FROM VULNERABILITY TO RESILIENCE:

LONG-TERM LIVELIHOOD RECOVERY IN RURAL CHINA AFTER THE 2008 WENCHUAN EARTHQUAKE

by

Ziqiang Han

A dissertation submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Disaster Science and Management

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Disaster recovery is considered as the least understood aspect of emergency management by both practitioners and researchers. In the past few decades, the concept of recovery has evolved from a linear process focused on the physical aspects to a multi-dimensional, dynamic social process that reflects the different stages and patterns of human activities. However, the lack of experiences from developing countries rather than the United States alone limits the theorization effort of disaster recovery. This dissertation contributes the knowledge of disaster recovery from the recovery experience in China after the 2008 Wenchuan earthquake, and a sustainable development perspective is integrated in the study.

The Sustainable Livelihoods Approach (SLA) which is developed and widely used in the anti-poverty and development areas is adopted as the research design and theoretical guidance framework in the study series. The SLA framework, especially the five livelihoods assets (financial capital, human capital, social capital, natural capital and physical capital) are used as the main measurements of recovery. Meanwhile, the perception of recovery is also included as one dimension of recovery in the dissertation.

The data used in this analysis mainly comes from three data collection efforts. The first one is conducted in June, 2008, about one month after the earthquake and disaster response data is collected through semi-structured interviews. A second data collection effort which adopted a mixed method is implemented in January, 2009. Both quantitative household surveys and semi-structured qualitative interviews are

used for data collection. A stratified sampling method is used for the questionnaire survey, and semi-structured in-depth interviews are implemented with both community leaders and community members. In total, 515 household questionnaire surveys and 50 in-depth interviews from nine villages within three towns are obtained for analysis. The third data collection effort occurs in the summer of 2012 and follows up on the same households and villages from the 2009 effort with similar data collection patterns. Finally, information from 415 households is followed and another 37 qualitative interviews are obtained in the summer of 2012. The qualitative data is coded and analyzed using QSR Nvivo 10 and the quantitative data is analyzed by Stata 12.1.

The qualitative data reveals that there are six stages of post-disaster activities within these families: self-protection, safety information seeking/rescue, family reunion and temporary sheltering with uncertainty, self-rescue and waiting in temporary shelters, housing reconstruction/repair and livelihood recovery. For the most burdensome housing reconstruction, the unified reconstruction with counterpart assistance, the unified reconstruction without outside help, combined-reconstruction, and self-reconstruction are the four patterns of reconstruction. The major determinants of household reconstruction decision making include the available individual/household resources, higher level government support, and community collective actions.

In terms of livelihood assets, the comparisons of the results between the situation in the early recovery period (i.e., 2009) and three years later (i.e., 2012) indicate that all the five livelihood assets: financial capital, human capital, physical capital, natural capital and social capital have increased. With the increase of these

livelihood assets, the inequalities of the financial capital, physical capital, natural capital and human capital also enlarged. On the contrary, the social capital gap has decreased in 2012 compared with the situation in 2009. The financial capital structure changes also reflect the changes of people's livelihood strategies since the earthquake: people earn more from their salaries than on-farm activities.

The physical capital which reflects the housing condition has the biggest improvement in the disaster recovery process. Overall, most of the 2008 earthquake survivors have recovered from the housing recovery aspect, no matter in terms of estimated house value, housing structure or in terms of habitable space. Though the social capital is narrated as useful for housing recovery in the qualitative interviews, the quantitative models doesn't support such hypothesis. On the contrary, financial capital and human capital's effects on housing reconstruction are significant. Meanwhile, the government assistance is found to play an important role of facilitating housing recovery.

In terms of recovery perception, about 70% of our survey respondents report that they have recovered from the disaster impact while another 30% say that they have not recovered yet. The financial capital has a consistently significant positive effect on perceived recovery while other four livelihood capitals' effects are not statistically significant. The results also show that the current livelihood assets are stronger predictors of recovery perception than the changes of livelihood assets, which may indicate that psychological –related recovery perception may be more determined by current well-being status rather than absolute changes.

The final chapter discusses the theory and practice contribution, as well as some possible further research agenda of disaster recovery.

Chapter 1

INTRODUCTION

Research surrounding disaster recovery has attracted more and more attention in recent years, culminating in the National Disaster Recovery Framework developed by Federal Emergency Management Agency (FEMA) and released just three years ago in 2011. Despite this interest, disaster recovery is still considered the least understood aspect of emergency management by both practitioners and researchers (Smith & Wenger, 2007). Moreover, as Rubin writes that the "research and knowledge base in the realm of long-term recovery is seriously inadequate to the needs we face today" (Rubin, 2009 p.1).

