, thus leading to slow recovery.

The caste system in Nepal plays a very influential role in many of the social and economic functions, which were evident from the study. The societal privileges ascribed to a group based on the traditional caste hierarchy system does not hold in the modern context; for example, a shift in the societal privileges such as socio-economic condition and access to resources among the caste groups were evident in this study. The underprivileged *Janajati* caste group had the highest likelihood of residing in the least recovered neighbourhood compared to the traditionally claimed least privileged caste group *Dalit*. These findings potentially indicate that the social vulnerability regarding caste/ethnicity still exist in Nepal and significantly impacted the country's ongoing reconstruction process. However, the societal privilege ascribed to caste groups based on the traditional outlook of caste hierarchy might have shifted to other forms over time (for example, *Dalit* is not least privileged in terms of reconstruction compared to underprivileged *Janajati*). This raises the issue of re-evaluating the caste system (based on access to privileges) while tailoring the national development programs for the equitable distribution of resources.

Household characteristics

Household characteristics such as age, total family numbers, dependency ratio, education, and occupation of the respondents in this study were significantly associated with the reconstruction in the univariate analysis; however, the association was not statistically significant when adjusted with the other predictor variables in the final logistic model. This indicated that household characteristics other than economic status and caste/ethnicity impacted disaster recovery, but these are not as strong as other characteristics and attributes of the community.

This study also found that larger families had a higher likelihood of living in the most recovered VDCs/municipalities. More family members would mean more people to look after and assist in the house reconstruction when the whole region was facing an acute shortage of masons. Most earthquake-affected households could not afford to hire all the skilled/unskilled workforce needed for the reconstruction due to its high demand and high charge. Therefore, they had to rely on their members for the reconstruction of their houses. As one of the

participants of FGD stated the difficulty of reconstruction work and how they had to help each other for the reconstruction, “*Some people do the ‘rent and barter system’ The households having masons do the works in turn sometimes. They go to other houses after finishing theirs*”. This finding suggests that some household characteristics such as the family size might have some visible impact on the recovery process linking logistic difficulty in reconstruction.

Past disaster literature reveals several household characteristics that have significantly impacted the disaster recovery process. These included but are not limited to household characteristics such as related to age (Ainuddin & Routray, 2012; Tatsuki & Hayashi, 2002; Yang et al., 2015), gender (Wang et al., 2012; Zottarelli, 2008), family size (Ainuddin & Routray, 2012), education, employment/dependency ratio (Wang et al., 2012), rent unit owners (Zhang & Peacock, 2009), and local cultures and wisdom (Chang et al., 2012a; Kusumasari & Alam, 2012). However, these household characteristics have been linked with various indicators of recovery such as evacuation, repopulation, house reconstruction, employment recovery, sales of homes, or even the vulnerability in future disasters. This could be one of the reasons for the limited role of household characteristics revealed in our study. Although the role of household characteristics in disaster recovery was limited in this study, they cannot be ignored entirely and should be considered when explaining the trajectory of recovery.

Community Resilience

This study found that community resilience was a crucial factor in explaining disaster recovery. Community resilience denotes the intrinsic adaptive capacities of communities that help them to adapt to crises and transform into a better state than before (Fran H Norris et al., 2008). What constitutes these capacities is still a matter of debate among the disaster researchers, but the common attributes are strong social capital, effective disaster management resources, better communication and information, community competencies (specific capacity of a community to tackle the problems), and attachment towards the place.

This study developed and validated a community resilience tool and tested it among the earthquake-affected population in Nepal. The mean scores of the resilience scales and subscales were significantly higher in the most recovered VDCs/municipalities. This indicated the presence of better resilience among the most recovered VDCs/municipalities. Therefore, it was concluded that the 25-item community resilience tool with six constructs was a consistent and valid tool to assess the resilience capacity suitable for a mountainous country like Nepal.

The newly developed community resilience scale had an acceptable reliability (Cronbach Alpha Value=0.89) as a whole, although the sub-scale ‘trust towards government’ (Cronbach

Alpha Value =0.68) and 'place attachment' (Cronbach Alpha Value =0.56) demonstrated relatively low internal consistency. This could be because of low item numbers (n=3) within the sub-scale (Kottner & Streiner, 2010). This suggests that this community resilience scale is a better measure as a single construct tool and researchers need to be cautious when interpreting the sub-scales separately. The tool was further tested among the 744 households to examine its relationship with the disaster recovery in the final regression model, which is discussed in the subsequent paragraphs.

Community connectedness: The first subscale resilience scale, 'community connectedness', represented social capital where the communities' organization, mutual help, support, connection, and communication were explored. This study findings evidenced better community connectedness (a strong network) within the community had a better chance of early recovery. This finding was in line with many of the findings of previous disaster studies where strong social capital, whether bonding, bridging, or linking, proved to have a pivotal role in attaining early recovery even after controlling for significant other predictors (Airriess et al., 2008; Aldrich, 2011b; Aldrich & Meyer, 2014; Bhandari, 2014; Mishra et al., 2017; Mukherji, 2014). Social capital denotes the networks, norms, and trust that facilitate communication (Aldrich, 2012a; Coleman, 1988; Cutter et al., 2008). A strong social network among community members helps to enhance collective actions and helps make an appropriate decision at the time of crises (Nakagawa & Shaw, 2004) and increases resilience (Pfefferbaum, Pfefferbaum, et al., 2015).

The qualitative interviews revealed that those villages supported by a non-profit organization and strongly connected by local multifunctional cooperatives were found in the most recovered VDCs/municipalities. These cooperatives organized local women for regular collection of small amounts of cash and provided low-interest loans to earthquake-affected residents to build their house. The cooperatives also trained women in various capacity enhancing programs. These cooperatives were active in function, and almost every household in the VDC was a member of it. Not only did they provide monetary help, but these cooperatives also motivated people to involve themselves in some industrious jobs, such as goat rearing and kitchen gardening. People were active, mutually helpful, and confident compared to other places. No such cooperatives or networking activities were actively involved in organizing people in the least recovered VDCs/municipalities. This leads to the conclusion that local networking among the community members helps tackle the problems during crises.

Disaster management: The second subscale of community resilience was disaster management which explored almost every resource and capacity of the community to handle and manage the disaster. The households that reported that their community had better disaster

management provisions had a lower likelihood of living in the least recovered VDCs/municipalities. Crisis management and recovery are very strongly dependent on local provisions and resources the community has, to tackle the imminent catastrophes. The communities with better disaster management plans, committees, or resources to tackle the crises were always better positioned to deal with the crises and recover from them more quickly. This was evidenced in the aftermath of 2015 Nepal Earthquake. The people living in a remote area built their makeshift shelter with the help of local bamboo and timber from their local community forest instead of waiting for Government, whereas the city residents waited for days to receive the Government relief material hoping that relief would arrive soon (Mishra et al., 2017). Similarly, the recovery efforts that considered existing local culture and popular wisdom in building houses helped significantly to improve Indonesia's recovery process in the aftermath of 2006 earthquake (Kusumasari & Alam, 2012).

The in-depth interview with the Government officials conducted as part of this study further supported this fact. The interviews revealed that the communities from the remote area with transportation difficulty were the ones to build their houses early compared to communities close to district centres. Many households did not even wait for the Government grant to rebuild their home since the grant was uncertain, and they would not survive the harsh cold weather in the far mountains if they did not build their house. This finding highlights the importance of the role of local organizations in disaster management. It confirms that communities with local resources and provisions are more resilient to crises than the community dependent on others for help.

Disaster management has been a crucial starting point of disaster recovery. If the disaster is managed and appropriately handled, the impact can be minimized, paving the path to early recovery. In China, factors relating to project control and management, including project schedule, project resourcing plan, competence of construction professionals, and resource procurement lead time, were crucial for resourcing the reconstruction material in the aftermath of the Wenchuan earthquake (Chang et al., 2012b). The recovery process was also hindered due to bad disaster management despite sufficient grants and support. For example, the excessive competition among aid organizations and limited aid absorptive capacity of Sri Lanka and Aceh during the Indian Ocean Tsunami hindered effective aid utilization despite the copious foreign aids and grants (Athukorala, 2012). This had been a lesson to be learned for the disaster planners and the stakeholder of disaster recovery worldwide.

Information and communication: The third subscale of the community resilience tool, 'information and communication', explored the link and connection within the community people, information system, media, and means of information sharing among the community

members during the crises. Our study found that households with had better information and communication resources had a reduced likelihood of being in the least recovered VDCs/municipalities. This finding was corroborated by the studies done in various countries of different continents at different episodes of the disaster recovery process (Chandrasekhar, 2010; Chang et al., 2012a; Khan et al., 2015; Raju, 2013).

Prior knowledge of the trusted source of information always has been helpful in disaster management during crises, especially during early evacuating the place and managing preventive measures. For example, the lack of an effective early warning system by the local council significantly contributed to the negative impact on the small and medium enterprises during the 2011 Thailand flood in Nonthaburi province (Marks & Thomalla, 2017). The findings of this study highlight the crucial role of community communication and information sharing in the management of disaster recovery. The community with better information and communication among its members had a better likelihood of recovering early.

Leadership/governance: The fourth subscale of community resilience tool 'leadership/governance' explored the issues related to trust towards the Government authorities, the fairness of local leaders, and the development works done by the local Government, thus representing overall governance. This study revealed that households that held better trust towards the Government officials were more likely to reside in the least recovered neighbourhoods. This contrasts with the findings of past disaster studies where good governance had played a positive role in disaster recovery (Chamlee-Wright & Storr, 2010; Cho, 2014; Peng et al., 2013). In this current study, the questions in this subscale inquired into the people's perception regarding trust held towards the Government and local leaders (usually a council representative) as a proxy of governance. So, the findings are possibly explained because rural people, who mostly belonged to the least recovered neighbourhoods, held more trust towards the officer bearers of Government offices than the households of most recovered VDCs/municipalities located closer to the marketplace and district centres. During the interviews, people living in rural areas were more likely to show respect for Government officials. In contrast, the people residing in urban areas were quite open and critical of the local Government. This finding was consistent with the results of trust towards disaster officials discussed under the institutional domain of the community resilience tool.

Administrative service accessibility: The fifth subscale of community resilience tool 'administrative service accessibility' explored the capacity of the residents in getting access to the essential administrative facilities and resources, such as Government offices and services. This study revealed households who reported that they had better access to administrative services had a slightly higher likelihood of being in the least recovered neighbourhood. This

indicated the people who responded better with access to the Government offices had a higher likelihood of residing in the least recovered neighbourhood. This finding was also consistent with the previous result of the subscale governance in the preceding section. Since access to the Government offices and trusting the office bearers had similar connotation, people might have perceived both as the same issue. This could be the possible reason for the negative association of accessibility with the disaster recovery with a similar reason mentioned above in the governance construct.

Place attachment: The sixth subscale of the community resilience tool ‘place attachment’ explored the residents’ level of attachment to the place. The likelihood of the household being in the least recovered decreased with the increase in the place attachment score. This meant the household which showed strong place attachment had a higher likelihood of residing in the most recovered VDCs/municipalities. Hence, it can be said that strong community place attachment among the householders played a positive role in disaster recovery. This finding was supported by the studies done in Indonesia, Japan, New Orleans, the United States, where people who identified with their community had done better in disaster recovery than people who migrated (Airriess et al., 2008; Cho, 2014; Kusumasari, 2015).

The sense of belongingness to a place is associated with the shared values the residents live up to, the culture they share, and age-old traditions that bind the communities. Culture has always influenced various aspects of human life, equally impacting disaster recovery. Evidence from the past studies revealed that communities rooted in culture and firmly attached to the common belief and values of the community have adapted to crises very fast (Ainuddin & Routray, 2012; Mills et al., 2011). The neighbourhoods which are attached to their community are tightly knit in the networks. This sense of belongingness increases their strength and boosts their confidence (Airriess et al., 2008). Moreover, they coordinate and collaborate for the community welfare and hence can do better during the crisis with their community strength. The presence of discriminatory practices, geographically vulnerable mountain terrain, disaster-prone landscape, less employment opportunity, bad roads, and infrastructure in the least recovered areas could explain for having low place attachment in the least recovered areas.

This study strongly highlights the positive roles of community network in disaster recovery. The strong community networks and strengthening could help manage to tackle the future crises. Dynes, in his study, expressed the view that disaster recovery should focus on an understanding of the local community involved, rather than simply focusing on the physical or technological agents like a warning, evacuation, sheltering, feeding, search and rescue, public information, and so on (Dynes, 1993). Similarly, Oteng-Ababio (2014) explains that

rather than trying to implement and enforce exogenous policies and practices, multi-approach strategies involving all stakeholders in building the resilience of residents at risk can achieve the objective of risk reduction in disaster. Hence, the components and areas of network that makes a community strong can help reduce the impact of imminent risks in the future.

5.2.2 Economic aspects affecting the disaster recovery

Financial status

The household's financial situation, such as income, savings, assets or credits, and external aid and support, plays a crucial role in the recovery process and stands out even amidst other vital factors that impact disaster recovery. This was evident in our study, where the household's monthly income predicted the likelihood of being in the most or least recovered VDCs/municipalities. The findings revealed that the households with a lower monthly income had more likelihood of being in the least recovered VDCs/municipalities than households with higher monthly income. This indicated the significant role of household income in the house reconstruction. The findings of qualitative in-depth interviews further supported the role of the economy in the reconstruction. The interviews and discussions revealed that most residents in the least recovered VDCs/municipalities were relying totally on the housing grant amounting to Rs. 300,000 (approx. USD 2600 given in three instalments) for their house reconstruction. The primary reason for the delays in the house reconstruction was linked to the causes related to housing grant release. Most households would like to rebuild one storey with a tin roof that could just be covered by the Government house grant. With the few exceptions, most of the families were farmers who had no other financial resources to add up to the Government grant to rebuild their house with their comfort. Literature reveals the external aid and grant had been a great support, especially immediately after a crisis, to adapt to the impact and begin the reconstruction process (Wang et al., 2012) if the resources are managed effectively (Athukorala, 2012).

In line with these findings, several studies have reported the significant impact of household income on the disaster recovery process, including reconstruction of their houses after a disaster (Ainuddin & Routray, 2012; Arlikatti et al., 2010; Boamah et al., 2015; Wang et al., 2012; Wang et al., 2015; Zottarelli, 2008). However, the financial condition of the households was measured with different indicators in different disaster events depending upon the economic activities influencing the livelihood of the residents at that time. For example, people living in rental units and low-income households were to recover slowly in the aftermath of Hurricane Katrina ((Ainuddin & Routray, 2012; Zhang & Peacock, 2009). In addition, uninsured households were the ones to suffer in the recovery process in New Orleans (Green et al., 2007). This highlights the substantial role of regular household financial status in

reconstruction progress and can be concluded that a better household economy expedites the reconstruction progress, especially house reconstruction.

5.2.3 Physical Infrastructure and geographical vulnerability affecting the disaster recovery

Physical Infrastructure and geographical vulnerability Three of the physical factors considered in this study significantly predicted the variability of the recovery status in the neighbourhoods. These were the severity of the impact of the disaster, the amount of time to reach the selected essential facilities, and geographical vulnerability.

Severity of the impact of disaster

The findings of this study revealed that households in the least recovered neighbourhood had a higher likelihood of increased severity of the damage. These findings were corroborated by the study done in the Ninth Ward of New Orleans in the United States, where the recovery activities were delayed by levee reconstruction (Green et al., 2007). Past studies revealed that physical factors had a significant influence the disaster recovery, such as the damage incurred on the residential building (Haas et al., 1977; Tatsuki & Hayashi, 2002; Yasui, 2007), the intensity of destruction of infrastructures (Al-Nammari & Lindell, 2009), and loss of human lives (Balgah et al., 2015). This finding was supported by the results of qualitative in-depth interviews done with residents where the houses and other infrastructures such as cattle sheds and detached toilets were reportedly severely damaged in the least recovered compared to most recovered VDCs/municipalities. The severe damage to commodities and human lives limits the capacity of the household to recover due to damaged or limited household resources.

Accessibility to services

The study findings reveal that access to services such as natural resources, administrative and Government services, health services, emergency services, financial services, better roads, and means of transportation play a vital role in managing disaster recovery and rehabilitation. The accessibility to essential services was represented by a composite score allotted to the time taken by residents to reach the eight essential facilities and services, with a higher score meaning more time. This study revealed that more time to reach essential services was incurred by households in the least recovered VDCs/municipalities. This revealed that the accessibility of essential facilities and services plays a vital role in the reconstruction recovery. This was evident from the direct observation of the researcher during the data collection at the study site.

If people have undisturbed transportation services and reliable roads, lives could be saved with quicker transportation to proper health services. The reconstruction materials such as sand, pebbles, stones, and cement could be procured quickly and speed up the reconstruction

process. The qualitative interviews and field observations identified that access to transportation services was worse in the least recovered VDCs/municipalities than in most recovered VDCs/municipalities. Two of the neighbourhoods in the least recovered VDCs/municipalities had functional roads only during the dry season. They were closed during the rainy season for a half year due to steep, slippery, and challenging road conditions. One of the neighbourhoods in the least recovered VDCs/municipalities had to utilize their whole day climbing downhill and uphill to run simple errands or receive their house grant from the closest bank. People had to remain cut off from the marketplace for a long time unless they would risk carrying loads of essentials and groceries uphill on their back. Due to the problem of the seasonal roads, they also had trouble procuring reconstruction material as the vehicle would run only for six months during the dry season. They were further burdened by higher truck charges compared to more accessible places.

The neighbourhoods in the most recovered VDCs/municipalities enjoyed relatively better privileges compared to the least recovered areas. The neighbourhoods in the most recovered VDCs/municipalities were close to the marketplace district centre and had better access to trucks that would carry construction materials. They were better equipped with technical human resources. This explains why transportation accessibility is so crucial for reconstruction in the context of a mountainous country like Nepal, where physical infrastructures are almost at a primitive stage.

Geographical vulnerability

Similarly, geographical vulnerability or risky location was another physical factor that was influential in predicting the progress of disaster recovery in our study. This study found that households vulnerable to geographical and topographical risks had a higher likelihood of residing in the least recovered neighbourhood.