In the past few decades, the concept of recovery has evolved from a linear process focused on the physical aspects referred to as reconstruction, to a multi-dimensional, dynamic social process that reflects the different stages and patterns of human activities. The idea of post-disaster improvement is preferred by many scholars to the idea of returning to pre-disaster normality, especially when the disasters are occurring in developing countries, while the concepts and practices of sustainable development and vulnerability and risk reduction are being integrated into disaster recovery processes. The measurements of disaster recovery, no matter at which level (households, communities, regions, etc.) are increasingly to multi-dimensional, including both physical (economic) and social-psychological aspects. The determinants of disaster recovery are many, include pre-disaster planning, socioeconomic status and development trends, disaster impacts and disruptions, post-

disaster response efforts, informal and formal external assistance (governmental and institutional capacity), and macro-socioeconomic or program/policy changes.

Mmost of the empirical lessons in current disaster recovery studies are based on western culture and government systems, particularly from North America. The lack of knowledge from developing counties such as China, which has very different historical, cultural, and governmental systems compared with the United States, has limited the theorization efforts of disaster recovery (Tierney & Oliver-Smith, 2012) and challenges the generalizability of empirical generalizations. Side by side with social units such as individuals, households/families, and communities (Dynes & Quarantelli, 1989), although there is an increasing trend of examining and discussing recovery at the community level, studies focusing on the household level should never be neglected. As Norris discussed in a report on behavioral science perspectives on resilience, "…the resilience of individuals is dependent upon the resilience of the communities in which they are embedded…It is equally important to recognize that the resilience of communities is dependent upon the resilience of the individuals who compose them" (2010, p.1). Households as the basic units of society and could be understood from an open system (Drabek & Key, 1984) and should be given more privilege when disaster recovery research is limited.

This dissertation contributes to the knowledge of disaster recovery through examining household and community recovery processes after the catastrophic Wenchuan earthquake in 2008 in China. The concept of sustainable livelihoods is borrowed from the development studies and integrated into the research design of this dissertation, making this dissertation more valuable for generalizing its application to other developing countries and areas. This dissertation utilizes a longitudinal dataset

that was obtained through three connected studies after the earthquake. Presumably, it is thus more reliable and suitable for increasing our understanding of recovery as social processes.

This dissertation addresses five sets of major research questions. First, what are the processes (stages and patterns) of recovery in households and communities after the 2008 Wenchuan earthquake in China? Second, are there any significant changes between the early recovery period and four years later in terms of livelihoods and assets (human, social, natural, economic and physical capitals)? Third, taking housing recovery as an example, what's the recovered status of housing in 2012, and what are the roles of social capital and government assistance in housing recovery? Fourth, how do people perceive their recovery and what are the determinants of recovery perception? Lastly, how can the sustainable livelihood analysis framework contribute to the theorization effort of disaster recovery? The answers to the first four research questions are arrived at inductively from the empirical data, while the answer to the last question is addressed discussing the results of this study in conjunction with other relevant literature.

The organization of this dissertation is depicted in the chart that follows:

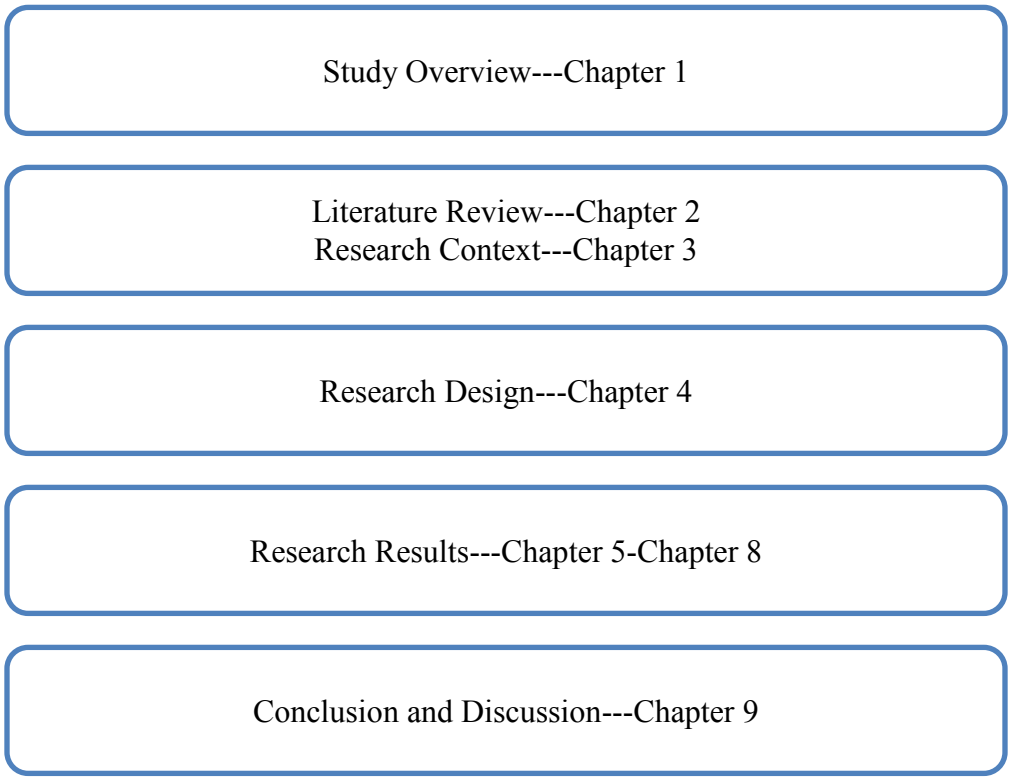

Figure 1.1 Dissertation Structure

The first chapter provides an overview of the study.

The second chapter reviews the definitions and determinants of disaster recovery from both academic literature and government policies. In particular, the literature review addresses the following questions: Recovery to where? Is there a timetable for recovery? What are the dimensions and measurements of recovery? In terms of determinants, both macro and micro influencing factors are summarized and discussed. Specifically, the role of social capital and government assistance in disaster recovery is reviewed.

The third chapter describes the overall impact of the earthquake, disaster response, and recovery programs and policy changes after the earthquake. Additionally, the vulnerable context of the fieldwork site, the disaster impact, and the adaptations of policy changes in this region are presented.

The forth chapter elaborates on the research design of this study. The theoretical framework, the Sustainable Livelihood Analysis Framework, is used to guide the design of research tools. The evolution of this longitudinal study, including data collection strategies and tactics at each time period is explained in detail. Furthermore, the data analysis strategies are clarified and discussed.

Chapters five through eight include the research findings. Household recovery process and patterns are presented in the fifth chapter. The sixth chapter compares the livelihoods assets and changes at the beginning of the recovery period with what they were four years later. The seventh chapter examines the housing recovery issue and the roles of social capital and government assistance in housing recovery. The eighth chapter explores how respondents perceive recovery and the determinants of recovery perception.

The final chapter presents a summary of the key findings, the contributions and limitations of this study, and the ways in which the Chinese case contributes to the theoretical understanding of recovery. Directions for future research are proposed.

Chapter 2

DISASTER RECOVERY: DEFINITIONS, MEASUREMENTS AND DETERMINANTS

Both practitioners and researchers recognize that disaster recovery is the least understood aspect of emergency management (Smith & Wenger, 2007). A famous disaster recovery researchers, Claire Rubin, concluded in 2009 from her 30 years' worth of experience and retrospection on long-term recovery, that, "the research and knowledge base in the realm of long-term recovery is seriously inadequate to the needs we face today" (Rubin, 2009 p.1). This chapter provides a review of the various dimensions and layers of disaster recovery, including definitions and measurements of disaster recovery synthesized from different scholars and practitioners over the years, and the corresponding determinants that are considered to influence disaster recovery. Specifically, the role of social capital and government aid in the disaster recovery process is reviewed and discussed in the concluding remarks regarding determinants. Finally, a summary and discussion of the existing literature on disaster recovery is presented and the research questions of this study are proposed.

2.1 What is Disaster Recovery?

In order to understand the concept of disaster recovery, it is necessary to answer the following questions: Recover to where? Is there a timetable for recovery? What dimensions should recovery have and how should it be measured? Following a summary of the goals, timetable, dimensions and measurements of recovery from

previous literatures, the definition of recovery used in this study is outlined and discussed.