The findings of this study revealed that there were several reasons related to the physical attributes of the community, such as authorities not allowing for rebuilding in the risky territory, residents themselves being wary about recurrent disasters, and fear of the aftershocks that would probably lead to the delay in the reconstruction of houses at the risky locations. The risk was life-threatening so, the residents were hesitant to build their houses. This explains how houses located in risky geographical territory fell behind in the reconstruction process. The in-depth interviews with village council representatives in two of the least recovered VDCs/municipalities revealed that the residents were not provided with compensation or provided alternative places to live until almost three years after the earthquake. This explains the reason for the delay in reconstruction in these areas.

Past evidence suggests that experience of recurrent hazards and other geographical vulnerability hinders recovery if the adaptive community capacity is weak. For example, a study in coastal Orissa, India examining ten years after a Cyclone event in 1999, concluded that recurrent Cyclones and poor community resilience undermined the recovery even to a pre-hazard state (Chhotray & Few, 2012). Similarly, a study conducted in the aftermath of Hurricane Sandy in New York City revealed that the community's history of a disaster had an influential role in making relocation decisions (Binder et al., 2015). These studies corroborate the findings of this study and explain the influential impact of geographical vulnerability in the recovery process.

5.2.4 Institutional aspects affecting the disaster recovery

External aid and support

The indicator of external aid that stood out in this study in predicting recovery status was delay in receiving the first instalment of a housing grant. The result revealed that households residing in the least recovered VDCs/municipalities were more likely to experience a delay in receipt of the first house grant than most recovered VDCs/municipalities. The crucial role of house grants was further explained by the fact that most households were building their house, entirely relying on the grants as their sole resource for building. The housing grant was only intended to support the house reconstruction and not cover the entire house reconstruction cost. This indicates how desperate the residents were to receive the house grant for the house reconstruction. Therefore, delay in the receipt of the first instalment of house grant was why people could not build their house earlier as most of the population had no other financial resource.

The Government had provided a housing grant to support house construction in three instalments. Everyone received the first instalment of NRS 50,000 (Approx. USD 431), but the proportion of beneficiaries receiving second NRS 150,000 (USD 1293) and third (Approx. USD. 862) were gradually low. This was because each household had to complete specific earthquake-resistant criteria before becoming eligible for subsequent instalment.

The interviews with residents and local representatives revealed that the majority of people who received their first tranche of the housing grant just before the biggest festival of Nepal Dashain spent this money on food, drinks and to celebrate the festival. It seemed people did not have a clear idea about the purpose of the housing grant. This was either because they were wrongly advised regarding the housing grants by the local leaders in the village, or the authorized reconstruction authorities (NRA, local Government) did not explain its meaning effectively through their channels. Nevertheless, the external aid and grants played a significant role in the reconstruction process and corroborated that timely allocated external

aid is crucial in expediting the recovery process. The study findings revealed that one of the VDCs in the most recovered neighbourhood was entirely supported by NGO in house reconstruction, monitoring the reconstruction, helping with the technical persons (engineers, masons, etc.). This village also had a very strong network of multifunctional financial cooperative which would provide easy loans and organize and train the residents on various skill enhancing issues. This was the community where 90% of the third instalment of house grant had been utilized, indicating better progress in reconstruction works. The role of micro-finance or financial cooperatives was further corroborated by the local micro-finance manager, who revealed that these micro-financial institutions were actively providing hassle-free house loans at affordable interest rates, which was expediting the reconstruction process.

Vocational Training

The household survey analysis revealed training received had a negative association with disaster reconstruction. The households whose members received training had a reduced likelihood of being in the least recovered VDCs/municipalities compared to households whose members did not receive training. This finding led to the conclusion that the training provided by NGOs and INGOs was not effective in disaster recovery. This study had used training provided to the earthquake-affected population by NGOs and INGOs as an indicator of external agency support. Most of the training was skill-enhancing technical skills, such as mason and carpenter training, household livelihood support training, such as backyard farming, goat farming, garment sewing cutting training, and some were meant for raising awareness on rights, such as human rights, women rights, and transparency. This training was intended directly or indirectly to help the households in the reconstruction process.

The results of qualitative interviews justified these contrasting findings. The interviews revealed that very few people who got training worked as masons or carpenters to support the house reconstruction process after completing training. This was because some of the mason training conducted by I/NGOs lasted for a week only, which was too short to learn any building skills. Nevertheless, the trainees were made happy by providing them with some daily allowances. Many I/NGOs accomplished their targeted tasks by providing training to the residents and prepared the reports, but neither did they guide them to put them in the real work, nor did they track to check if their training had been fruitful. Another big issue in training was I/NGOs spending significant resources and money on awareness, rights, and personality training. These kinds of training had no direct application in the current ongoing house reconstruction process, and people were doing it for the sake of receiving the daily allowances. People were just concerned about how their house reconstruction could be managed before the Government timeline to save from further lapse of the house grants. So, training proved to be somewhat a waste of resources and not tailored as per the local need.

Some of the in-depth interview participants recall, "*Most people fight to get a place in training slots just to get the daily allowances and food during the period*". People used their energy and links to persuade the local party leader to include them in training just to receive the allowance. Most of the training recipients were either in foreign labour job or doing their traditional agriculture. People saw training just as an opportunity to earn some rupees. After the training, the people who were doing real mason jobs were the ones who were already working as masons. This explains how unplanned and unmanaged resources were ineffective in the reconstruction programs.

Past studies revealed support from the donor agencies (NGOs, INGOs) had been found to have a mixed impact on disaster recovery. It depended on the cross-matching interest of the donor agencies and the demands of the population, the Government monitoring and regulation of one door policy (working through only one Government authority to check the overlapping), and local adaptive capacities. The lack of local adaptive capacities failed to utilize the donor fund effectively in Sri Lanka (Athukorala, 2012) in the aftermath of the Indian Ocean Tsunami. However, some disaster-affected countries and places have made good progress in disaster recovery when supported by donor agencies (Chamlee-Wright & Storr, 2010; Cho, 2014; Khan et al., 2015; Wang et al., 2012).

Trust towards Government

This study chose the trust held towards the Government as an indicator of governance. The findings revealed that a higher level of trust was increased among households in the least recovered neighbourhood compared with the most recovered neighbourhoods. This finding was in contrast to conventional belief, where good governance is associated with better development, as evidenced in the literature (Matanle, 2013). The reason for this finding is similar to one explained in the governance subscale of the community resilience scale. People's sense of respect and regard towards public office bearers might have developed a sense of trust towards them, not because people were happy about their works. This was observed more among the rural and remote communities that belonged to the least recovered neighbourhoods than residents from most recovered VDCs/municipalities, usually in urban areas or close to city centres.

An incident experienced during one of the FGDs supported this fact even more where a village development secretary was requested to invite the participants to an FGD. No participants talked bad about the current local representatives but instead swore at past representatives as expected. But when one of the participants of FGD was interviewed later in the household survey, he vented out his grievances contrary to his satisfied and happy demeanour in the earlier group discussion. The people did not want to annoy their contact person in the fear that he would not invite them to meetings and discussions next time, and they would miss the

allowances. So, these findings shed light on the fact that trust shown towards disaster officials did not truly represent the actual Government functioning.

Better governance can lead to harmony between the citizens and the development of the place. Corrupt and failed governance gives rise to problems, conflicts, and hindrances in the development of the place (Sadiquei et al., 2012). The trust held by residents in the least recovered VDCs/municipalities towards the disaster officials holding civic positions was a mixture of fear and reverence. In contrast, people in the city area/accessible places were more practical and relatively open in expressing their views. So, based on the findings, it can be fairly said that perception held towards certain revered leaders or persons holding civic positions do not necessarily represent their working capacity and efficiency, especially in the context of culturally rooted communities. Traditional people have different meanings towards the Government authorities and persons holding executive positions irrespective of their activities or responsibilities. Researchers argue that Governments tend to take a conventional approach to manage natural disasters and concentrate their focus on hardening levees, raising existing homes, and repairing damaged facilities (Aldrich, 2011b, 2012a; Aldrich & Meyer, 2014; Oteng-Ababio, 2014) than focusing on understanding and building the social fabric of the community.

Chapter 6 Conclusion and Recommendation

This chapter concludes the thesis by discussing the significance and future implications of the findings and the tools developed in this study. The research contributions and implications for policy and practice are discussed here, followed by appropriate recommendations for Nepal's National Disaster Recovery Framework and relevant stakeholders of disaster recovery.

This study set out to identify the factors impacting disaster recovery in the aftermath of the Nepal earthquake 2015 using a mixed method design and comprehensive approaches. First, the study identified established factors of disaster recovery with the help of a systematic review of the literature and developed a preliminary model of the integrated path of disaster recovery informed by it. This model was developed into a survey instrument to test among the earthquake-affected population in Nepal. The study findings conclude that variation in the progress of disaster recovery is not only dependent on the damage intensity of the disaster and external grant but also on pre-existing factors such as social vulnerability and resilience at household and community levels and the accessibility of the facilities and services in a mountainous country like Nepal. This finding corroborated the proposition of the integrated preliminary model of disaster recovery.

The preliminary model of disaster recovery assumed that the progress and path of disaster recovery is not only dependent on the damage intensity of the disaster but also on pre-existing factors such as vulnerability and resilience at the household and community levels. The way the domains and factors interact contribute to the consequence of the disaster. These same domains and factors then mediate or exacerbate the process of disaster recovery. Depending on the endpoint, the recovery process could strengthen or weaken the domains and factors and influence the outcome of the next disaster.

The study findings corroborated the trajectory of the preliminary model of disaster recovery. As projected by the model, the final statistical model in this study found that social factors (community networks) at the household and community level, along with the severity of the disaster impact, explained the variation in the disaster recovery. For example, households with higher community resilience (the community capacity to cope with external risks) had a higher likelihood of residing in the most recovered neighbourhood. The role of small community organizations and donor agencies were also evident during the data collection. Almost 90% of the residents had completed their house reconstruction where the local Government representative was active, the village was supported by an NGO, and community members were organized by local financial cooperatives.

Household characteristics such as income and caste/ethnicity also played a significant role in explaining the variation with pre-existing vulnerability such as living in a risky location, severity of the disaster impact along with delay in receiving house grants. These findings were also supported by the results of the qualitative interviews; the least recovered VDCs/municipalities were mostly rural villages located far away from essential services and marketplaces and had difficult transportation roads.

Most of the households in least recovered VDCs/municipalities were in very poor condition (a significant portion were landless), were often the subject of land and road disputes, had suffered heavy damage from the earthquakes and were very unlikely to be serviced by I/NGOs activities. In contrast, the most recovered VDCs/municipalities were close to the city and marketplace, had better road and transportation facilities and an overall better economic condition. But the observations and interviews also revealed that people living in remote places had built their houses earlier where they were supported by multi-purpose/microfinances and organized by strong local government representatives. Whereas VDCs very close to bustling marketplace also had difficulty in building their houses but had not strong presence of INGOs or active local organizations and microfinances. Microfinance in one of the most recovered VDCs organized, trained, and made local women aware of livelihood earnings in various areas which helped them to generate income eventually helping in their house reconstruction. So, these findings lead to the conclusion that poor households can do better recovery if their social network is good. Similarly, better household income and sufficient grants does not always guarantee early recovery after a disaster if their social network or individual resilience to withstand the crises is weak.

6.1 Contributions and implication of this thesis study

1. Development of quantifiable indicators disaster recovery: This study developed a quantifiable indicator of disaster recovery based on the reconstruction indices such as reconstruction stage of the residential building, water sources, detached toilets, school and health centre buildings in each local council territory (Rural/Metro Municipal Corporation). This indicator will help to determine the disaster reconstruction progress status of communities in the mid-period of reconstruction progress to review and track their progress. This information could be used to inform necessary changes to the reconstruction process if any problems exist to boost communities lagging before the reconstruction period finishes in the future. This study could not include all the progress records of damaged infrastructures such as roads and electricity; however, these can be included in the future if the record system is updated and made available.

2. To the best of my knowledge, this is the first study that has developed a community resilience tool in the context of Nepal to assess the adapting capacity of a community at the time of crises. Post future disasters, this tool can be used to explore community resilience such as connectedness, community capacity to deal with the disaster, internal communication during crises, accessibility to administrative services, and attachment to place. Relevant authorities can use that information to plan and carry out preventive measures if community vulnerability is identified. The tool was validated in rural mountainous areas of Nepal but can be easily modified for other urban contexts since the items are adapted and modified from validated tools used in an urban context.

6.2 Recommendations and suggestions

Based on the findings of this study, the following suggestions and recommendations are made for stakeholders engaged in future disaster recovery.

- a. The study findings showed community resilience had a better impact on disaster recovery. Therefore, post-disaster recovery programs should be focused on strengthening the local capacity of the community to develop their resilience. The local financial cooperatives were good examples of organizing and empowering people to save regularly. The Government should encourage small cooperatives and financial organizations to help unite people and make them more resilient. This will increase the economic power, thus raising their internal resources and develop a sense of togetherness to solve any future community problems.
- b. The study also showed that having an active local Government representative in the village was helpful for monitoring and managing the post-disaster challenges. Many roles, which local Government could have exercised for the benefit of the community, were instead held by central Government officers. For example, if the house grant distribution was given to local authorities to run, then more houses would have been built than was observed in this study. People in affected areas waited unnecessarily in tents for over nine months just because the house reconstruction policy was on hold in the central offices. Therefore, the findings of the study suggest the essential authorities should be passed to the Local Government that could be crucial at the time of crises.
- c. This study also found a significant link with caste/ethnicity to disaster recovery. The underprivileged *Janajati* castes were the most vulnerable and had a higher likelihood of residing in the least recovered VDCs/municipalities. But the Government categorized and prioritized another caste, the *Dalits*, who were not the most vulnerable in terms of house reconstruction. It was the underprivileged *Janajati* castes (*Danuwar and Pahari*) that were found to be most vulnerable to the disaster. The *Dalits* had a higher likelihood of residing in the most recovered VDCs compared to underprivileged *Janajati* castes. All I/NGOs were

following the Government criteria to choose *Dalits* to prioritize in their programs and plans such as training and providing support in cash and kind. But the findings and field observation of this study revealed the underprivileged *Janajati* castes were the most underprivileged group who needed priority more than any other group. This leads to a recommendation to the Government authority to review the caste category based on which amenities and facilities are allotted by Government and non-Government institutions. Resource allocation needs to be set based on the need of the caste group, not on the conventional, traditional, religious-based caste categorization.

d. Poor roads and transportation were among the significant reasons for the delay in house reconstruction in the least recovered VDCs/municipalities. The central Government needs to help the local Government help build this infrastructure as this is the lifeline of the village. Two of the villages from the least recovered VDCs/municipalities had roads that were closed for six months per year during the rainy season. The residents had to store all their household materials and groceries for six months. Rebuilding or building this infrastructure is of utmost priority in the least recovered VDCs/municipalities.

6.3 Strength and limitations and implication of the research findings

Strengths: The first strength of this study is its design. This study is a mixed-methods study using a mix of qualitative and quantitative research methods. In addition, it included comprehensive approaches such as literature review, tool development, testing validation and application in the actual disaster scenario. Each subsequent step or approach was informed and guided by the preceding steps. For example, the systematic review informed the development of the survey instrument and the community resilience tool. Both of which were further modified after feedback from the local informants. These tools were then pilot-tested and validated in a small sample and then used to collect data in the large population at different places.

Another strength of this study was the large sample size. The dataset included quantitative data collected from 744 households in eight VDCs (council territory) from eight different places chosen randomly from most and least recovered VDCs/municipalities. The statistically calculated sample size was doubled to avoid the cluster effect. Hence, this increases the likelihood of better generalization to the hilly communities in a developing country like Nepal. Similarly, the quantitative method was supported by over 40 qualitative in-depth interviews, informal interviews, field visits and note-taking, observation, FGDs with almost all levels of stakeholders of disaster recovery. The participants included representatives from central and local Government, I/NGOs, the National Reconstruction Authority, party leaders, residents, vulnerable population such as single women, widows, and members of the marginalized

population. This allowed the researcher to compare, and cross verify the information to reach a correct conclusion.

Limitations: Like many cross-sectional studies, this study is unable to disentangle the temporal relationship in order to impute causality. The association of the predicting factors with the disaster recovery can be tracked in this study; however, cannot establish the causal relationship. For example, we cannot be sure whether strong community resilience led to better recovery or better recovery enhanced community resilience. Hence, caution should be taken when generalizing the findings.

The researcher had limitations of cross verification of statements of local residents with the statements of disaster authorities for the second time. This was because it was difficult to get an appointment with the government officers and other representatives of disaster stakeholders even for the first time, and second time they denied.

The district Sindhupalchowk is a hilly region of Nepal and does not represent all the districts of Nepal regarding the environmental and geographical condition. Hence, the interpretation of the findings could vary depending upon the context. For example, the plain lowlands of Nepal have accessible roads and transportation services compared to hills and mountains and hence do not have transportation problems in material transportation. Therefore, caution needs to be taken while generalizing the findings to other places with contextual variation.

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Appendix I

1. Interview Schedule for Household Survey

Questionnaire number:..... Interviewer's Name.....Respondent no.....Village/municipality: Ward Number.....

Street/Tole/Marg: Date.....