2.1.1 Recover to Where?

Generally, there are three categories of recovery goals: the restoration of the status quo as completely and rapidly as possible, reconstruction as a chance to realize structural improvements, or no defined recovery goal and timetable after disasters. Of course, in reality, there is usually the simultaneous co-existence of multiple recovery aims, which may change periodically (Geipel, 1991). In Haas *et. al*'s classic study of four cities in the United States that focused on housing and jobs, the disaster recovery consisted of four overlapping periods: the emergency period, the restoration period, the replacement reconstruction period, and the commemorative, betterment, and developmental reconstruction period. The emergency period represented the time in which "the community copes with problems caused by the extent of the destruction and the number of dead, injured homeless and missing". The restoration period was marked by "the patching up of public utilities, housing, commercial and industrial structures which can be restored, and the return to relatively normal social and economic activities". The replacement reconstruction period was the time in which the city's capital stock was rebuilt to pre-disaster levels, and the social and economic activities returned to pre-disaster levels or higher. The final stage served three different, but possibly interrelated, functions: "to memorialize or commemorate the disaster; to mark the city's post-disaster betterment or improvement; or to serve its future growth and development" (Haas, Kates, & Bowden, 1977). The recovery was recognized as ordered, knowable, and predicable, for the emphasis was mainly focus on the building environment. However, later studies have shown that the recovery

process does not follow a predictable timeline, and that the recovery process is actually a dynamic rather than a linear process (Rubin & Popkin, 1990).

Recovery may mean to bring back to or regain a normal position or condition. After a disaster, restoration to pre-disaster conditions or normality is usually used as an indicator of recovery. Take housing recovery as an example. The recovery is often measured as post-disaster indicators returning to the pre-disaster levels (Zhang & Peacock, 2009). In federal assistance programs implemented after the Northbridge earthquake, the recovery effort was designed to rebuild or replace what was in place before the earthquake. Scholars evaluated the effect of these federal government assistance programs in terms of residential recovery, measuring the changes in population and housing between 1990 and 2000 (Loukaitou-Sideris & Kamel, 2004). Following this line of thinking, the concept of restoration, which indicates that the situation has been brought back to the original pre-earthquake state after a disaster (Dynes & Quarantelli, 1989,2008), is usually considered to be analogous with the term "recovery", perhaps due to an over emphasis on engineering solutions.

The approach of perceiving "recovery" as restoration can be problematic, because returning to pre-disaster levels does not necessarily mean building back for the better (Ganapati, Cheng, & Ganapati, 2012). From a dynamic and development-oriented viewpoint, there is no exact returning to "pre-disaster" conditions once a disaster has happened. Regardless of whether the disaster has stimulated positive change or has hastened the development trend of a community, the community will never be exactly the same as it was before the disaster occurred (Greene, 2006). Furthermore, recovering to the pre-disaster situation implies restoring the pre-event inequality, exploitation and vulnerability as well (Oliver-Smith, 1990). This is

especially common in some underdeveloped areas in developing countries with extreme poverty, chronic injustice and exploitation, and high-risk exposure, such as it has been in recent disasters in Pakistan (Mustafa, 2003) or Haiti (Olshansky & Etienne, 2011). Thus, as Wisner *et. al.* suggest, "in order to have 'recovered', a household should have not only re-established its livelihood, physical assets and patterns of access, but should be more resilient to the next extreme event" (Wisner, Blaikie, Cannon, & Davis, 2004). The idea of "build back better" (Lyons, Schilderman, & Boano, 2010) or "recover better" should be adopted, especially in the case of developing countries where "build back better" is indeed possible (Mulligan & Nadarajah, 2012) if the ideas of development, vulnerability and risk reduction are integrated into recovery activities (Shaw, 2006), with the physical and social planning integrated with one another to address local needs in culturally appropriate ways (Mulligan, Ahmed, Shaw, Mercer, & Nadarajah, 2012).

Besides the challenges of rebuilding infrastructure, homes, and businesses, the opportunity is a critical component of post-disaster recovery and risk reduction (Liu, Anglin, Mizelle Jr, & Plyer, 2011). For example, low-lying communities in New Orleans and Mississippi in the wake of Hurricane Katrina can be seen as opportunities for redevelopment into parks, new transit systems, education villages, new business centers, or tourist attractions (Waugh & Smith, 2006). Some other successful cases of using disaster recovery as a redevelopment opportunity can be found in Santa Cruz after the 1989 Loma Prieta earthquake (Arnold, 1999). Reconstruction after disaster can be viewed as a process of integrating development and recovery goals by improving the physical structures, standard of living, and creating job opportunities,

while integrating them into the community's social and cultural values (Pantelić, 1991).

Hence, beyond a return to previous "normality", there is the opportunity to integrate disaster mitigation, vulnerability reduction, and sustainable development into the recovery process, in hopes of achieving improvement through recovery. However, except for the hope of recovering better, there would be recovered (including the betterment), recovering in the process and retreat status of an entity (individual/household/organization/community or others) given upon a time after a disaster.

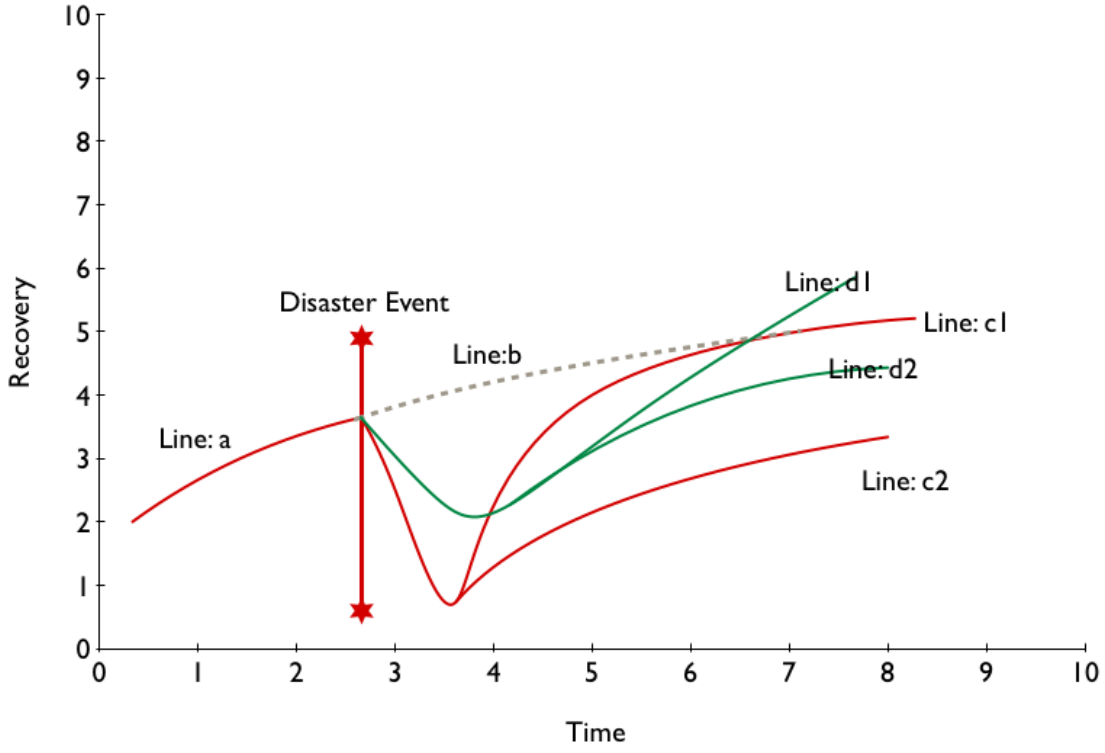

Figure 2.1 Possible Recovery Patterns after Disasters

2.1.2 Is There a Timetable?

FEMA has recognized that the recovery process is "a sequence of interdependent and often concurrent activities that progressively advance a community toward a successful recovery". Besides the pre-disaster planning and decisions which will have a cascading effect on the speed of recovery, there are three interrelated phases of recovery: short-term recovery, which is measured in days, it "addresses the health and safety needs beyond rescue, the assessment of the scope of damages and needs, the restoration of basic infrastructure and the mobilization of recovery organizations and resources including restarting and/or restoring essential services for recovery decision-making". The second is intermediate recovery, which can last from weeks to months. It is a phase that involves "returning individuals, families, critical infrastructure and essential government or commercial services to a functional, if not pre-disaster, state. Such activities are often characterized by temporary actions that provide a bridge to permanent measures." Finally, long-term recovery is the phase "that may continue for months or years and address complete redevelopment and revitalization of the impacted area, rebuilding or relocating damaged or destroyed social, economic, natural and built environments and a move to self-sufficiency, sustainability and resilience". Housing, infrastructure, business, psychological and public health, and mitigation activities are the main concerns for long-term disaster recovery (FEMA, 2011a).

Recovery begins when a community "repairs or develops social, political, and economic processes, institutions, and relationships that enable it to function in the new context within which it finds itself" (Alesch, Arendt, & Holly, 2009). In term of reconstruction, some scholars have suggested three phases: a short-term stage, which lasts about one year, a second stage, which lasts two to five years, and long-term

development, which could last six to ten years (Geipel, 1991). Other scholars have used a more observable method, where the recovery within neighborhoods could be grouped into five stages: “vacant lot”, “no visible signs of recovery”, “debris removal and gutting”, “repair without occupancy”, and “occupancy” (Green, Bates, & Smyth, 2007). Looking at housing recovery specifically, Quarantelli suggested four phases of housing recovery: emergency shelter, temporary shelter, temporary housing, and permanent housing (Quarantelli, 1995). Later observations have indicated the possibility of skipping phases or moving back and forth among the four housing recovery phases after disasters (Cole, 2003). Additionally, two trajectories, damaged/repaired and damaged/demolished/rebuilt, can exist in the residential building recovery process (Rathfon, Davidson, Bevington, Vicini, & Hill, 2012). For instance, after the 2003 Bam earthquake in Iran, there were only three stages of sheltering: temporary tent shelters, intermediate or semi-permanent shelters, and permanent housing (Khazai & Hausler, 2005).