Respondent's Information

1. Please tell me your full name:2. How old are you? Please mention in completed years..... 3. Sex: a. Male b. Female

A. Demographic Profile of the Household

Please provide the following information regarding all the members living in this household including members currently living out of the house for various purpose. Start with the head of the household. Please provide the information for each demographic characteristic mentioned below against each individual household member. (Central Bureau of Statistics, 2011a, 2011b; Population Division, 2012)

Interviewer will complete the information

Cod e No.	A1. Full Name	A2. What is the Age of the (Name)?	A3. What is the Sex of the (Name)?	A4. What is the completed education level of the (Name)?	A5. What work did the (Name) usually did during the last 12 month?) (Central Bureau of Statistics, 2011b)	A7. In which of the following organizations does (Name) has the membership with?	A8. Absentees
	Include the names of all the members of the households whether living together or living out of the house for different purposes. Start with head of the household	In completed years	1. Male 2.Female	0.Can't read and write 1.Informal 2.Primary (1-7) 3. Secondary (8-10) 4.Higher Secondary (10-12) or equivalent 5. Bachelor's Degree or Equivalent 6. Master's Degree or equivalent and above	1.Agriculture 2.Salary/Wage 3.Own economic enterprise 4. Extended economic enterprise 5. Seeking work 6. household work 7. student 8. No work 9. foreign employment 10.retired 11. Disable/unable to work 12. Others (specify)	1. Social welfare: (e.g. senior citizen welfare, mother's group, human rights, red cross, local club members, child club, Rotary, Lions, Jaycees, etc.) 2. Cultural : (e.g. cultural welfare groups, ethnic development groups, linguistic group, cultural dance groups, "Guthi", "Rodi", etc.) 3. Religious: (e.g. various sects of religion or missionary based on religion.) 4. Political: (e.g. ward, village, district or state level membership of political party or its wings.) 5. Users group/internal resources mobilization group: (e.g. community forest, water, hydroelectricity users group, ward development users group etc.) 6. Management Committees/financial organizations: (School, microfinance, cooperatives, health centres/hospital, Local Disaster management etc.) 7. Others Specify	Mention the reason for the members living outside of this household 1.Work inside country 2. Foreign employment 3.Study inside country 4. Study outside country 5.Marriage 6. Security 7. Others (specify)

1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							

4. Which among the following caste/ethnicity group does your household belong?

- I. Hill Brahmin II. Hill Chhetry III. Janajati/Newar VI. Dalit V. Terai Madhesi VI. Muslims

5. What is your family type? (Population Division, 2012)

- I. Nuclear (single married couple with or without children)
 II. Joint (brothers living together with their family and their parents)
 III. Extended (family with extended members and more than three generation)
 IV. Others (Specify).....

6. What is your religion? (Population Division, 2012)

- I. Hindu II. Buddhist III. Kirat IV. Christian V. Islam VI. Others (specify).....

7. Please list the number of household members who have one of the following disabilities and their information. (Central Bureau of Statistics, 2011b)

Age	Sex	Type of Disability	Severity of Disability (Nepal, 2014) <i>(Please refer to the table below for the definition)</i>	When did the disability start?
		a. Physically disability (e.g. person in wheelchair or one who needs support for movement) b. Blind and low vision c. Deaf and hard on hearing d. Blind and deaf e. Speech Problem f. Mental illness g. Intellectual disability (Mental retardation) h. Multiple disabilities i. Others (specify).....	a. Profound disability (Difficult to perform daily activities even with continuous assistance of others) b. Severe disability (Inability to perform daily individual or social activities without the help of others.) c. Moderate disability (Ability to perform daily activities and participate in social life if a barrier-free environment, appropriate training, and education are provided.) d. Mild disability (Ability to perform daily activities and participate in social life if barrier-free environment provided)	a. Birth disability b. Before earthquake due to injury/sickness c. After earthquake due to earthquake injury d. After earthquake due to other injury/sickness

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B. Economic Status

This section deals with the economic status of the household. (Central Bureau of Statistics, 2011a)

8. What is the primary source of income in this household? (Population Division, 2012)
- a. Agriculture
 - b. Services (Government/private service/teaching/police/army etc.)
 - c. Professionals/Technical/Managerial (doctors, Engineers, office managers, etc.)
 - d. Skilled (mechanics, mason, carpenter, electrician/maintenance, taxi or other vehicle drivers, tailors etc.,)
 - e. Semi-skilled (support worker in mason, carpenter, electric maintenance, sewing etc.)
 - f. Unskilled (labour works, cleaning, daily wages, etc.)
 - g. Small business (store, handicraft, hardware, animal husbandry, poultry farming, fish farming, or other agricultural production with the monthly turnover of less than Rs. 20000
 - h. Business (industry, shops/departmental stores, animal husbandry, poultry farming, fish farming, or other agricultural production with the monthly turnover of more than Rs. 20,000-50,000
 - i. Business (industry, shops/departmental stores, animal husbandry, poultry farming, fish farming, or other agricultural e production with the monthly turnover of more than Rs. 50,000
 - j. Foreign employment
 - k. Senior citizen allowance
 - l. Pensions, gratuity/gratuity
 - m. Others (Specify).....
9. Which of the following best represents your current monthly household income?
- I. Less than Rs. 10,000 per month
 - II. Rs. 10,000- Rs. 19,999
 - III. Rs. 20,000- Rs. 29,999
 - IV. Rs. 30,000 – Rs. 39,999
 - V. Rs. 40,000- Rs. 49,999
 - VI. Rs. 50,000 and above

10. What is your total household income? *(This question inquiries about the total household income per month and year. Please include all the sources of regular income from each individual members' earning coming from Job, services, foreign employment, pension, gratuity, farm-related earning and from any other common household sources like the business, agriculture production, or industry having a regular or seasonal income .)*

No.	Income Sources	Monthly income in Rupees (please include all the household income which is regular and monthly)	Yearly income in Rupees (Please include all the household income which is not regular but is seasonal or annual)
a.	Total Wage income of all the members (Salary, pension, incentives etc.)		
b.	Remittances		
c.	Income from household non-farm enterprise (household business, enterprise, share dividend, trade, industry etc.)		
d.	Income from renting agricultural land and other commodities (vehicle, house, equipment/material),		
e.	Income from crop		
f.	Income from livestock		
g.	Others (Specify)		
	Total household income		

11. Does your household have a regular saving in a bank, cooperatives or any other financial institution? a. Yes b. No

If yes mention the saving amount per month.....

12. Do your household members have an insurance policy? a. Yes b. No

If yes mention the total amount of premium per year.....

C. Impact of Disaster:

13. Please list the number of physical facilities damaged/destroyed in your household by the earthquake.

I. House.....

- II. Kitchen.....
- III. Cowshed
- IV. Storage building.....
- V. Water tank/tap/pipeline....
- VI. Toilets.....
- VII. Vehicles.....
- VIII. Electronic appliances (TV, Refrigerator, computer etc.)
- IX. Others (Specify).....

Housing

14. What was the type of house you lived in before the earthquake?

- I. **Low strength Masonry building:** Walls are made up of locally produced masonry (stone, brick, and sun-dried brick) bonded with mud mortar). The roof is mostly of timber or bamboo covered with tiles, slate, shingles, or CGI sheets.
- II. **Cement mortared masonry building:** Wall built up with fired brick, concrete block or stone in cement-sand mortar and floors and roofs are of reinforced concrete or reinforced brick concrete.
- III. **Reinforced concrete frame with infill:** cast-in-situ concrete frames with masonry partition and infill walls (brick, block or stone masonry). Floors and roofs consist of reinforced concrete slabs
- IV. **Wood and bamboo building:** constructed of timber or bamboo with a wooden plank, thatch or bamboo strip walling materials with flexible floor and roof.
- V. **Others** (Specify).....

15. What was the impact on the house after the earthquake?

- I. No Impact II. Partial damage III. Medium damage IV. Heavy damage V. Did not have a house VI. Others (Specify)...

16. What is your household's current living provision?

- I. Tent/makeshift shelter II. Living in a damaged house III. Living in a maintained house IV. Living in a rebuilt house V. living with others (Specify)...

17. What is the current status of your house reconstruction?

- I. Not built yet II. Just started III. About to complete IV. Complete V. Did not have to build

18. How long after the earthquake you started to rebuild your house?

19. What is the reason behind late rebuilding?

20. At present what among the following problems are you facing in the house reconstruction? (Tick all the options that apply)

- I. Construction manpower not available.
- II. Difficulty in transporting construction material.
- III. Lack of construction material (water, sand, cement, iron rod, pebbles, etc)
- IV. Complication in Government process to obtain house grant
- V. National Reconstruction Authority's engineers not available on time
- VI. Financially unable
- VII. Others specify.....

21. On the basis of progress made on reconstruction of the damaged building, how do you evaluate the progress made in reconstruction?

- I. Very poor
- II. Poor
- III. Just OK (average)
- IV. Good
- V. Very Good

Status of essential services before and after earthquake				
Services	Status of essential services before earthquake	What was the impact on the facility immediately after the earthquake? <i>(Select from among the following options of severity of damage as per your evaluation)</i>	What is the current status of the facility? <i>(Select from among the following options that apply best to your household in relation to facility mentioned.)</i>	On the basis of progress made on reconstruction of the damaged/destroyed facilities, how do you evaluate the progress made in your household for the mentioned facility?
22. Water source	a. Household Tap (inside house) b. Public piped Tap (outside house) c. Local spring water d. Surface water (e.g. river/dam/lake/pond/stream/canal) e. Others (Specify).....	a. No Impact b. Partial damage c. Medium damage d. Heavy damage e. Did not own water source f. Others (Specify).....	a. Household Tap (inside house) b. Public piped Tap (outside house) c. Local spring water d. Surface water (e.g. river/dam/lake/pond/stream/canal) e. Others (Specify).....	a. Very poor b. Unsatisfactory c. Just OK d. Satisfactory e. Excellent
23. Toilet facility	a. Water seal toilet (to piped sewer system) b. Ring toilet (to septic tank) c. Open Pit latrine without slab d. Temporary e. Open field defecation(No toilet) f. Others (Specify).....	a. No Impact b. Partial damage c. Medium damage d. Heavy damage	a. Water seal toilet (to piped sewer system) b. Ring toilet (to septic tank) c. Open Pit latrine without slab d. Temporary e. Open field defecation(No toilet) f. Others (Specify).....	a. Very poor b. Unsatisfactory c. Just OK d. Satisfactory e. Excellent

Services	Status of essential services before earthquake	What was the impact on the facility immediately after the earthquake? <i>(Select from among the following options of severity of damage as per your evaluation)</i>	What is the current status of the facility? <i>(Select from among the following options that apply best to your household in relation to facility mentioned.)</i>	On the basis of progress made on reconstruction of the damaged/destroyed facilities, how do you evaluate the progress made in your household for the mentioned facility?
24. Electricity	a. Regular supply b. Intermittent supply c. No supply at all d. Others (Specify).....	a. No Impact b. Partially damaged c. Heavily damaged d. Completely destroyed	a. Regular supply b. Intermittent supply c. No supply at all d. Others (Specify)	a. Very poor b. Unsatisfactory c. Just OK d. Satisfactory e. Excellent
25. Cooking Fuel	a. Firewood b. Liquefied Petroleum Gas c. Electricity d. Coal e. Others (Specify).....	a. No impact b. Partially disturbed the fuel supply c. Completely disturbed the supply d. Others (Specify)	a. Firewood b. Liquefied Petroleum Gas c. Electricity d. Coal e. Others (Specify).....	a. Very poor b. Unsatisfactory c. Just OK d. Satisfactory e. Excellent

iii. Impact on human lives

26. Was someone from your household injured in the event?

- I. Yes
- II. No

Please provide detail information for every household member injured in the event.

Code No <i>(Please provide number given to members as in demographic table under column 'No')</i>	25.1 What was the age of injured at the time of earthquake?	25.2 What is the sex of injured person/s?	25.3 What were the injuries sustained? (Central Bureau of Statistics, 2011a; Joshi)	25.4 What was the time taken to heal the injury completely?	25.5 Who treated your injury or supported to treat? <i>(money materials and help)</i>	25.6 How do you rank the injuries addressed by the authorities/health facilities?
		a. Male b. Female	a. Open wounds b. Fractures and dislocation c. Limbs amputation d. Head injury e. Internal organ injury f. Others	a. Less than one month b. 1-6 month c. 6 month to one year d. 1-2 year e. Still not healed completely)	a. local government b. Hospitals/health centres c. NGOs/INGOs d. Community / neighbourhood e. family f. None	a. Very poor (not addressed) b. Poor (unsatisfied) c. Average d. Fair (addressed up to some extent) e. Very good(Properly addressed)

27. Did someone from your household lose their lives in the earthquake?

I. Yes

II. No

If yes fill the information for the deceased member of household

No.	What was the age of deceased?	What was the sex of deceased? 1.Male 2.Female	Remarks
1			
2.			

D. Accessibility to various services and offices

With respect to your household, please fill complete the following information regarding the availability and accessibility of the important offices, services, and facilities in the village.(Central Bureau of Statistics, 2011b)

D1. Local facilities, essential services government offices	D2. How much time would it take to reach the facility?	D3. What are the primary means of Transportation?	D4. How frequently are the means of transportation available?	D5. How difficult is it for you and your family to reach the mentioned facility?
	a. Less than 30 minutes b. 30 minutes to 1 hour c. 1-2 hours d. 2-3 hours e. More than 3 hours	a. Public Bus b. Motorbike c. Walking d. Others (Specify)...	a. Anytime b. Every half an hour c. Every hour d. 2-4 times a day e. 2-4 times a week f. Once in a week g. Others (Specify).....	a. Very difficult b. Difficult c. OK (Neutral) d. Easy e. Very easy
28. Marketplace				
29. Health service				
30. Village ward office				
31. School				
32. District Coordination Committee Office				
33. Police/army (security personnel)				
34. Fire Brigade/rescue service/Ambulance				
35. Bank/financial institutions				

E. Natural vulnerabilities

36. Did this village face any natural calamities or disasters in the five years prior to the earthquake? (Tick all the options that apply)

- a. Earthquake
- b. Landslide
- c. Windstorm
- d. Thunderstorms
- e. Floods
- f. Heavy rainfall/hailstone/snow
- g. No natural disaster faced

37. Please provide the information regarding the location of the house.

Where was your house located before the earthquake?	The current location of the house <i>(Observation by interviewer)</i>	How do you rank your current house on the basis of severity of perceived risk from geographical vulnerability?
a. Plain land b. Foothill c. Peak d. Slope e. Others (Specify).....	a. Plain land b. Foothill c. Peak d. Slope e. Others (Specify).....	a. Very high risk b. High risk c. Moderate risk d. Low risk e. No risk at all

38. Please provide information regarding various natural disasters that you perceive your household is at risk of with appropriate reasons.

Natural Disasters	Mention why it is a risk to your household for each mentioned natural disaster? <i>(Tick as many options as applicable)</i>	How do you rank your current house on the basis of severity of perceived risk from each natural disaster?
i. Earthquake	a. Has occurred frequently b. Geo-territorial makeup (slope, peak, barren, Foothill, Riverside, soil composition) is prone to disaster c. Have heard from experts d. Have heard from fortune tellers/astrologers	a. Very severe b. High c. Moderate risk d. Low risk e. No risk at all

	e. Others (specify)	
ii. Landslide	a. Has occurred frequently b. Geo-territorial makeup (slope, peak, barren, Foothill, Riverside, soil composition) is prone to disaster c. Have heard from experts d. Have heard from fortune tellers/astrologers e. Others (specify)	a. Very severe b. High c. Moderate risk d. Low risk e. No risk at all
iii. Windstorm	a. Has occurred frequently b. Geo-territorial makeup (slope, peak, barren, Foothill, Riverside, soil composition) is prone to disaster c. Have heard from experts d. Have heard from fortune tellers/astrologers e. Others (specify)	a. Very severe b. High c. Moderate risk d. Low risk e. No risk at all
iv. Thunderstorm	a. Has occurred frequently b. Geo-territorial makeup (slope, peak, barren, Foothill, Riverside, soil composition) is prone to disaster c. Have heard from experts d. Have heard from fortune tellers/astrologers e. Others (specify)	a. Very severe b. High c. Moderate risk d. Low risk e. No risk at all
v. Floods	a. Has occurred frequently b. Geo-territorial makeup (slope, peak, barren, Foothill, Riverside, soil composition) is prone to disaster c. Have heard from experts d. Have heard from fortune tellers/astrologers e. Others (specify)	a. Very severe b. High c. Moderate risk d. Low risk e. No risk at all

vi. Heavy snowfall/rain/hailstone	a. Has occurred frequently b. Geo-territorial makeup (slope, peak, barren, Foothill, Riverside, soil composition) is prone to disaster c. Have heard from experts d. Have heard from fortune tellers/astrologers e. Others (specify)	a. Very severe b. High c. Moderate risk d. Low risk e. No risk at all
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F. Reliefs, Aid, and Grants

39. Please provide information regarding the status of your household while receiving Relief/aid/grants provided by the Government or NGOs/INGOs for relief, reconstruction, and rehabilitation after the earthquake.

39.1 Aid/Grant/Loan	39.2 Received status <i>(go to Q no. 38.6 if No)</i>	39.3 Amount of relief package/material received	39.4 How many days after the event you receive aid/grant/loan?	39.5 Mention whether the donor is Govt. Or non-Govt. 1. Govt 2. Non-Govt	39.6 If not, mention the reason why your house did not receive aid/grant/loan	39.7 Is the grant/aid/loan/facility sufficient to your need?
Did your household receive relief package immediately after the disaster?	a. Yes b. No	1				a. Very insufficient b. Insufficient c. moderate d. Sufficient e. Very sufficient
		2				
		3				
Did your household receive house grant/loan for your damaged/destroyed house?	a. Yes b. No	1.				a. Very insufficient b. Insufficient c. Moderate d. Sufficient e. Very Sufficient
		2.				
		3.				

40. Did you or any of your household/family members receive any vocational or skill-enhancing training like carpentry, Mason, knitting, handicrafts, etc.?
I. Yes II. No

Please fill necessary information regarding any vocational or skill-enhancing training like carpentry, Mason, knitting, handicrafts etc. received by you or any of your household members.

Code No <i>(Please provide number given to members as in demographic table under column 'No')</i>	40.1 Name of Vocational training received by any household members	40.2 What was the duration of that training?	40.3 Has any member been employed with that skill	40.4 Which organization provided the training?	40.5 Did this training help your household in any way?
	a. Carpenter b. Mason c. Sewing cutting/knitting d. Handicrafts e. Basket making f. Bio-fuel briquettes making <i>(made up of sawdust, leaves twigs, and clay)</i> g. Electrician h. Awareness/Human rights i. Others (specify).....		a. Yes b. No	a. Government b. NGO c. INGO d. Local Community Organization e. Political Party f. Religious Organization g. Others (specify).....	a. Not at all <i>(did not help in any way.)</i> b. Slightly <i>(applied skills at household purpose occasionally)</i> c. Somewhat <i>(gained skills and applied at homes for few purposes and earned occasional sums outside house with the skills)</i> d. Moderately <i>(skills applied significantly at your household/earned moderate but not regular)</i> e. Extremely <i>(Skills applied to one's own household significantly/made a regular source of income from that skills.)</i>

41. If any of the household members including you have not received any kind of training then what do you think was the reason?

- I. Did not have eligible members to take the training
- II. Concerned authority did not come to us/no one informed about the training
- III. Did not have information about it
- IV. No members interested in taking training

- V. Tried but was unsuccessful in getting training
- VI. Others (specify).....

G. Governance

42. Please fill in the following information regarding your trust towards disaster management stakeholders and local public authorities in your area.

*(*Based on your household experience, please rate the level of trust towards below given authorities of reconstruction management and Government in managing an effective distribution of reconstruction material (grant/loan/training) in your village in the rating scale of 1-10, 10 scores indicating highest trust.)*

Name of the stakeholders of disaster recovery	42.1 Do you trust the authority mentioned below for effective reconstruction works in your village?	42.2 If no, why don't you trust the authority for the distribution of reconstruction material?(please select more than one option if applicable)	42.3 If yes, why do you trust the authority for the distribution of reconstruction material? (please select more than one option if applicable)
42.1 Village Development Committee (VDC)/ Ward committee	a. Complete distrust b. No trust c. Neutral d. Trust e. Complete trust	a. Corrupted/Biased b. Irregular at offices c. Did not act effectively during rescue and relief period d. Currently not being involved in reconstruction work e. Have bad impression/troubled community people f. Unfair/unjust g. Others (Specify)	a. Managing reconstruction very nicely b. Regular at offices c. Very keen to help people d. Did better job during rescue and relief works e. No complaints at all f. Others (specify)
42.2 District Coordination Committee (DCC)	a. Complete distrust b. No trust c. Neutral d. Trust e. Complete trust	a. Corrupted/Biased b. Irregular at offices c. Did not act effectively during rescue and relief period d. Currently not being involved in reconstruction work e. Have bad impression/troubled community people f. Unfair/unjust g. Others (Specify)	a. Managing reconstruction very nicely b. Regular at offices c. Very keen to help people d. Did better job during rescue and relief works e. No complaints at all f. Others (specify)

Name of the stakeholders of disaster recovery	Do you trust the authority mentioned below for effective reconstruction works in your village?	If no, Why don't you trust the authority for the distribution of reconstruction material? (please select as many options as applicable)	If yes, Why do you trust the authority for the distribution of reconstruction material? (please select as many options as applicable)
42.3 NGOs/INGOs	a. Complete distrust b. No trust c. Neutral d. Trust e. Complete trust	a. Corrupted/ Biased b. Irregular at offices c. Did not act effectively during rescue and relief period d. Currently not being involved in reconstruction work e. Have bad impression/Troubled community people f. Unfair/unjust g. Others (Specify)	a. Managing reconstruction very nicely b. Regular at offices c. Very keen to help people d. Did better job during rescue and relief works e. No complaints at all f. Others (specify)
42.4 Political party leaders	a. Complete distrust b. No trust c. Neutral d. Trust e. Complete trust	a. Corrupted/ Biased b. Irregular at offices c. Did not act effectively during rescue and relief period d. Currently not being involved in reconstruction work e. Have bad impression/Troubled community people f. Unfair/unjust g. Others (Specify)	a. Managing reconstruction very nicely b. Regular at offices c. Very keen to help people d. Did better job during rescue and relief works e. No complaints at all f. Others (specify)
42.5 National Reconstruction Authority (NRA) personnel	a. Complete distrust b. No trust c. Neutral d. Trust e. Complete trust	a. Corrupted/Biased b. Irregular at offices c. Did not act effectively during rescue and relief period d. Currently not being involved in reconstruction work e. Have bad impression/Troubled community people f. Unfair/unjust g. Others (Specify)	a. Managing reconstruction very nicely b. Regular at offices c. Very keen to help people d. Did better job during rescue and relief works e. No complaints at all f. Others (specify).....

H. Social Activity/Social support

43. Did you cast your vote in the recent Federal elections?

- a. Yes
- b. No

43.1 If not, what was your reason for not voting in the recent Municipal/Village Council election?*(Tick as many as applicable)*

- a. Voting centre was far
- b. Did not feel like casting vote/not interested
- c. Lack of faith in political parties
- d. Instructed to do so by senior members of the family
- e. Candidates not worthy
- f. Others (Specify).....

44. Did all your eligible household members vote in recent village/municipal council election?

- a. Yes
- b. No

44.1 If not, what were the reasons for not voting in the recent Municipal/Village Council election? *(Tick as many as applicable)*

- a. Voting centre was far
- b. Did not feel like casting vote/not interested
- c. Lack of faith in political parties
- d. Instructed to do so by senior members of the family
- e. Candidates not worthy
- f. Others (Specify).....

45. Provide information regarding your participation in the mentioned events and activities. (tick as many options as applicable)

Sn.	45.1 What events/activities do you participate in?	45.2 How often do you participate in the events/activities?	45.3 How many other members of your household participate in the events/activities?
I.	Social Activities (Welfare, community works, social gatherings, users group activities, local club or cooperative activities, social functions)	a. Never b. Rarely (once in a year) c. Occasionally (once in a month) d. Moderately (once in a week) e. Frequently (more than twice a week)	
II.	Political Activities (gatherings, functions, activities etc.)	a. Never b. Rarely (once in a year) c. Occasionally (once in a month) d. Moderately (once in a week) e. Frequently (more than twice a week)	
III.		f.	
	Religious/cultural Activities (rituals like birth, marriage, death, thread, etc. and religious functions, sermons, and gatherings)	a. Never b. Rarely (once in a year) c. Occasionally (once in a month) d. Moderately (once in a week) e. Frequently (more than twice a week)	

46. Participation support during relief and reconstruction phase

46.1 Did you or any of your household members participate in relief/rescue and reconstruction process in your village in the recent earthquake?	46.2 If Yes in what activities?	46.3 Who helped you and your household during the immediate relief and rescue phase?	46.4 Who is helping you at present in getting loans and Aids?
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a. Yes b. No	a. Nobody called me for help b. Didn't feel like helping c. Relief rescue team did not contacted me to participate d. Nobody in the village wanted to participate	a. Family b. Neighbour c. Friends d. Government people e. Police/Army f. Others (Specify).....	a. Local political leader b. Government representative (VDC/Ward member) c. NRA official d. NGO/INGO representative e. Local organization group f. Others (Specify).....
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47 Multidimensional Scale of Perceived Social Support (Zimet et al., 1988) (Zimet, Dahlem, Zimet & Farley, 1988)

Instructions: We are interested in how you feel about the following statements. Read each statement carefully. Indicate how you feel about each statement.

	Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Factors
1	There is a special person who is around when I am in need(respected person in the neighbourhood, teacher, social worker, etc.)	1	2	3	4	5	SO
2	There is a special person with whom I can share my joys and sorrows	1	2	3	4	5	SO
3	My family really tries to help me.	1	2	3	4	5	FAM
4	I get the emotional help and support I need from my family.	1	2	3	4	5	FAM
5	I have a special person who is a real source of comfort to me.	1	2	3	4	5	SO
6	My friends really try to help me.	1	2	3	4	5	FRI
7	I can count on my friends when things go wrong.	1	2	3	4	5	FRI

8	I can talk about my problems with my family.	1	2	3	4	5	FAM
9	I have friends with whom I can share my joys and sorrows.	1	2	3	4	5	FRI
10	There is a special person in my life who cares about my feelings.	1	2	3	4	5	SO
11	My family is willing to help me make decisions.	1	2	3	4	5	FAM
12	I can talk about my problems with my friends.	1	2	3	4	5	FRI

The items tended to divide into factor groups relating to the source of the social support, namely family (Fam), friends (Fri) or significant other (SO).

I. Community Resilience Tool

a. Adapted and modified community resilience Tool

The following statements are possible descriptions of your community. Please indicate whether you agree or disagree with each statement by selecting the appropriate response.

Adapted from (Leykin et al., 2013; Mishra et al., 2017; Pfefferbaum et al., 2012; Sherrieb et al., 2012)

	Items	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
1	People in my community feel like they belong to the community.	1	2	3	4	5
2	People in my community are committed to the development and well-being of the community.	1	2	3	4	5
3	People in my community help each other in their daily life.	1	2	3	4	5
4	My community treats people fairly no matter what their background, ethnicity, or religion is.	1	2	3	4	5
5	My community has programs to support the care and safety of handicapped, pregnant, women, old age, and children in the neighbourhood.	1	2	3	4	5
6	People in my community can be trusted	1	2	3	4	5
7	My community has the resources it needs to take care of community problems (resources include money, information, technology, tools, timber, sand, pebbles, etc).	1	2	3	4	5
8	People in my community are able to get the services they need (ward office, hospital, police, court, tax and land revenue, bank etc.)	1	2	3	4	5
9	People in my community know where to go to get things done. (Such as neighbourhood development to ward office, disputes to police and army, rights violation to human rights violation etc.	1	2	3	4	5
10	My community also collaborates with organizations and agencies outside the community to get things done.	1	2	3	4	5

11	My community has mechanism to keep people informed about issues that are relevant and important to them.	1	2	3	4	5
12	Local information coming from community mechanism about issues in my community is generally accurate and fair.	1	2	3	4	5
13	Communication sources used by my community are effective in reaching residents. (Communication sources may include, for example, television, radio, newspaper, internet, telephone, local organizations.)	1	2	3	4	5
14	My community has effective leaders (There are trustworthy leaders).	1	2	3	4	5
15	My community considers the successes and failures to learn from the past.	1	2	3	4	5
	Items	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
16	People in my community trust local village development/municipal council and ward representatives.	1	2	3	4	5
17	My community actively prepares for future disasters and community crises	1	2	3	4	5
18	My community can provide emergency services during a disaster (such as relief and rescue, ambulance, health service etc.)	1	2	3	4	5
19	My community has services and programs to help people after a disaster or community crisis. (how to manage relief, rescue and the management of the affected)	1	2	3	4	5
20	If a disaster or community crises occur, my community provides information about what to do.	1	2	3	4	5
21	People in my community discuss issues so they can improve the community.	1	2	3	4	5
22	I feel proud to tell others where I live	1	2	3	4	5
23	I would be sad to leave the community where I live	1	2	3	4	5
24	My remaining in this community is connected to beliefs and values which are common to community members	1	2	3	4	5
25	The relation between various groups, ethnicities, religion, and parties in my community are good	1	2	3	4	5

26	My community holds meetings to voice views, opinions	1	2	3	4	5
27	The road and transportation are accessible to essential services like hospital, emergency services,	1	2	3	4	5

b. CRAM 10 Item resilience scale (Conjoint Community Resilience Assessment Measure)

The following questions refer to your place of residence. (For a small or rural community)

Please indicate to what extent you agree with each of the following sentences:

	In my place of residence,	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
1	The municipal authority functions well.	1	2	3	4	5
2	There is mutual assistance and people care for one another.	1	2	3	4	5
3	My community is prepared for an emergency situation.	1	2	3	4	5
4	I am proud to tell others where I live.	1	2	3	4	5
5	Good relationships exist between various groups.	1	2	3	4	5
6	I trust the local decision makers.	1	2	3	4	5
7	I can count on people in my community to help me in a crisis situation.	1	2	3	4	5
8	Residents are aware of their roles in an emergency situation.	1	2	3	4	5
9	I have a sense of belonging to my community.	1	2	3	4	5
10	Residents in my community trust each other.	1	2	3	4	5

J. Women’s Empowerment:

Following scale includes three domain to measure the women’s empowerment. Women’s mobility, Women’s freedom from family domination and women’s economic security and contribution to family support. (Nanda, 2011; Schuler et al., 1997)

I. Women mobility: <i>(Please give 1 point for each place the participant has visited and one point the participant went there)</i>		
a.	Have you been to Bazaar (marketplace)?	Yes = 1, No = 0
	Have you ever been there alone?	Yes = 1, No = 0
b.	Have you ever been to hospital/clinic/doctor?	Yes = 1, No = 0
	Have you ever been there alone?	Yes = 1, No = 0
c.	Have you ever been to fairs, fetes, festivals, occasional theatres, concerts, circus or shows?	Yes = 1, No = 0
	Have you ever been there alone?	Yes = 1, No = 0
d.	Have you ever gone outside the village?	Yes = 1, No = 0
	Have you ever been there alone?	Yes = 1, No = 0
II. Freedom from family domination:		
Have any of the following happened to you in the past 12 months?		
a.	Husband/other family member took your money when you didn’t want him/them to. Yes = 1, No = 0	<i>(Please classify women as empowered and code as “1” if she said that none of the below mentioned things had happened to her. Otherwise, classify women as not empowered and code as “0”.)</i> Empowered = 1 Not Empowered= 0
b.	Husband/other family member took your land/ jewellery/poultry/livestock when you didn't you didn't want him/them to. Yes = 1, No = 0	
c.	Husband/other family member prevented you from visiting your parents. Yes = 1, No = 0	
d.	Husband/other family member prevented you from working outside the home. Yes = 1, No = 0	
III. Economic security and contribution		
<i>(Please assign “1” point for each of the following statement (a-d) if a woman responded “yes” and “0” if she responded “no”. In case of statement ‘e’, assign “1” point if women responded “all, most, half, or some” in response to the proportion of her contribution to household expenses, and give “0” point if she responds “very little or none)</i>		
a.	Do you, in your own name, own any land, your homestead land or your house?	Yes = 1, No = 0
b.	Do you yourself own any productive assets (for example, cattle or sewing machine)?	Yes = 1, No = 0

c.	Do you have any cash savings?	Yes = 1,	No = 0
d.	Have you ever used your savings for business or money lending?	Yes = 1,	No = 0
e.	Of your total household expenses, what proportion is met through your own earnings?	All/most/half = 1, 0	Very little/None =
	Total Score		

- I.** Did you or any of your household members experience any kind of difficulty in receiving government or nongovernment's relief, grants and facilities that were meant to you (*Select the best response that applies to you or your household member*)
- No difficulty
 - Authority did not listen to my grievances
 - No authority approached
 - Influential people got more facilities
 - Facility/relief and grants were delayed compared to others
 - Family members did not let me receive the facility
 - I did not get the allotted amount
 - Others (specify).....
- J.** Did you or any of your household members experience kind of difficulty in receiving skill enhancing training like handicrafts, basket weaving carpenter, mason, etc. from the government or nongovernment agency? (*Select the best response that applies to you or your household member*)
- No difficulty
 - Authority did not listen to my grievances
 - No authority approached
 - Influential people got more facilities
 - Facility/relief and grants were delayed compared to others
 - Family member did not let me receive the facility
 - I did not get what was meant for me
 - Others (specify).....
- K.** Did you receive any difficulty in living in the temporary house?
- Yes
 - No
- If yes, what were the problems?
Thank you

2. In-Depth Interview

The primary objective of the in-depth interview is to identify the factors behind the progress of recovery and reconstruction in the evaluation of various representatives of stakeholders of disaster recovery and the general population among the earthquake survivors. The representatives of stakeholders will be officials from National Reconstruction Authority, District Coordination Committee, District Administrative Office, VDCs, NGO/INGOs, and local representatives of political parties who are directly involved in reconstruction management in the district. The general population will include key persons from various VDCs/municipalities such as elected ward chairman, school teachers, local leaders etc. The findings of this in-depth interview will allow us to know the factors of reconstruction recovery from both the stakeholder and general population's perspective and to correlate and cross verify with each other. It will also help in adding uncovered factors impacting disaster recovery in the survey instrument from both the perspectives. Finally, the conclusion of this interview will also help in data triangulation with the outcomes of focus group discussions and quantitative community survey done with survivors of the earthquake.

a. In-depth interviews with Representatives of Reconstruction Stakeholders in the community

Participant ID.....Name: Date.....
Sex.....Organization..... Age.....
Designation:

1. Summarize the progress of 2.5 years reconstruction works in the district.
Prompt whether satisfactory or unsatisfactory. Summarize overall success failure in housing reconstruction, grants/loans adequacy, skill-enhancing training, resumption of essential services (water, fuel, electricity, hospital, school, etc.) Describe and detail what are the probable reasons behind satisfactory or unsatisfactory progress in the above-mentioned area as per your organization's evaluation
2. List the 10 most recovered villages in the district as per your organization's assessment. Please explain in detail in what areas of reconstruction they have progressed effectively. Explain the reasons behind such progress.
3. List the 10 least recovered villages in the district as per your organization's assessment. Please explain in detail in what areas of reconstruction they have not progressed effectively. Explain the reasons behind such unsatisfactory progress.
4. What are the major problems faced by the villages in terms of reconstruction?
Problems in accessing/distribution reliefs, grants, loans, facilities, training etc.
Problems in the resumption of essential services like (water, fuel, electricity, hospital, school,) Problems in the reconstruction of public physical facilities like road, bridge, public buildings etc.
Reasons for such problems and management plan to tackle such problem.
5. What are the major areas of progress made in reconstruction in the district?
Reasons for such satisfactory progress (proper coordination among stakeholders, good partnership with local community organization, good community involvement, adequate supply of money and material, etc.)
6. Do you think the reconstruction work will complete in the five-years timeline of NRA framework? Please detail the reasons for both responses. (Inadequate supply of money

and materials, low social participation, improper coordination from other stakeholders, delay in supply of sanction amount, political disturbance, etc.)