In practice, the National Wenchuan Earthquake Reconstruction Plan of China alleged to finish all reconstruction within three years (Wenchuan Earthquake Reconstruction Council, 2008). Similar reconstruction ambition was also found in Chile’s national reconstruction plan after the 2010 Chilean earthquake and tsunami, though some local officials from severely damaged areas remained critical and skeptical about this goal (Siembieda, Johnson, & Franco, 2012).

Still other researchers suggest that there should be no formal recovery timetable because “while a community may ‘recover’, there will be individuals, families, and organizations that do not recover---even many years later---in the sense of returning to their former lives” (Alesch et al., 2009), and that there should be no

arbitrary timeframe in the process of moving from disaster relief to long-term recovery (Mulligan & Nadarajah, 2012).

2.1.3 Dimensions and Measurements

The *International Journal of Mass Emergencies and Disasters* published a series focusing on disaster recovery theorization efforts in 2012, with topics that covered the built environment (Alesch & Siembieda, 2012), ecosystems (Berke & Glavovic, 2012), economic recovery (Chang & Rose, 2012), institutional dimensions (Smith & Birkland, 2012) and social dimensions (Tierney & Oliver-Smith, 2012) of disaster recovery. The dimensions and measurements of recovery at both the macro and micro level are reviewed and discussed in this section.

Macro-Level:

Community recovery emerges "as the outcome of several sets of activities: restoring basic services to acceptable levels, replacing infrastructure capacity that was damaged or destroyed, rebuilding or replacing critical social or economic elements of the community system that were damaged or lost, and establishing or reestablishing relationships and linkages among critical elements of the community" (Alesch et al., 2009). The extent of recovery can be measured by a wide range of indicators, such as changes in population and residential units, vacancy rates, affordability of housing, retention of local residents, structural improvements, extent of retrofitting, quality of life, the time taken for reconstruction, the quality of reconstruction, and residents' satisfaction with recovery outcomes (Loukaitou-Sideris & Kamel, 2004). Based on the recovery experience in New Orleans after Hurricane Katrina, housing rehabilitation, public service and infrastructure, and labor force and employment, are recognized as the key indicators of recovery at a macro level for analysis (Liu, Fellowes, Mabanta, &

Program, 2006). Other argues that if a large evacuation occurred before the disaster struck, the percentage of returned households and population in the community should be generally used as a measure of recovery (Finch, Emrich, & Cutter, 2010). Looking at housing recovery specifically, data including remotely sensed data, statistical data, and interviews for quantitative measuring, monitoring and evaluating post-disaster recovery, could be used as an indicator of recovery (Bevington et al., 2011). Taking into consideration the varied investment and sources for housing recovery, there are four major models of recovery: the redevelopment model, capital infusion model, limited intervention model, and market model (Comerio, 1998).

For business recovery, some studies use the time of re-opening as the measurement of recovery (Asgary, Anjum, & Azimi, 2012), other studies use real profit, real sales, capital stock, and owner hours (De Mel, McKenzie, & Woodruff, 2012), while others use changes in sales or income as a measure of business recovery instead (Becchetti & Castriota, 2011;Resosudarmo, Sugiyanto, & Kuncoro, 2012).

Micro-Level:

Most studies of recovery at the micro-level adopt a multi-dimensional measurement. Such as Haas *et.al*'s classic study about family recovery, where housing recovery, jobs recovery, and perceived recovery were used as the indicators of family recovery. Families can be perceived as recovered in the physical aspect, but recovery can also be defined based on their own perception (Haas *et al*., 1977). Following the two crosscutting themes of the importance of kinship linkage and the loss of family functions in early disaster studies, the long-term family recovery in Bolin's work predominately covers three dimensions: housing recovery, economic recovery, and emotional recovery in terms of quality of life. Economic recovery refers to the

achievement of a financial status equivalent to pre-disaster economic circumstances. Housing recovery was mainly developed through computation of changes in housing characteristics using pre- and post-disaster housing measures. Lastly, emotional recovery is related to the reestablishment of psychosocial qualities after disruptive disasters (Bolin, 1982,1986,1994;Bolin & Bolton, 1983,1986;Bolin, 1976;R. Bolin, 1994).