7. What are important factors that are contributing to speedy disaster recovery in this district? If possible list the factors in order of highest importance. Reason for such importance
8. What are important factors that are hindering speedy disaster recovery in this setting? If possible list the factors in order of highest impact. Mention the reasons for hurdles.
9. What possible suggestion or support would you expect from the concerned authorities (government, INGOs/NGOs, public, political leaders etc.), to make a successful recovery in the district?
10. What was the relief and grant distribution strategy for the specific groups (women, senior citizen, and underprivileged ethnicities)? Did they have problems in accessing the grants/loans/facilities in the district? Discuss with reasons behind it.
11. What is the status of coordination between stakeholders in providing reconstruction materials for recovery? Prompt: The impact on reconstruction process.

b. In-Depth Interview with key persons in the community

Participant ID.....Name: Date.....
Sex.....Organization..... Age.....
Designation:

1. Summarize the progress of 2.5 years reconstruction works in your village.
Prompt whether satisfactory or unsatisfactory. Summarize overall progress in housing reconstruction, grants/loans adequacy, skill-enhancing training, resumption of essential services (water, fuel, electricity, hospital, school, etc.) Describe and detail what are the probable reasons behind satisfactory or unsatisfactory progress in the above-mentioned area as per your experience
2. Please explain in detail in what major areas of reconstruction the village has progressed effectively. Explain the reasons behind such progress.
Prompt,
Proper coordination among stakeholders,
Good partnership with local community organization,
Good community involvement, local clubs, CBOs, cooperatives etc, cultural organizations
Good support and coordination from local government,
Good support from the non-government organization.
Strong leadership, political party's initiation,
Affluent community, internal resources like forest, sand, pebbles etc for housing reconstruction
3. Please explain in detail in what areas of reconstruction the village has not progressed effectively. Explain the reasons behind such unsatisfactory progress.
Prompt,
Problems in accessing/distribution reliefs, grants, loans, facilities, training etc.
Problems in the resumption of essential services like (water, fuel, electricity, hospital, school, etc.)
Problems in the reconstruction of public physical facilities like road, bridge, public buildings etc.
Problems in housing reconstruction, technical problems, lack of resources etc.

Poor community, marginalization, remoteness, lack of transportation of raw material, etc.

Low political commitment, weak initiation of local government, less partner organization etc.

lack of technical manpower, masons, engineers, lack of labour force etc.

4. Do you think the reconstruction work will complete in the five-years timeline of NRA framework? Please detail the reasons for both responses. (Inadequate supply of money and materials, low social participation, improper coordination from other stakeholders, delay in supply of sanction amount, complex instalment process, political disturbance, etc.)
5. What possible support would you expect from the concerned authorities (government, INGOs/NGOs, public, political leaders etc.), to make a successful recovery in the district?
6. What was the relief and grant distribution strategy for the specific groups (women, senior citizen, and underprivileged ethnicities)? Did they have problems in accessing the grants/loans/facilities in the district? Discuss with reasons behind it.
7. What is the status of coordination between stakeholders in providing reconstruction materials for recovery? Prompt: The role of NRA, local government, partner organization and political party.

3. Focus Group Discussion with general population of earthquake survivors

The main objective of this focus group discussion is to identify and list the factors that impact the progress of reconstruction progress as per the perception of the general population of the earthquake survivors. This discussion will explore the information pertaining to problems that are coming in the way of the satisfactory reconstruction process. Similarly, this discussion will also explore their perception of what factors are facilitating the reconstruction process in their community. The reasons behind hindering or facilitating the recovery process will also be discussed in detail. The differential treatment faced by specific vulnerable groups in accessing the facilities of recovery will also be discussed with reasons. This finding will also help us to cross verify the findings and outcomes of the in-depth interview with stakeholders and community household survey with survivors of the earthquake.

Number of participants:..... Age Sex.....
Village:..... Ward:..... Venue.....
Date.....

Focus group discussion issues

1. How is overall reconstruction process going on?
Probe: Housing reconstruction, Aid/Grants, Loan, their present resident status, electricity, water, toilet, school, health centres, roads.
2. What are the major problems faced by your village now in the reconstruction process?
Probe: Economic, infrastructure, public services, essential services, housing, cultural, human rights, administrative hassle, resources, raw material, lack of transportation, skilled manpower, technical person, labour etc.
3. How do you think it can be managed? Probe: Good management, more grants, loans, community participation and involvement, policy modification and amendments etc.
4. How do you think overall reconstruction and recovery can go well? Probe: Government's role, aid/grant/loan, training, local participation etc.
5. Did you have any problems getting access to relief grants and loans during immediate relief period? Do you have problems now in getting access to grants, loans, and facilities? Probe: Delayed reliefs, favoured groups, biased distribution, uncoordinated programs, duplication, not targeted to need, etc.
6. Do you think this village is progressing well in reconstruction? Probe: Housing reconstruction, resumption of schools, health centres, government office, maintenance of essential services like water, electricity, cooking fuel, transportation etc.
What are the reasons behind unsatisfactory progress? Probe for each area mentioned above
What could be the reasons behind satisfactory progress? Probe for each area mentioned above
7. Did any specific groups (women, senior citizen, underprivileged ethnicities) have problems in accessing the grants/loans/facilities? Probe: Reasons behind it.
8. Do you have local users group or organization to look facilitate, manage and monitor the progress of recovery? Probe: Its function, role, and achievement.
9. Which clusters in your village are doing well in reconstruction? Probe; The reasons behind such satisfactory progress.

10. Which clusters in your village are falling behind in making progress in the reconstruction? Prompt; The reasons behind such low progress.
11. Describe and discuss the role of the stakeholders of disaster recovery in the reconstruction of your village. Prompt, Reasons if any of the stakeholders had not fulfilled their roles as per citizen's expectation.
 - a. NRA.....
.....
 - b. DCC
.....
.....
 - c. DAO.....
.....
 - d. VDC
.....
.....
 - e. INGOs/NGOs.....
.....
 - f. Local
leaders.....
.....
12. How do you define a community? What type of disaster is your community likely to face? Do you have community disaster plan and management? How does it function? Did it help in the past disaster?
13. How often people help each other in public matter. Do people meet regularly for common interest? Do you have community organization to work for common interests? Was it utilized for disaster recovery and crises period?
14. What community resources you have on hand to handle some unwanted events or disaster in the community? Probe: Collective fund, organization, supportive network (welfare, religious, philanthropic, etc.), Natural resources like the forest, rivers, lake, etc.
15. What are the provisions provided by the government for disaster management during a crisis? (Ambulance, evacuation plan, fire brigade, emergency health facility etc.)
16. What are the major hurdles in disaster management and planning in the community? How can it be addressed? What resources are needed to overcome these hurdles?
17. Are there any successful instances of successful crises and disaster management in the past with the initiation of the community? If yes share some examples. What made that initiation successful?

Thank you

4. Adapted and modified community resilience Tool (Pilot Version)

The following statements are possible descriptions of your community. Please indicate whether you agree or disagree with each statement by selecting the appropriate response. Adapted from (Leykin et al., 2013; Mishra et al., 2017; Pfefferbaum et al., 2012; Sherrieb et al., 2012)

	Items	Pfefferbaum um CART 2013	Pfefferbaum RL 2015	Leykin CCRA M2013	Sherrie b 2012 Expand ed CART	Original CART	Mishra 2017	Survey Instru ment
1	People in my community feel like they belong to the community.	Y	Y	Y	Y	Y		FS
2	People in my community are committed to the well-being of the community.	Y	Y		Y	Y		FS
3	People in my community have hope about the future. (vague)	Y	Y		Y	Y		P
4	People in my community help each other.	Y	Y	Y M	Y	Y		FS
5	My community treats people fairly no matter what their background is.	Y	Y		Y	Y		FS
6	My community has programs to support the care and safety of handicapped, pregnant, women, old age, and children. (rephrased) CCRAM Lekin 2013		Y	Y	Y	Y		FS
7	People in my community work together to improve the community. (sounds similar with question 2)	Y	Y		Y	Y		P
8	People in my community can be trusted (modified from Lekin 2013)			Y M		Y		FS
9	My community has the resources it needs to take care of community problems (resources include money, information, technology, tools, timber, sand, pebbles, etc).	Y	Y	Y M	Y	Y		FS
10	People in my community are able to get the services they need.	Y	Y		Y	Y		FS
11	People in my community know where to go to get things done.	Y	Y		Y	Y		FS
12	My community works with organizations and agencies outside the community to get things done. (rephrased)	Y	Y		Y	Y		FS

13	My community keeps people informed about issues that are important to them.	N	Y	N		Y		FS
14	Local information about issues in my community is generally accurate and fair.				Y	Y		FS
15	Communication sources used by my community are effective in reaching residents. (Communication sources may include, for example, television, radio, newspaper, internet, telephone, local organizations.) (added to make clear)				Y	Y		FS
16	Communication and information in my community focus on positive as well as negative issues. (difficult to make people understand)					Y		P
17	My community has effective leaders.	Y	Y			Y		FS
18	My community looks at its successes and failures so it can learn from the past. (rephrased to make it understandable)	Y	Y		Y	Y		P
19	My community develops skills and finds resources to solve its problems and reach its goals. (complex meaning)	Y	Y		Y	Y		P
20	My community has priorities and sets goals for the future. (complex meaning)	Y	Y		Y	Y		P
21	People in my community trust local officials	N	Y	Y M	Y	Y		FS
22	My community tries to prevent disasters and crises. (Similar to 23)	Y	Y		Y	Y		P
23	My community actively prepares for future disasters and community crises	Y	Y		Y	Y		FS
24	My community can provide emergency services during a disaster.	Y	Y	YM	Y	Y		FS
25	My community has services and programs to help people after a disaster or community crisis.	Y	Y	YM	Y	Y		FS
26	If a disaster or community crises occur, my community provides information about what to do.		Y		YM	Y		FS

27	My community is at risk for disasters and community crises (floods, flash floods, landslides, drought, thunderstorm, avalanche etc.) No variation in response					Y		P
28	People in my community communicate with leaders who can help improve the community. (this does not happen in reality, interviewee feedback)	Y	Y		Y			P
29	People in my community are aware of community issues that they might address together.	Y						P
30	People in my community discuss issues so they can improve the community.	Y						FS
31	I am proud to tell others where I live			Y				FS
32	I would be sorry to leave the community where I live			Y				FS
33	I remain in this community for ideological reasons(hard to make the understand the meaning of question)			Y				P
34	My remaining in this community is connected to beliefs and values which are common to community members. (rephrased)			Y				FS
35	The relation between various groups, ethnicities, religion, and parties in my community are good (slightly modified in words)			Y				FS
36	My community holds meetings to voice views, opinions (rephrased)				Y			FS
37	My community has mechanism to provide accurate info to residents				Y			PT
38	My community has trusted person to deliver info in the time of crises				Y			PT
39	Local media is trusted to give accurate info							PT
40	There is very less social conflict in my community regarding ethnic, religious, language and other diversities (same meaning from negative side 35)						Y	P
41	People in my community care for marginalized communities (similar to 35)						Y	P
42	The road and transportation are accessible to essential services like hospital, emergency services, (mixed with 43)						Y	FS

43	The road and transportation are accessible to essential services like market, schools, and public offices.(combined with 42)							Y	PT
44	My ethnicity does not affect in any way in getting help during crises							Y	PT
45	People in my community give priority for the safety of vulnerable like handicapped, pregnant, women, old age, and children.							Y	PT
46	Essential services like fuel, water electricity are in adequate supply at the time of need in my community							Y	PT
	Resilience is defined as the ability to quickly return to routine following an emergency event. To what extent do you agree with each of these sentences?								
47.	My personal level of resilience is high					Y			PT
48.	My community's level of resilience is high					Y			PT

FS: Items included in household Survey, P: Items removed after Pilot testing, PT: Items removed after pre-testing and interviews

5. Field Observation Checklist (Sindhuplachowk 2017/2018, Nepal)

1. Damage status: Damage status of houses, the living condition of people in the tents, damage status of other commodities and debris removal damage status of public roads and infrastructures such as water sources, public buildings etc.
2. Reconstruction of house, health centers, school buildings, and household detached toilets: The progress of all the basic reconstruction works their status were observed for the comparison and verification of the data.
3. Roads and transportation difficulty: The difficulty and availability of transportation was observed during the field visits. The condition of the roads and difficulty related to terrain and weather was observed during the data collection.
4. Closeness of local market: The accessibility and availability local market from the places were observed and noted for the comparison between the VDCs.
5. Business and trade around the place: The local business such as small hotels, grocery shops, and convenient shops were observed.
6. The availability of any disaster management equipment were also observed in each VDC office.
7. The VDC office in all the eight places were observed to note down the activities running regarding disaster recovery and house grant distribution with the help of charts, notes, and records maintained by the VDC office.

Appendix II

Journal Article: Development of an Integrated Pathways Model of Factors Influencing the Progress of Recovery after a Disaster

Original Article

Development of an Integrated Pathways Model of Factors Influencing the Progress of Recovery After a Disaster

Sailesh Bhattarai, MA¹, Bruce Maycock, PhD², Helman Alfonso, PhD², and Alison Reid, PhD²

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Abstract

Disaster recovery is a complex and multidimensional process that is affected by the physical environment, social and economic conditions, and institutional strength and integrity. However, there is a lack of understanding as to why some communities recover quicker than others after experiencing the same disaster event. What are the critical factors needed for optimal disaster recovery and what factors predispose communities or individuals to poor disaster recovery? This article presents a literature-generated integrated pathways model of disaster recovery. A systematic search of the peer reviewed literature identified 54 peer-reviewed publications that met our search criteria. The thematic content analysis of that literature revealed 14 factors that affected disaster recovery, which were clustered into 4 domains (social, physical/ environmental, economic, and institutional/procedural). The integrated pathways model was developed to accommodate all of the domains and factors identified in the reviewed literature and the mediation and impact pathways that they influence. Using a combination of qualitative and quantitative data collected after the 2015 Nepal earthquake, the authors will examine and verify the interaction between domains and variables to identify those elements that are found in the most recovered and least recovered communities. The aim will be to modify and refine the model and enhance the understanding of the interaction between variable and to produce a data-driven model in order to better understand the factors that impede or enhance disaster recovery.

Keywords

disaster recovery, integrated pathways model of disaster recovery, factors influencing disaster recovery

What are we already know:

- Literature indicates there are many factors impacting upon disaster recovery.
- There is inconsistency in definitions and the metrics and indicators used to measure disaster recovery
- Current models of disaster recovery tend to focus upon a few specific indicators.

What this article adds:

- Identification of the domains, factors and variables impacting upon disaster recovery.
- Synthesized descriptions of the domains (social, physical/environment, economic, institutional).
- Presentation of the Integrate Pathways Model of Disaster Recover, which views the recovery process as a multidimensional phenomenon and assumes there is enabling and inhibiting interaction between and within domains.

Introduction

Disaster is a potentially traumatic, acute onset, time delimited, event attributed to natural, technological, and human causes that has devastating consequences on human social life and health and is collectively experienced.^{1,2} Natural disasters such as earthquakes, tsunamis, and hurricanes are difficult to predict, but it is possible to reduce the impact of the catastrophe after the event if recovery is planned in advance to reduce the vulnerability and risks.³ However, the recovery process is the least understood aspect of disaster management.^{4,5} It is a complex and multidimensional process involving the physical, social, economic, and institutional

¹Bisheshwor Prasad Koirala Institute of Health Sciences, Dharan, Nepal ²Curtin University, Perth, Western Australia, Australia

Corresponding Author:

Bruce Maycock, College of Medicine & Health, University of Exeter, Exeter EX4 4PY, UK. Email: bmaycock@iinet.net.au

components of community life.⁶ There is a lack of clarity in defining what constitutes successful recovery. The conventional definition of “returning back to normalcy”⁷ has been criticized because the normalcy of a pre-disaster state is no longer seen as adequate with multiple recent frameworks suggesting a new normal needs to be created, one that can withstand, cope, and adapt to future risks.^{8,9}

The difficulty in understanding the recovery process is in part attributed to definition inconsistencies and to the use of varying metrics and indicators to measure disaster recovery. Some studies have used the subjective perception of the affected population such as satisfaction with the recovery progress,¹⁰ whereas others have used objective metrics and indices such as the domestic assets index¹¹ to measure recovery. There are many direct and indirect interconnected factors (physical, social, institutional, economic, and environmental) of community life that facilitate or block the process of recovery.^{12,13} Furthermore, indicators of recovery and factors that influence it vary, depending on the phase of disaster management, which typically consist of the early relief and response phase (short-term), the temporary settlement and reconstruction phase (intermediate), and restoration and rehabilitation phase (long-term).^{14,15}

A better understanding of the recovery process and its influencing factors can lead to effective post-disaster planning and recovery.⁵ Various frameworks¹⁶⁻²⁰ and disaster recovery theories have been developed to guide relief efforts and achieve satisfactory disaster recovery; however, many of the models and theories are not comprehensive¹³ and are not empirically replicable.²¹ Similarly, most of the disaster studies are based on single or few case studies and are therefore not generalizable.²²

This article seeks to address previous gaps in disaster recovery by presenting a literature-generated integrated pathways model to better understand the process and progress of disaster recovery. Specifically, we address the following research questions: (1) What are the factors or combination of factors that influence

the recovery after disaster? (2) How do the factors or combination of factors explain the pathways to successful disaster recovery?

Methods

An extensive review was undertaken of the peer-reviewed literature using keywords “factors,” “determinants,” “components,” “indicators,” “models,” “theories,” “framework,” “community resilience” in combination (using Boolean operator AND) with the search terms “disaster recovery,” “recovery,” “reconstruction,” and “seismic resilience” from 1990 to 2018 using the databases ProQuest Scopus and Web of Science. In addition, articles were retrieved from the citations of the searched articles and later searching in google scholar. The resulting list of studies was selected after reviewing the abstracts. The selection of studies was limited to scholarly articles, English language, and studies that had relevant content related to factors or combination of factors affecting natural disaster recovery. Articles on engineering, biodiversity and geographical environment, and computer informatics were excluded. Studies about non-natural disasters were also excluded.

Thematic content analysis identified a list of determinant factors of disaster recovery. This included coding for references to factors that facilitated or impeded the process and progress of disaster recovery. The items were further grouped under emerging broad categories. The identified factors and items under the broad categories were later compared with previous frameworks and theories of disaster recovery for consistency. A theoretical framework was developed that accommodated the multidisciplinary nature of disaster recovery and linked the interrelated factors in the pathways of disaster recovery.

Results

The literature search identified 1845 disaster articles (Figure 1). Core theoretical frameworks not applied in real disaster scenario and duplicates in the database were checked and removed (518), and after

reviewing the abstracts, 152 articles remained. A further 62 articles were removed that were conference, workshop proceedings, and working papers leaving 90 articles in which the influencing factors of disaster recovery were clearly discussed. After examining the full articles, 36 ineligible articles were further removed leaving a total of 54 articles in the analysis. The 54 articles reported on different natural hazards including hurricanes, tsunamis and coastal storms, floods, and earthquakes occurring in many locations around the world.