In order to capture the relatively abstract impacts of disasters and the recovery process which could reflect on-going changes, Bates and Peacock developed the Domestic Assets Scale. It captures the economic value of household facilities of household functional areas (shelter, potable water supply, lighting, food preservation, eating equipment, human waste disposal, food preparation, floor cleaning equipment, dishwashing, and transportation) as the measurements of recovery. If the Domestic Assets Index met or exceeded the pre-disaster level, the household would be defined as recovered (Bates, 1982;Bates & Peacock, 1992,1993;Peacock, Killian, & Bates, 1987). Later on, the Domestic Assets Index approach was modified and adopted for assessing the impact of Indian Ocean tsunamis on households. The results suggested that this measurement was a reliable and valid measurement of household living conditions and was useful in tracking recovery effects over time cross-culturally and cross-nationally (Arlikatti, Peacock, Prater, Grover, & Sekar, 2010).

Recent studies about disaster recovery include more dimensions. For instance, Abramson *et. al.* developed a five-dimension measurement for individual disaster recovery including: housing stability, economic stability, physical health, mental health, and social role adaptation. They then analyzed the pre-disaster psychological strength, risk and disaster exposure, and neighborhood contextual effects, including

formal and informal help, using a structural equation model. The model was tested using data from a sample of displaced households following Hurricane Katrina. The results indicated that all of the five components of the recovery measure were positively correlated with a latent measure of recovery, with mental health and social role adaptation displaying the strongest association (Abramson, Stehling-Ariza, Park, Walsh, & Culp, 2010). Another study employed a measure of quality of life that included four dimensions including, physical health, psychological state, social relationships, and environment, to examine the disaster survivors' recovery five years after the Bam earthquake. A comparison of the results with data on the general population showed that experiencing the disaster may adversely affect the psychological aspect of quality of life, however the earthquake resulted in better social relationships in affected communities compared with the general population (Ardalan et al., 2011). In Tatsuki's study about life recovery after the 1995 Kobe earthquake, the life recovery measure was drawn from 14 items that captured the respondents' perception of life fulfillment/readjustment (seven items), life satisfactions (six items) and future prospect (one item) (Tatsuki, 2007). In a recently published book on recovery, the contents of disaster recovery included the debris management, environmental recovery, historical and cultural resources, housing, business recovery, infrastructure and lifelines, social and psychological recovery, and public sector recovery (Phillips, 2011).

In short, the measurement of disaster recovery tends to be multi-dimensional, often originating in early studies, and showing more accuracy as they have been improved over time. Overall, many of these studies use physical and/or economical

measurements, while another category pursues the more social-psychological aspects in which recovery is linked to individuals' perception.

2.1.4 Definition

The principles that inform recovery efforts understood as revitalization instead of rebuilding, involve the victims in their own recovery, conduct oversight and provide accountability, carefully consider ecological balance, and take action to address issues and crises that the private sector cannot adequately handle (Hartman & Squires, 2006).

Before defining the concept of recovery, there is a need to clarify a variety of terms that are often used interchangeably with disaster recovery: restoration, reconstruction, rehabilitation, reinstitution, and recovery. Restoration implies that "after a disaster, things are brought back to the original pre-disaster state". Similarly, rehabilitation suggests "a restoration although more of people than things," and restitution suggests "some kind of restoration of the rightful claimants of owners," implying the need for legal actions to return to a pre-disaster situation. Reconstruction, on the other hand, centers on the physical rebuilding of human communities in the post-disaster period. Finally, recovery, as the most inclusive term, refers to "moving a disaster impacted community to a healthy state which can include restoration, reconstruction and social change," which "may or may not be the same as the pre-impact level" (Dynes & Quarantelli, 1989,2008;Quarantelli, 1991,1999). In short, restoration, rehabilitation, reconstruction, and other similar terms only reflect part of the more general process of recovery after disasters.

In practice, the new National Disaster Recovery Framework developed by FEMA in 2011(FEMA, 2011a) defines recovery as "those capabilities necessary to

assist communities affected by an incident to recover effectively, including, but not limited to, rebuilding infrastructure systems, providing adequate interim and long-term housing for survivors; restoring health, social, and community services; promoting economic development; and restoring natural and cultural resources.”.