Altogether 14 factors of disaster recovery were identified from the thematic content analysis. These were broadly summarized into 4 main categories (or domains) of disaster recovery: social, physical/environment, economic, and institutional/procedural. Each of these domains contained a variety of factors that were assessed via a range of variables and which are identified in Table 1 along with the corresponding authors. The variables column identifies literature-derived variables related to the factors and domain. For example, variables like networks, community participation, organization, voting turn out rate, internal bonds, membership of council, and so on, are taken as indicator of social capital under social domain which impact disaster recovery.

Domain Descriptions

Social Domain. The social domain contained 4 factors: social capital, community resilience, social vulnerability, and household characteristics. Social

capital was characterized as the networks, norms, and trust that facilitated cooperation⁵⁸; community

resilience referred to the inherent capacities of community to adapt before, during, and after a disturbance.^{20,59,60} However, social capital and community resilience were used interchangeably in some studies.^{17,58} Several studies^{19,23,24,27,29} reported the influential role of community networks and social capital in determining the progress of recovery. This contrasted with studies that reported strong internal bonds that did not necessarily lead to collective action for disaster recovery,²⁸ but instead favored the dominant population and neglected those at the periphery such as Dalits, women, and marginalized ethnicity.²¹ These contrasting outcomes highlight the importance of understanding context, vulnerability, and power differentials the role of social capital on disaster recovery.

Vulnerable groups are often the ones most affected in disaster events.⁶¹ Social vulnerability is a state or a situation of an individual, group, or community that influences their capacity to cope, resist, or recover from the impacts of natural hazards.⁶² The neglect of groups such as women, children, single people, people with disabilities, minority groups, and marginalized communities make these populations more vulnerable especially when they already face social prohibitions and pre-disaster structural inequity. There are numerous examples of vulnerable people being exploited, not being considered, or not having the resources or supports

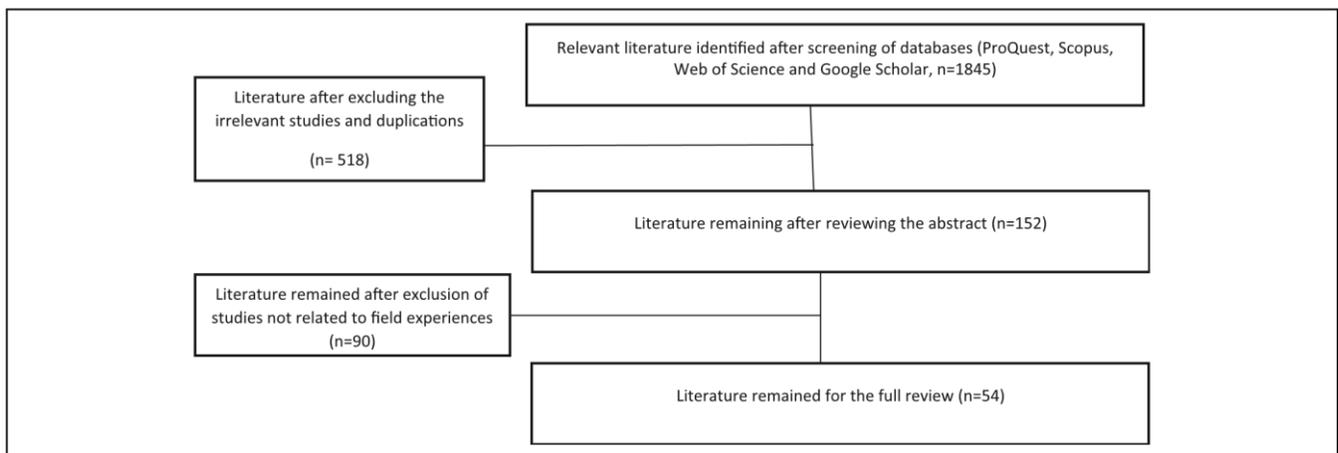


Figure 1. Flow diagram of literature selection process.

example, following the flooding of Kuvri village in Pakistan, a village known for its honey production, the survivors were provided cash grants to restock their hives and replace their equipment. However, recovery to a pre-disaster state was delayed for more than 2 years due to exploitation and pre-disaster structural inequity between the villagers and business men.³⁸ The problem of social vulnerability is a feature of both developing and developed countries in the aftermath of disaster, for example, survivors of hurricane Sandy who lived with family members before the disaster were less likely to relocate than those who lived alone, underscoring the vulnerability of the single individual in rebuilding and decision-making during the recovery.⁵

Various studies in the past have established the role of household factors in disaster recovery, either individually or in combination with other factors such as external aid, government policies, and disaster management.^{43,45,47} Household characteristics such as family size, the number of earning members, sources of income, literacy, and gender composition substantially impact the recovery process. For example, a higher proportion of external aid and better household demographic indicators, such as, more working members, higher literacy rate, and small family size, were mutually linked and influential in speeding up recovery following the Yao'n earthquake in China.⁴³ Social dimensions and population characteristics at

household and community levels are potential influential factors of recovery in almost every type of disaster situation and thus should be accounted for while explaining the progress and path of disaster recovery.

Physical/Environment Domain. Three factors were identified as contributing to the physical/environment domain: the impact of the disaster on households, geographical vulnerability, and the condition of available infrastructure (Table 1). Damaged infrastructure created serious consequences for both residents and rescuers, prolonging the post-event recovery process.⁶³ For example, following the Hanshin-Awaji Kobe earthquake 1995 in Japan, the level of damage incurred during the disaster correlated with household economic recovery, that is the higher the damage the greater the decrease in household consumption.⁴⁸ Similarly, difficult topography may hinder the recovery and reconstruction process.²⁰ The risk is compounded when the preexisting geographical vulnerability such as mountainous terrain,²⁰ recurrent natural hazards,⁴¹ preexisting infrastructure vulnerability³² combined with adverse physical infrastructure such as bad roads, poor essential facilities, weak community adaptive capacities, and poor institutional support. This combination of factors explained the slow recovery, after Hurricane Katrina in Lower Ninth Ward. Preexisting social and economic adversity exacerbated the impact of levee failure and impeded the recovery process even in the areas where the houses suffered limited damage.³²

Table I. Categorization of Domains and Factors Affecting the Disaster Recovery in Past Studies.

Domain	Factors	Variables	Study	
Social	Social capital	Church-based networks	Airriess et al²³	
		Number of nonprofit organizations	Aldrich²⁴	
		Family bonds	Nejat and Damnjanovic²⁵	
		Uur panchayat^a, council membership	Aldrich²¹	
		Voting turnout rate	Aldrich and Crook,²⁶ Aldrich²⁷	
		Family relations, Guthi^b organization, link to government	Mukherji²⁸	
		Pre-disaster community networks	Bhandari²⁹	
		Community activities, organization	Nakagawa and Shaw¹⁹	
		Community participation	Ganapati³⁰	
		Community willingness	Peng et al³¹	
	Social vulnerability	Social vulnerability	Social network	Buckland and Rahman³³ and Green et al³²
			Social homogeneity	Mishra et al²⁰
			Marginalized neighborhood Women, Dalits^c, Muslims	Alipour et al¹ Aldrich²¹
			Socioeconomic marginalization	Green et al³²
			Women resilience (adaptive capacities)	Kusumasari³⁴
			Race, religion, ethnicity, inequality	Bolin and Bolton³⁵
			Minority neighborhood	Zhang and Peacock³⁶
			Race and class	Cutter et al³⁷
			Structural inequity (micro enterprise exploitation)	Aijazi³⁸
			Racial blaming	Ai et al³⁹
Community resilience	Community resilience	Community network, community cohesion, involvement Grass root adaptive capacity	Mannakkara and Wilkinson⁴⁰ Chhotray and Few⁴¹	
		Faith, spirituality, cultural values and heritage social support, kinship, resourcefulness	Banks et al⁴²	

	Household characteristics	Male: female ratio, labor: members aged 16-55 years ratio, migrant worker members aged 16-55 years ratio, education	Wang et al⁴³
		Unemployment, returned migrants, vulnerable members	Huafeng⁴⁴
		Age, working away from home	Yang et al⁴⁵
		Age, occupation	Tatsuki and Hayashi⁴⁶
		Unemployment, low education, loss of loved ones	Wang et al⁴⁷
Physical/ environment	Impact of disaster	Damage of household buildings	Haas et al,⁷ Sawada and Shimizutani,⁴⁸ Tatsuki and Hayashi,⁴⁶ Yasui³
		Damage intensity	Chang⁴
	Geographical vulnerability	Recurrent hazards	Chhotray and Few⁴¹
	Infrastructure	Infrastructure and levee construction	Green et al³²
		Built environment; water, light, human waste disposal, fuel, communication, shelter	Dhaka⁴⁹
		Physical connectivity, natural resources	Mishra et al²⁰
Economic	Household economy	Low household income, flood insurance Low household income, poor assistance	Green et al³² Wang et al⁴⁷
		Rental units and low income	Huafeng⁴⁴
		Pre-disaster collateralizable asset	Zhang and Peacock³⁶
		Economic security	Mishra et al,²⁰ Sawada and Shimizutani⁴⁸
	Economic development	Economic development	Cao and Xiao,¹³ Dynes and Quarantelli,⁵⁰ Peng et al³¹
		Uneven distribution of wealth	Cutter et al³⁷

(continued)

Table 1. (continued)

Domain	Factors	Variables	Study
Institutional/ procedural	Policy	Land appropriation policy	Ganapati ³⁰
		Change in household registration status	Yang et al ⁴⁵
	Governance	Governmental guidance	Peng et al ³¹
		Decentralization, people's participation local Government	Cho ⁵²
		Citizen's expectation of Government intent and capacity	Chamlee-Wright and Storr ⁵¹
		Institutional progressiveness	Mishra et al ²⁰
	Disaster management	Institutional capacity and procedural vulnerability	Hsu et al, ⁵³ Matanle ⁵⁴
		Post-disaster legislation that simplify and fast tract existing legislative procedures	Bassett et al ⁵⁵
		Weak institutional support	Chhotray and Few ⁴¹
	Politics/ leadership	Political capital	Dhakai ⁴⁹
		Crisis leadership	Liu ¹⁰
		Governance/political instability	Matanle ⁵⁴
	Aid and aid organizations	Proportion of funding for reconstruction	Wang et al ⁴³
		Uncertainty regarding reconstruction budget	Cho ⁵²
		Foreign aid/grant	Athukorala ⁵⁶
Aid organization coordination management		Ganapati ³⁰	
Stakeholder participation/power, legitimacy, urgency of action, trust		Chandrasekhar ⁵⁷	
	Access to external development services	Mishra et al ²⁰	

^aParish Council. ^bInstitution of shared properties especially to carry out religious activities. ^cUnderprivileged caste group (especially those facing social discrimination like untouchability).

Economic Domain. The economic domain contains 2 factors: household economy and economic development of the entire community or region. Financial security is critical to any development works and the rate of disaster recovery.³³ The state of the household economy before the disaster significantly affects the disaster recovery capacity of a household (and eventually neighborhood), enabling economically sound households to use their own resources to cope and recover from a disaster event even before Government relief arrives.³² Household income has been a substantial factor in predicting recovery outcomes especially in physical reconstruction.^{43,48} This was evident in China after 2009 Yao'n earthquake where the households with lower income took longer to rebuild.⁴³ Easy access to inexpensive loans⁴⁸ and disaster insurance³² are other important economic aids that can support households at the time of crises to assist speedy reconstruction and recovery.

In addition to household income and access to financial institutions, the overall economic development of the community (trade, business, and economic resources) tends to ensure better management and capacity to restore and rehabilitate the damaged community and property.^{31,50} The role of economic development on disaster recovery was evident in the study conducted by Cao and Xiao,¹³ where an index to measure the potential of reconstruction and recovery in 31 provinces in China showed that economically developed provinces had higher capacity to recover and reconstruct after a catastrophe than poor economic provinces.

Institutional Domain. The institutional domain that included the role and responsibility of institutions such as national, state, and local Governments, aid organizations, and other welfare groups involved in the management of a disaster had 5 factors: policy affecting recovery, governance; disaster management; politics; and external aid and donor organizations. Central Government's primary role in disaster management functions included construction of plans and policies; establishment of fair and equitable processes for channeling funds; coordinating and managing external organization activities; mobilizing local resources and authorities; facilitating restoration of public facilities; and prioritizing the vulnerable groups.⁵¹ Interviews conducted with various officials and stakeholders of disaster following the Sichuan earthquake in China revealed Governmental guidance was one of the 3 critical factors in the development of concentrated rural settlement for the affected population, along with earthquake survivors' willingness to be involved in the settlement project and economic development of the region.³¹ Conversely weak institutional support was one of the critical reasons that the reconstruction of houses in the aftermath of super cyclone in Orissa, India, was slow.⁴¹

The role of aid and grants is critical in the reconstruction process, especially for poor communities; however, the availability of aid and grants does not always guarantee satisfactory recovery. For example, in the aftermath of Indian Ocean Tsunami in Aceh province, Indonesia, although foreign aid played a vital role in relief and reconstruction

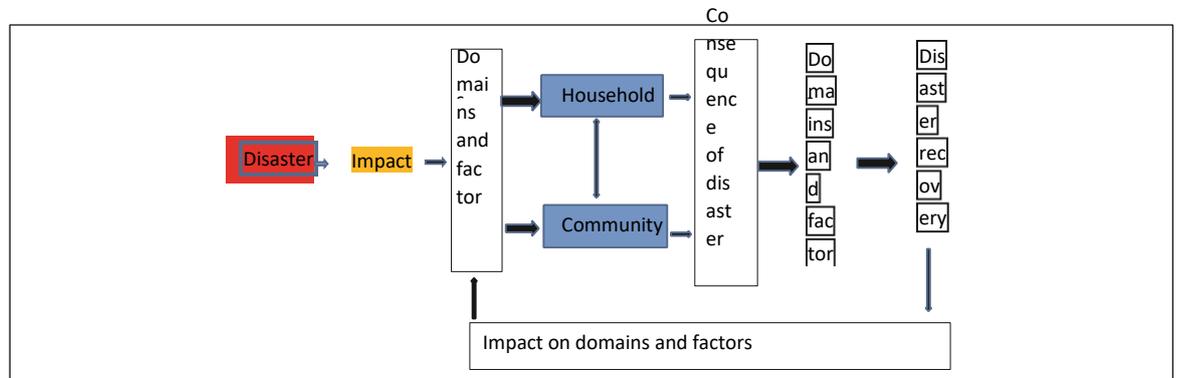


Figure 2. Integrated pathways model of factors affecting disaster recovery.

phase, it was not used effectively in the recovery phase due to a lack of coordination from Government and excessive competition among aid organizations.⁵⁶ Continuous coordination and monitoring of aid and grants is required throughout the reconstruction and recovery phases.

The lack of effective governance of the central authority in involving local organizations, local communities, and international donor agencies both in the planning and implementation of the recovery processes can hinder the effective utilization of aid, thereby affecting reconstruction and recovery. For example, a study done in a village of India in the aftermath of the Indian Ocean Tsunami revealed that participation or nonparticipation of the local community in the disaster reconstruction process depended on the trust, legitimacy, or power status of stakeholders (characteristics of effective governance).⁵⁷

In addition, excessive centralized policy and bureaucracy of the state Government hinders the disaster management process, as the administrative burden and processes delays the recovery process. For example, a study focused on recovery governance following the 2011 earthquake and tsunami in Japan revealed that the central Government did not transfer the reconstruction authority to the local Government and the local authorities had to focus on central programs rather than local, thus preventing the rapid recovery process.⁵²

Unfavorable Government policy before or after the disaster event can act as a barrier in the recovery progress and can contribute to increased vulnerability. While the disaster studies discuss constructive policy during recovery in the aftermath of a disaster, there has also been a phenomenon termed “disaster capitalism” where Governments undemocratically imposes policies such as private land appropriation, impractical displacement, and exploitation of natural resources, taking advantage of disaster to cause added burden to the population already devastated by a catastrophe.⁶⁴ For example, a case study done on the Goluck, Turkey, after the 1999 earthquake revealed that the district Government did not ensure full replacement costs to those whose lands were appropriated for reconstruction of housing and that the expropriation process was delayed leaving the people discontent in the housing recovery process.³⁰

The role of Government in coordination and management of disaster, good governance, developing and implementing practical and favorable disaster policies, effective

coordination with donor agencies and local counterparts, and equitable and transparent delivery of grants are the influencing factors affecting disaster recovery.^{31,53,54} Evidence also reveals the importance of fair, trustworthy, transparent, and effective action of nonGovernmental organizations donor and welfare organization in the recovery process.^{52,53,65}

It was evident from the literature that the domains, factors, and variables discussed above interacted with one another to influence disaster recovery. The following section presents a preliminary integrated pathways model of disaster recovery. The word preliminary is used to denote that the model has not yet been validated, which will be the next step undertaken by the authors.

The Preliminary Integrated Pathways Model of Disaster Recovery

This model is based on factors identified from the literature (Table 1) that had affected disaster recovery. This preliminary pathway model of disaster recovery is built on the assumption that the broad domains of recovery determinants do not act as watertight compartments. Rather the model views the recovery process as a multidimensional phenomenon in that, there is interaction within and between domains and their associated factors. Therefore, this model anticipates interaction effect and emphasizes that the combination of factors can produce different outcomes in disaster recovery.

This assumption created difficulty for the authors as they attempted to represent the finding and concepts from past studies and create a model that accommodated what was known. For example, a single domain, such as social capital, has been represented by 12 variables, and yet this may not fully capture the term in the broad sense. Trying to capture the dynamic interactions between the domains and variables was difficult and numerous models were drafted and disposed of before the authors opted for a model that was succinct, simple, and yet accommodated all of the interactions identified in the literature.

The model (Figure 2) starts from the premise that there has been a disaster, the impact of which depends on the intensity and nature of the event, however, the consequence of which is mediated or exacerbated by the 4 domains (physical/environmental, social, economic, and institutional/procedural) and their associated factors. These domains are represented as acting at an individual/household level and at a community level (which depending on the size of the disaster could be a local community or refer to the broader community/region or even nation). The model assumes that progress and path of disaster recovery is not only dependent on the damage intensity of the disaster but also on preexisting factors such as vulnerability and resilience at household and community levels.

The way the domains and factors interact contribute to the consequence of the disaster. These same domains and factors then mediate or exacerbate the process of disaster recovery. Depending on the end point, the recovery process could strengthen or weaken the domains and factors and influence the consequence of the next disaster.

The next phase in the model development will be to examine the interaction between the domains and variables and the characteristics that contribute to better recovery.

For example, the model anticipates the interplay of 5 major factors within the institutional domain that influence the path of recovery: central Government policy, grant aid, local authority, and the aid organizations. Critical to this are the concepts of trust, legitimate and

fair, Government, and having leaders committed to the society who can plan and execute good disaster management. The role of Government and disaster organizations are crucial in developing favorable policies, channeling the funds, coordinating the stakeholders, involving affected communities, and distributing grants and amenities to the affected population.

Although factors such as economic conditions, community participation, grant and aid, and direct Government action during the disaster are crucial for disaster recovery, this model also anticipates numerous interactions among the factors at household-, community-, and community-level institutions to be also important in the recovery process.

For example, a primary assumption of the literature is that strengthening capacities and reducing the vulnerabilities of individual households will contribute to building a stronger community. Furthermore, it is assumed that this stronger community would have greater capacity to communicate and coordinate effectively with authorities and access and utilize resources (local resources and external aid) to adapt and rehabilitate at times of crises. Finally, the efficient management and coordination of local and central Government authorities and effective inputs and supports from aid and welfare organizations will expedite the recovery process.

Conversely the literature assumes that vulnerability hinders recovery, starts at the household level, for example, single parents, old age, and handicapped. During crisis, a family having a weak social support network, lower income, and household demographic indicators (such as low literacy, large family size, and high dependency rate) are less able to adapt to adversities, make appropriate decisions, procure the needed resources, and get access to appropriate services and institutional authorities to utilize these services in managing the crises in a timely manner.

A stronger community is the one that is composed of households having strong internal networks and a better link with external agencies (Government and private authorities) and supported by good physical and economic background. A cohesive society has stronger community resilience and networking and organization within the community, which is vital in coordinating and communicating with the authorities and accessing the resources to overcome and respond to the adversity during crises.

Conditions such as lack of physical infrastructure (roads and means of transportation), difficult terrain (high steep land, coastal areas, river banks etc), lack of essential facilities (electricity, water, and health services), or lack of fair access to consumer-friendly financial institutions hamper the process of recovery.

The model assumes that the path of recovery is not a consequence of a single factor or unilineal combination of multiple factors; rather, there is an overlapping, synergistic, and interactive relations of factors that determines the disaster recovery and varies context to context. This interaction could enhance or impede successful reconstruction and recovery process. This preliminary model will test all of these assumption via analysis of household, community, and Government data collected before and after a large natural disaster.

Conclusion

The thematic content analysis of the peer-reviewed disaster recovery literature identified 4 broad domains (Social, Economic, Physical/Environmental, and Institutional/ Procedural) important to disaster recovery. The integrated pathways model based on empirical evidence describes the possible interactions of variables and pathways that leads to a successful recovery after a catastrophe. Using a combination of qualitative and quantitative data and with the help of comprehensive approaches (including instrument development and validation), the authors will verify and test the model using data collected following the 2015 earthquake in Nepal. The quantitative results from a comprehensive survey instruments that will measure all of the domains in Table 1 will be triangulated with the qualitative findings of interviews, focus groups discussions, observation, informal conversation with Government, private organizations, and local community and leaders. The aim will be to modify and refine the model and enhance the understanding of the interaction between variable and to produce a data-driven model in order to better understand the factors that impede or enhance disaster recovery.

Authors' Note

Bruce Maycock is now affiliated with University of Exeter, Exeter, UK.

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Name: Professor Wah-Yun LOW

Position: President & Managing Editor, APJPH

Date: 26th May 2021

Please return signed form to sailesh.bhattarai@postgrad.curtin.edu.a

Appendix III Top and Least Ranking VDCs/municipalities as per reconstruction scoring

Table 1 The list of top and least ranking VDCs/municipalities as per the scoring of reconstruction in four facilities after the earthquake, Sindhupalchowk, Nepal 2017/2018

	Village Development Committes (Local Council)	1 st instalment house grant	2 nd instalment house grant	3 rd instalment house grant	2 nd house grant proportion	3 rd house grant proportion	House score	Health centre construction type	Health centre construction Score	Health centre construction status	Health centre construction status score	Health score
3	Fatakshila	1076	10	0	0.009	0	0.009	Old perm	3	Plan maint.	1	0.667
5	Marming	846	32	0	0.038	0	0.038	Temp tin	1	Tin temp	1	0.333
6	Baruwa	818	34	0	0.042	0	0.042	Temp tin	1	comp	2	0.5
8	Jyamire	1570	96	0	0.061	0	0.061	Prefab	2	Ong.	2	0.667
75	Kadambas	1124	401	173	0.203	0.308	0.511	Old perm	3	plan maint	1	0.667
76	Kalika	653	238	97	0.216	0.297	0.513	Prefab	2	comp	3	0.833
78	Jalbire	630	345	0	0.548	0	0.548	Old perm	3	plan maint	1	0.667
79	Irkhu	919	335	188	0.160	0.409	0.569	Prefab	2	comp	3	0.833

Perm: permanent; Prefab: Prefabricated; maint: maintenance; temp: temporary; Ong: construction ongoing; comp: complete.

Table 1 The list of top and least ranking VDCs/municipalities as per the scoring of reconstruction in four facilities after the earthquake, Sindhupalchowk, Nepal 2017/2018 (contd..)

	Local Council	Damaged school rooms	Reconstructed school rooms	Number of school damaged	School building reconstruction score	Damaged toilets	Toilets built	Toilet reconstruction score	#Final score
3	Fatakshila	54	35	4	0.162	397	327	0.824	0.059
5	Marming	67	30	7	0.064	718	543	0.756	0.067
6	Baruwa	40	2	5	0.01	487	350	0.719	0.069
8	Jyamire	89	58	8	0.081	899	225	0.250	0.081
75	Kadambas	79	53	8	0.084	834	834	1	0.494
76	Kalika	61	43	5	0.141	545	432	0.793	0.498
78	Jalbire	39	27	3	0.231	611	611	1	0.538
79	Irkhu	58	37	5	0.128	751	751	1	0.552

$$\#Final\ Score = House\ score * 0.87 + Health\ Score * 0.02 + School\ score * 0.08 + Toilet\ score * 0.03$$

House reconstruction scoring: The buildings reconstruction was scored on the basis of the instalment of house grant received by the earthquake-affected residents from the government through local Municipal Corporation. All the data of housing grants were from collected from National Reconstruction Authority office and Department of Urban Development and Building Construction office at district level. The total beneficiaries those qualified for the house grant were 78,537. Around 20% had received second and little over 3% had received third instalment of house grant at the time of data collection.

First the percentage of second and third instalment of house grant received in each Village development committees (VDC)/municipality were calculated against the eligible beneficiaries (first instalment receiver). The proportion of third instalment receiver against the beneficiaries (first instalment receiver) were calculated dividing the number of third instalment of grants received in VDC/municipality by number of first instalment receiver. The third instalment was given twice the weightage than that of second instalment, hence the proportion was multiplied by 2. The proportion of second instalment receiver against the beneficiaries was

calculated by dividing the number of second instalment receiver by the first instalment receiver (in case of third instalment receiver, the number of third instalment receiver were subtracted from second so as to exclusively include second instalment receiver). Finally, the two proportion were added to get a final score for the housing reconstruction for each VDCs/municipalities. The higher score better the reconstruction status. House grant provided by the government in three instalment were given as follows.

1. First instalment (total beneficiaries) = Household qualified for first instalment of house grant of Rs. 50000 as a support to build their damaged houses (1 AUD= approx. Rs. 76)
2. Second instalment = Household receiving Rs. 150,000 after completing their building up to DPC (damp proof course, base level) after the verification of technical personnel (government engineers) that the structure is earthquake proof.
3. Third tranche= Household receiving Rs. 100,000 after completing their house up to the level above windows level after the earthquake proof verification from the valid technical personnel.

Health facility scoring: Second, the reconstruction status of the health centre buildings in the respective municipal corporation were scored on the basis of type of structure and the construction status during the period of data collection in the following way.

Current Health Facility Structure	Score	Construction status	Score
Temp(CGI sheets/tin sheet /tent)	1	withdrawn	0
Semi-permanent	2	Planned	1
Prefabricated	2	Planned maintenance	1
Old Permanent	3	Ongoing	2
Permanent	3	completed	3

The term used for the structure of the health facility building were explained as follows in the District Health Report 2017.

Prefabricated= structure constructed with prefabricated semi-permanent material. Has the life of 5 years and so. It can be assembled in short time.

Semi-permanent= mixed structure made up of concrete walls and base and tin or tiles roof. Permanent= concrete building having long standing life

Temporary = temporary structure made up tin, Corrugated Galvanised Iron (CGI) sheets or tents for short time duration

The health centre was scored on the basis of their structure type and their construction status. The type of structure were scored 1-3 on the basis of durability of building structure, permanent structure getting the highest score and temporary structure fetching the least score. The construction status was score ranging from 0-3 where construction status completed would get highest score and construction withdrawn would get 0. The construction status was scored only 2 when the VDC had the combination of temporary structure with construction completed instead of 3. For the facility conducting in the tent till the study period, both the structure and construction status were scored 1 each. The structure score was halved for the facilities whose reconstruction was withdrawn with construction score being 0. For example if the facility was permanent but the reconstruction was withdrawn then the structure type score would reduce to 1.5 instead of 3 and construction status would get 0. For the VDC having multiple facilities, average score of both facilities was taken for calculation. For example, VDC which had two health centers, the structure scores of both facilities was averaged to get one structure score for the VDC and same was done with construction score. Next, the average of both facility type and construction status scores were calculated and divided by 3 to calculate the proportion of reconstruction against the final average score. The higher score indicated better reconstruction progress.

School buildings scoring: The score for the reconstruction of school building was obtained by getting the ratio of proportion of school rooms completed and number of schools damaged in that particular VDC. First, the number of reconstruction of classrooms completed was divided by number of classrooms to be constructed in the VDC to obtain the proportion of classrooms completed. Then this proportion was divided by the number of schools damaged in that VDC to obtain the final score.

Toilets facility scoring: For the toilet facilities, simply the number of toilets completely reconstructed was divided by the total number of the toilets damaged in the VDC to get the final proportion of toilets reconstruction. This was taken as the toilet facility score.

Final score computation: The final score was computed by the adding all the scores of four damaged facilities and services. The weightage was given to each proportion as per the damage intensity reported by PDNA 2015(National Planning Commission, 2015). The damage estimation in million Nepalese rupees of housing, health, education and water sanitation were added to get a total damage estimation. From this, the proportion of damage estimation of each facility/service was calculated dividing the estimated damage of particular facility by total damage estimated of four facilities. As per the PDNA 2015 report, the proportion of damage of housing, health, education and toilet estimated in Nepalese currency was calculated as 0.87, 0.02, 0.08, and 0.03 respectively. This proportion of impact accounted for the damage intensity for each and was taken as weightage for each individual facility/service. Further, the scores of each facility/services was multiplied by the weightage of respective facility/services before adding all four scores to get the final recovery score. After obtaining the scores, all the 79 VDCs/municipalities were placed in ascending order with respect to their final recovery scores. The eight VDCs/municipalities at the top with lowest recovery score were taken as the “least recovered” communities and eight VDCs/municipalities at the bottom with highest scores were taken as most recovered communities. The final survey instrument of disaster recovery was field-tested on these two recovery -categorized communities.

APPENDIX IV: COREQ (COnsolidated criteria for REporting Qualitative research) Checklist (Tong et al., 2007)

Topic Item No.	Item no.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
Personal Characteristics			
Interviewer/facilitator		Which author/s conducted the interview or focus group?	50
Credentials		What were the researcher's credentials? E.g., PhD, MD	50
Occupation		What was their occupation at the time of the study?	50
Gender		Was the researcher male or female?	50
Experience and training		What experience or training did the researcher have?	50
Relationship with participants			
Relationship established		Was a relationship established prior to study commencement?	38
Participant knowledge of the interviewer		What did the participants know about the researcher? e.g., personal goals, reasons for doing the research	39
Interviewer characteristics		What characteristics were reported about the interviewer/facilitator? e.g., Bias, assumptions, reasons and interests in the research topic	39
Domain 2: Study design			
Theoretical framework			
Methodological orientation and Theory		What methodological orientation was stated to underpin the study? e.g., grounded theory, discourse analysis, ethnography, phenomenology, content analysis	42
Participant selection			
Sampling		How were participants selected? e.g., purposive, convenience, consecutive, snowball	38

Method of approach		How were participants approached? e.g., face-to-face, telephone, mail, email	38,39
Sample size		How many participants were in the study?	38,39
Non-participation		How many people refused to participate or dropped out? Reasons?	38,39
Setting			
Setting of data collection		Where was the data collected? e.g., home, clinic, workplace	38
Presence of non-participants		Was anyone else present besides the participants and researchers?	38
Description of sample		What are the important characteristics of the sample? e.g., demographic data, date	59-62
Data collection			
Interview guide		Were questions, prompts, guides provided by the authors? Was it pilot tested?	38
Repeat interviews		Were repeat inter views carried out? If yes, how many?	39
Audio/visual recording		Did the research use audio or visual recording to collect the data?	39
Field notes		Were field notes made during and/or after the interview or focus group?	40
Duration		What was the duration of the inter views or focus group?	39,40
Data saturation		Was data saturation discussed?	-
Transcripts returned		Were transcripts returned to participants for comment and/or correction?	-
Domain 3: analysis and findings			
Data analysis			
Number of data coders		How many data coders coded the data?	41
Description of the coding tree		Did authors provide a description of the coding tree?	-
Derivation of themes		Were themes identified in advance or derived from the data?	41,42

Software		What software, if applicable, was used to manage the data?	41,42
Participant checking		Did participants provide feedback on the findings?	-
Reporting			
Quotations presented		Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g., participant number	59-83
Data and findings consistent		Was there consistency between the data presented and the findings?	59-83
Clarity of major themes		Were major themes clearly presented in the findings?	59-83
Clarity of minor themes		Is there a description of diverse cases or discussion of minor themes?	59-83

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

APPENDIX V Photographs of Data Collection

Photographs of data collection in the Sindhupalchowk, Nepal 2017/2018





Photographs of data collection in the Sindhupalchowk, Nepal 2017/2018

The Least and most recovered Villages of Sindhupalchowk District 2017/2018, Nepal









SUPPLEMENT I

Pilot testing and re-testing of the survey instrument

A pilot survey was conducted among 50 households to ensure the clarity of the questions included in the survey instrument. The survey was conducted in two different wards around the district capital of Sindhupalchowk. The respondents included earthquake-affected household members above 18 years of age and included women, elderly people and disadvantaged ethnic groups to represent all strata of the study population. Altogether seven houses were replaced by adjacent households during the pilot survey; three houses had no eligible members, and four household members did not consent to participate. The survey was repeated after 15 days with selected items from the original instrument for retesting with the same respondents from the same households. These included five items from factors of disaster recovery and six items from the community resilience scale with Likert response (ranging 1-5) were re-tested in the survey.

The pilot study feedback provided constructive comments and suggestions on the format and structure of the questionnaire from the respondents. The items of survey questionnaire which were understood clearly after paraphrasing in the pilot study were included in the instrument. The item or questions were considered complex and dropped from the instrument where the respondents were unable to understand even after paraphrasing and repeating the questions for three times.

Table 1 Demographic characteristics of earthquake-affected pilot study respondents by close to city (Chautara-6) and far from city (Talchaur) in Chautara Sangachowkgardi Municipality, Sindhupalchowk district Nepal, December 2017/2018

	Characteristics of Pilot study respondents	Chautara-6 Close to City N=25(%)	Talchaur Far from City N=25(%)	Total N=50(%)
1.	Sex			
	Female	6(24.0)	6(24.0)	12(24.0)
	Male	19(76.0)	19(76.0)	38(76.0)
2.	Age			
	Mean (SD)	49.88 (13.88)	49.84((15.74)	49.36(14.7)
	Min-Max	24-78	27-82	24-82
	Age Category			
	18-40 yrs	8(32.0)	8(32.0)	16(32.0)
	41-60 yrs	12(48.0)	11(44.0)	23(46.0)
	61-70 yrs	3(12.0)	4(16.0)	7(14.0)
	Above 70 yrs	2(8.0)	2(8.0)	4(8.0)
3.	Education level			
	Can't read and write	19(76.0)	20(80.0)	39(78.0)
	Primary/secondary	4(16.0)	5(20.0)	9(18.0)
	Higher Secondary and above	2(8.0)	0(0.0)	2(4.0)
4.	Occupation			
	Agriculture	11(44.0)	22(88.0)	33(66.0)
	Service/wages	8(32.0)	1(4.0)	9(18.0)
	Own business/shops	5(20.0)	1(4.0)	6(12.0)
	Household chores	1(4.0)	1(4.0)	2(4.0)
5.	Ethnicity			
	<i>Brahmin/Chhetri</i>	14 (56.0)	25(100.0)	39(78.0)
	Janajati/Newar	7(28.0)	0(0.0)	7(14.0)
	Dalit	4(16.0)	0(0.0)	4(8.0)

Table 1 describes the demographic characteristics of the pilot study respondents. Most participants were male. The majority were aged 41-60 years, but there were also some senior citizens and youth. Almost 4 out of 5 respondents were unable to read and write and agriculture was the major source of income in the family. The majority of respondents were from the privileged caste/ethnic group (*Brahmin and Chhetri, and Newar*) but represented the majority caste/ethnic groups of Sindupalchowk district.

After the pilot respondents' feedback regarding language and clarity of the questionnaire, options related to reasons for the delay in the reconstruction, such as lack of construction manpower, lack engineers to verify earthquake-resistant reconstruction were included in the instrument. These options were not anticipated as the process of house reconstruction and

house grant was not known before. The items that investigated the transportation accessibility to important services were also included in the survey instrument. This was done on the basis of feedback of two open-ended questions that asked about the factors that facilitated and hindered the house reconstruction and the feedback of initial interview with a local ward representative.

Table 2 Feedback of pilot study respondents regarding language, time taken to complete the questionnaire, and clarity of the question from Chautara-6 and Talchaur in Chautara Sangachowkgardi Municipality, Sindhupalchowk district Nepal, December 2017

Component	Frequency	Percentage
1. Language		
Clear	15	30.0
OK	32	64.0
Understandable	3	6.0
2. Time length		
Ok	20	40.0
Bit long	14	28.0
Long	11	22.0
Reduce to one quarter time	3	6.0
Reduce to half time	2	4.0
3. Clarity regarding questions		
Clear	7	14.0
Difficult to understand the meaning	13	26.0
Irrelevant	2	4.0
OK	14	28.0
Similar and repeated	14	28.0
4. Sections of question		
Trust towards stakeholders	1	
Community resilience	28	
Social support	3	

Four items were included at the end of the pilot survey that asked about the appropriateness of language, length of time taken to complete the pilot survey and the clarity of the question structures (Table 2). Almost all of the respondents had no difficulty understanding the questions in terms of language. The interview took 45 minutes to one hour to complete. The time length of the interview was considered lengthy by 60% of the respondents. After the feedback from the respondents in the pilot study, a few items from the questionnaire were removed to reduce the interview time in the final household survey. These included questions on income on individual member in the house (instead monthly income of family was included); accessibility to local agricultural cooperatives, and district headquarters (because it was irrelevant); and items regarding accessibility to fire brigade and emergency rescue services (only one fire service in the district headquarter and no emergency rescue services other than police and army services). More than half of the respondents had difficulty understanding one or two questions in the community resilience tool because of the sentence

structure (Table 2). Some items in the tool were found to be irrelevant and some seemed a repetition of already present items (Please refer to the Appendix I no 4 under 'Adapted and modified community resilience Tool Pilot Version' for details). Most of the difficult to understand questions were from the resilience scale (Table 2). The reason for this difficulty in understanding could be because of some of the items from the community resilience tool were a direct translation of the scale used in other parts of the world. The items that were difficult to understand or seemed a repetition were identified and marked. Very difficult to understand and repetition of questions with similar meanings were removed and framed the tool accordingly. (Please refer to '4.4 Development of Community Resilience Scale' for the details)

To assess the consistency of the survey instrument, a test-retest reliability check was done on 10 items from the community resilience scale (Table 3). The Intra-Class Correlation coefficient (ICC) values of all the 10 items in the community resilience scale showed a strong and significant correlation between pilot and retest items. This indicated that the items of community resilience were consistent and valid for further use in the household survey.

Table 3 Intra-class correlation coefficients (ICC) and the 95% Confidence Interval of selected community resilience scale among the pilot study family members of earthquake-affected households of Chautara-6 and Talchaur, Sindhupalchowk district Nepal, December 2017

Num.	Items of Community Resilience		Intra-class Correlation Coefficient	F test with true value 0		P-Value
				Lower bound	Upper bound	
1	Community has effective communication sources	Single Measures Average Measures	0.72 0.83	0.55 0.71	0.83 0.91	<0.001
2	Community has effective leaders	Single Measures Average Measures	0.68 0.81	0.49 0.66	0.80 0.89	<0.001
3	Community can provide emergency services	Single Measures Average Measures	0.71 0.82	0.54 0.70	0.83 0.91	<0.001
4	Community holds meetings to voice opinions	Single Measures Average Measures	0.90 0.95	0.84 0.91	0.94 0.97	<0.001
5	Community has less conflict regarding ethnic diversities	Single Measures Average Measures	0.91 0.95	0.84 0.91	0.95 0.97	<0.001
6	Community has accessible transportation service	Single Measures Average Measures	0.91 0.95	0.84 0.91	0.95 0.97	<0.001
7	Community people help each other	Single Measures Average Measures	0.86 0.92	0.76 0.86	0.92 0.96	<0.001
8	I feel proud to tell where I live	Single Measures Average Measures	0.93 0.96	0.89 0.94	0.96 0.98	<0.001
9	People feel like they belong to the community	Single Measures Average Measures	0.91 0.95	0.84 0.91	0.95 0.97	<0.001
10	Community people can be trusted	Single Measures Average Measures	0.94 0.97	0.90 0.95	0.97 0.98	<0.001
	A summative score of all the ten items of community resilience	Single Measures Average Measures	0.86 0.93	0.79 0.88	0.93 0.96	<0.001

Similarly, the Intra-class correlation coefficient (ICC) values of the five selected items in the factors of disaster recovery also revealed satisfactory reliability with ICC above 0.60 (Table 4). This suggested that the items used in the survey instrument were valid and could produce consistent results in the household survey.

Table 4 Intra-class correlation coefficients (ICC) and the 95% CI of Factors of disaster recovery among the pilot study family members of earthquake-affected households of Chautara-6 and Talchaur, Sindhupalchowk district Nepal, December 2017

Items of factors of disaster recovery		Intraclass Correlation Coefficient	F test with true value 0		P-Value
			Lower bound	Upper bound	
House reconstruction progress	Single Measures	0.83	0.71	0.90	<0.001
	Average Measures	0.91	0.83	0.95	
Evaluation of accessibility to the nearest marketplace	Single Measures	0.63	0.43	0.77	<0.001
	Average Measures	0.77	0.60	0.87	
Was the house grant sufficient?	Single Measures	0.77	0.60	0.88	<0.001
	Average Measures	0.87	0.75	0.93	
Trust towards local authority	Single Measures	0.76	0.61	0.86	<0.001
	Average Measures	0.86	0.76	0.92	
Trust towards NRA staffs	Single Measures	0.57	0.35	0.73	<0.001
	Average Measures	0.72	0.51	0.84	

Feedback from qualitative interviews informal conversations

The qualitative interviews and conversations with two key persons and one resident helped us further to understand the process and procedures of house reconstruction at the time that the pilot study was being conducted. This information helped us to refine, generate and consolidate the draft survey instrument. Items about savings and loan transactions were included in the questionnaire after the interview with the microfinance manager. Government policy regarding earthquake-resistant house building criteria and criteria for receiving instalments of house grant, difficulty in the transportation of construction material, lack of material, and lack of technical and construction manpower were revealed as important topics following interviews and conversations with Government the key persons and a resident. These items were appropriately incorporated into the survey instrument.

The interview with the Ward chair helped to fine-tune the options in the grant and aid, governance and social participation section. The exact amount of the Government-allotted relief package and house grants for the earthquake beneficiaries were known. The direct stakeholders of disaster reconstruction process, such as District Coordination Committee (DCC), engineers allotted by National Reconstruction Authority, rural and municipal council office, I/NGOs etc. were also identified during the interviews which was added to examine the perception of residents held towards these officials and authorities. The information regarding the situation of the immediate relief phase and people's participation was made clear to modify that section of the questionnaire. The items regarding frequent natural disasters were based on the interview with the officer of the District Emergency Operation Centre. The religion category was fine-tuned after feedback from a local resident and hotel owner's interviews. The observation visits to survey sites helped to include the items regarding transportation accessibility, questions regarding construction difficulties and the role of community cooperatives in organizing people and financial activity. These items were incorporated into the appropriate section in the survey instrument.

SUPPLEMENT II

Findings of Qualitative interviews and discussions

The earthquake experience and initial relief rescue phase (First month after the earthquake)

The experience of the earthquake was overwhelming and horrifying as no one in their lifetime had seen calamities on such an enormous scale. The level of damage and destruction caused to human lives and properties was unspeakable. A local resident and Government official described his experience, (P2): *'There were piles of dead bodies laid down at the Tundikhel (playground), all the houses of people had collapsed, and it was a time of chaos and extreme sadness. This office building had also completely collapsed at that time. We survived that day because it was a Saturday.'* It was a chaotic situation and uncertainty was everywhere. No one knew what would happen, how long it would go, or would they even survive? Another resident from a nearby village recalled his memories of that fateful day, (P31): *'When there were landslides during [and] after earthquake, there was dust and muddy fog everywhere. Rumour started to spread among the people that the volcano is going to erupt from the hills, and some started to run some hid and some even looted the properties during that time. our family members started to cry and insisted me to leave the place soon. But I told them So, if we are meant to die, would running help? So, if we are to die, we will die together in one place at our home.'* The hilly villages in the remote areas suffered more than urban centres close to cities and remained in uncertainty amidst the landslides and blocked roads until a rescue helicopter arrived to airlift the injured to district hospital and capital city Kathmandu.

The local Government offices were quick to respond even in this difficult situation. Army and police forces were quickly deployed to see if people buried under debris could be saved. But it was neighbours and family members that turned up to help immediately after the earthquake. The initial relief and rescue phase was under the control of Government authorities after a week or so. As per the account of local residents and Government offices, the immediate relief and rescue were handled properly, and things were under control except for the first few days. The District Relief and Rescue Committee (DRRC) was formed immediately within the next day of the event under the leadership of the District Administrative Officer. This committee included all the district office heads and I/NGOs representatives under the leadership of the United Nations Office for the Coordination of Humanitarian Affairs (UN OHCA). This committee coordinated all the relief and rescue donations and aids and the distribution of the material to the needy communities. The committee met every day to debrief, update on the progress, and make emergency decisions. In the initial days, there was a bit of confusion and an uncontrolled influx of donor agencies. But around 10 days post-earthquakes, the one-door policy was formed which coordinated all the aid and donation in the district. No organization

could bypass this committee. This led to channelization of relief funds and materials with the committee deciding what, where and when relief would go.

Good coordination between the local Government and other Stakeholders

Few houses in the most recovered VDC/municipalities were also built without coordination of local ward committee when no elected local Government representatives were present and council affairs were run by an all-party committee. Also, in this case, people did not wait for Government grants to build their houses as they needed shelter immediately, (P33). *‘There were 3 houses in this ward that were built by some organizations; they were not very strong but were liveable.... They did not coordinate with the ward office. It seems like they also built for some people who would have otherwise been capable themselves.’* Some organizations did not coordinate with the local Government bodies for the reconstruction activities such as building houses, installing water tanks, or providing training. The ward chairman of one of the most recovered VDC/municipalities mentioned, (P23): *‘I realized that they were supposed to give them a letter after the completion in implementation of their plans. In a way, they have been obliged to come to us. I have also mentioned to them that there has been a lack of coordination in some respects. They have moved forward accordingly.’* This finding suggests that I/NGOs failed to coordinate the local people and their representatives in the starting phase of the reconstruction process.

The Government official in the district affirmed that the coordination works done by District DCC during the early relief and rescue phase were very good. As per the account of a higher official in the DCC, the committee was headed by a chief district officer and included members, such as local development officers and representatives of the NGOs and I/NGOs working in the reconstruction relief and rescue works. The District Disaster Relief Committee (DDRC) meetings were frequently held if any problems arose and fixed instantly with the coordinated meeting, (P1): *‘If any action needs to be taken against anyone, then we would take the action immediately. In the beginning, we sat the DDRC meeting in the morning and the evening. Later, we started to sit in meetings in the evenings only then it came to every week. With that kind of system, almost everything came under our control. There were no health outbreaks. If something happened, then it would be handed over to the health cluster immediately then the affected would be airlifted.’* This statement indicates that the Government official believed that the local Government played a very active and pivotal role during the relief and rescue phase.

Good coordination of DCC with stakeholders in the relief and rescue phase

Besides the Government timeline to reconstruct the houses, the one-door policy was adopted by the local Government from the start even before the order had arrived from the centre. It had a positive impact in the later phase of the reconstruction process. This decreased the

overlapping of the support materials provided by the donor agencies in some communities and causing an extreme shortage in some. This led to successful coordination and conduction of the relief and rescue phase as claimed by the local authority, (P1): *'It would cause some areas to have many relief providers whereas some would have none. So, we implemented the "One Door System" under the authority of DDRC. If a responder had 5000 Canopy and proposed to go to 15 VDCs, we would only allow them to go to 2 VDCs so that they would be able to provide the Canopy to all people; approximately 2000 or a little more in each VDC.'* Due to the one-door policy, many donor activities were distributed to places in need instead of focusing only on certain places as per the Donor's interest. This was verified in the interviews conducted with I/NGOs representatives. Government District Disaster Relief Committee (DDRC) asked every I/NGO regarding their areas of interest and expertise before allowing them permission to work in the affected areas, (P10): *'We must work according to their instruction on where to get deployed.'* The channelling of funds and resources from the donor agencies helped to streamline the donor's support rationally and avoided the unnecessary overlapping of the programs. Unfortunately, interviews with local Government officials revealed that the manpower and resources (especially reconstruction engineers) could not be properly coordinated and collaborated in the reconstruction period at some places.

Good coordination between non-Government and Government organizations was also felt at the general population level as one of the participants of FGD conducted on most recovered village recalled, (FGD 3): *'Before this, an organization used to go the villages and distribute themselves on their own, but now they coordinate with ward office and has worked in drinking water project and other areas'*. The NGOs and INGOs working in reconstruction work in the district were coordinating with the local Government and periodically reporting to them regarding the progress of reconstruction works. This was evident in one of the most recovered villages as the council president recalled (P23): *"Before we were in office, they were selected by collaboration between the organizations, all-party committee, and the ward coordinator..... After the elections, the organizations do come to me for selections. They coordinate with us most of the time. However, some of them do show us their details some do not."*

Road and Land disputes: Some of the earthquake-affected residents felt the Government had put forward impractical road extension policies and rules post-earthquake which were creating problems in the reconstruction of houses. For example, the local residents had to contribute their land to extend the roads even where the residents had barely enough land to build a house on. The road extension program in the villages had not been discussed with the residents before bringing to the public. Therefore, people were hesitant to build their house in the confusion of

whether the land will be sufficient to build a house after allocating to the road extension as per the Government demand. This is how social mobilizer in a VDC explained this fact, (P21): *‘Well, after the newly elected took the office, there weren't any such discussions held with the community. It was conducted in the presence of local representatives by the urban municipality. Since 8 meters was too much; if they did, the road would cover an entire settlement beside the roads... The criteria for roads have caused some difficulty. People have expressed their grievances that, although they want to build their homes, the road criteria they need to meet has left them with insufficient land in which they could build their house.’* This showed that the Government had brought forwards policies without the consent of the residents which were impacting the reconstruction process.

The role and function of local Government ward committee (formerly VDC) in disaster recovery

The local Government authority known as a ward committee (former VDCs) had a crucial role in the reconstruction of houses. The ward committees had newly elected representatives after almost 20 years. The new representatives had been elected after the earthquake, so most of the ward transactions were done by the previous coalition committee. Most of the newly elected representatives were not happy about their predecessors, as one of the ward members explains his opinion, (P25): *'The previous secretary took all the money from the crushers and did not spend a penny to build the roads. So recently, we took the ward secretary together with ward chairman to ask the Crusher owner, "Where is the money that you submitted here in earlier times? Where was it invested in Fatakshila? The other areas have already built tarred roads, but nothing done in our area. Why?" From Now onwards even if some people ask for mere 1000 charity money you immediately contact ward authority.'* This revealed that the earlier local representatives had not worked as per the resident's expectation, although we could not contact any past representatives to have their say in that village. Some residents complained that engineers in the municipality were taking bribes from the residents in order to get their houses cleared of earthquake-resistant criteria. This incident had happened when people were tired of waiting for their house grant instalments. As one of the previous ward committee members explained the details, (P32): *'others started to wonder how that person had received his grant money so fast. Most of the people have taken loans. So instead of spending on interest on loans, they would rather spend some 8000 to 10,000 rupees on bribes if they would get it done. So, with this intention, they bribe the officer with pocket expenses and get their work done faster.'* This was further verified by two women residents who had paid the bribe money to the municipality engineer to get their house grants cleared. It seemed both had paid money after consulting each other.

Each of these wards had at least one engineer and one sub-engineer to monitor and verify the reconstructed house. The role of the ward chairman was to coordinate the district office, I/NGO, and residents in the reconstruction on top of its regular development work. Most of the ward committee had the plan to open a new track in the hilly area or to upgrade and extend the old ones. A chairman from a most recovered village mentioned that he had plans to build a road to support agriculture to transport the produce as they already had tractors at their disposal. Another ward chairman from a most recovered VDC was running financial cooperatives established by the members of the ward. It provided a small loan to the local women to build a house, support their livelihood by training them on income-generating activities. Almost all the households in the ward were a member of this cooperative. It was this village where most of the house construction was completed. This revealed that the local

Government representatives were active in the most recovered neighbourhoods.

The situation of the least recovered villages was totally different. The researcher could not interview the ward chairman in two of the least recovered wards; a member of the Ward Committee and a social mobilizer provided the information in those places. The primary headaches of the least recovered ward committee office were how to open the roads throughout the year. Hence, their majority of the budget was allocated to road construction. The residents had difficulty understanding the grant process as the least recovered places were far away from the district centre where the grant distribution was done.

Issue of Vulnerable Population

There was also the issue of homeless people. The reconstruction policy would only recognize the family with a patch of land to be eligible for a housing grant. The problems were to those residents whose houses were built on others' land, on public land, or were sharing the houses. The reconstruction authority revealed its limitations of responsibilities to solve this problem. The most NRA could do was to ask other organizations to prioritize them for vocational training. The authority from NRA explained, (P4): *'We have also told our development partners that they should keep these people in their priority if they plan to build any kind of house models..... If someone does not even have a house, we cannot give them the money neither can we build a house for them.'* The NRA office admitted that the Government had declared to provide an interest-free loan in coordination with local banks to the people who need more monetary help to build the house. A ward chairman from most recovered also had this in his knowledge but revealed it was not in practice, (P22): *'The Government had announced its plan to provide 25 lakhs rupees in the urban region and 15 lakh rupees in the rural region. But they have only shown us hopes but never been provided yet.'* The regular house loan provided by the banks were only at the reach of rich people, as a local teacher shared his experience, (P33): *'I was able to get it because I had connections with the right people. I might have got it because I had enough security deposit or maybe because I have a good job.'* The general population, on the other hand, surely knew about the loan incurred on them with heavy interest but never heard of a low-interest loan from any authorities. As one of the participants of the focus group mentioned, (FGD3): *'if you are building a house then certainly you have to take a loan.... we do not know about the interest-free loan. We haven't taken as well.'*