In academia, recovery has traditionally taken on a more outcome-oriented conceptualization, with emphasis on the physical aspect as seen in early studies (Haas *et al.*, 1977). Researchers like Nigg then began to point out that recovery should be conceptualized as a social process that “begins before a disaster occurs and encompasses decision-making concerning emergency response, restoration, and reconstruction activities following the disaster” (Nigg, 1995). Some other scholars have suggested that recovery can be defined as the “process by which a system has experienced a structural failure of this sort reestablishes a routine, organized, institutionalized mode of adaptation to its post-impact environment” since the disaster was often seen as a failure of social structure (Bates & Gillis Peacock, 1989). These changes in the definition of recovery reflect the shifts in conceptualizing disaster recovery in the last few decades from a linear, static issue with a specific set of stages, to a dynamic, interactive, decision-making process (Mileti, 1999).

One of the most widely accepted definitions of recovery in recent years comes from Smith and Wenger, who state that “disaster recovery can be defined as the differential process of restoring, rebuilding, and reshaping the physical, social economic and natural environment through pre-event planning and post-event actions” (Smith & Wenger, 2007). From a management perspective, the term recovery has been defined as “a process that involves communities and officials in a series of steps and stages through which households and businesses move at varying rates toward

establishing normal routines," as noted in Phillips' book *Disaster Recovery* (Phillips, 2011).

In summary, the definition of recovery should be multi-dimensional and reflect the different stages and patterns, and the dynamic processes of human activities, both before and after a disaster event. The definition should also be assessable and comparable as outcomes given upon a time.

2.2 Determinants

Pre-disaster vulnerabilities, socioeconomic status and governmental capacity, disaster impacts, immediate responses, along with post-disaster variables like institutional capacity, civil society-state relationships, recovery aid, and systems of social provisions, and post-disaster conditions, are the factors that influence post-disaster recovery processes and outcomes (Tierney & Oliver-Smith, 2012). These determinants of recovery are summarized and discussed at two levels: the macro, at the national or regional level, and the micro, at the community or household level.

2.2.1 Macro-level:

After reviewing five catastrophic disasters including, the Loma Prieta earthquake, Hurricane Andrew, the Northbridge earthquake, the Kobe earthquake, and the Grand Forks/Red River flood (North Dakota and Minnesota, 1997), Government Accountability Office (GAO) concluded that 1) having clearly defined recovery roles and responsibilities among stakeholders; 2) effective coordination and collaboration among recovery stakeholders; and 3) periodic evaluation of and reporting on the recovery process, were the three primary characteristics of successful disaster recovery efforts (Czerwinski, 2010,2012). Lessons from New Zealand earthquake events

indicate that central to recovery is how society organizes, mobilizes, and coordinates the diverse range of organizational and professional resources that can be called upon to assist in recovery. Recovery from disasters depends not just on people's ability to cope with the physical impacts of the events, but also on how the societal environment complements and supports the complex and protracted processes of community recovery (David, Julia, & Douglas, 2012).

In a study examining eight exemplary practices related to long-term disaster recovery and redevelopment from developing countries, the authors identified that successful recovery efforts emphasized local empowerment, organization, and leadership, and planning for sustainability. Consequently, they suggested three key approaches to enhance disaster recovery: 1) incorporate long-term recovery goals into disaster response and pre-disaster planning; 2) expand the knowledge base by incorporating research into recovery and harnessing lessons learned from international experiences, and 3) develop an outcome-oriented approach to disaster recovery planning, including the measurement of community-level outcomes (Garnett & Moore, 2010). Sri Lanka's experience after the 2004 tsunami illustrates that recovery can be hindered by a country's social and political conditions. Challenges to recovery include the need for centralized coordination and organization, planning and development control, gathering planning data, political leadership, equitable distribution of recovery assistance, and disaster education (Godavitarne, Udu-gama, Sreetharan, Preuss, & Krimgold, 2006).

2.2.2 Micro-level:

Community Recovery: Quarantelli and Dynes summarized the determinants of disaster recovery in the 1990s. Pre-disaster patterns and social trends, the economic

factors, government policies, and prior community recovery planning, were the influencing factors involved in disaster recovery according to their summary. Furthermore, the authors highlighted that if an affluent population was adversely affected by a disaster, the reproduction of past patterns was almost certain and the opportunity for increasing seismic safety during reconstruction was greater in a centralized society. In developing countries, though powerful groups also gain from disaster recovery, the "effort to increase seismic safety might produce some marginal increase in the general standard of living, even for those who continue to live in high risk areas" (Dynes & Quarantelli, 1989,2008).

According to FEMA's ESF long-term community recovery programs in the last seven years, common features among communities that had successfully recovered from disaster included those that had acted quickly, actively planned, engaged the community, developed partnerships, networks, and effective coordination strategies, made decisions and managed recovery locally, attempted mitigation, and prepared for recovery (FEMA, 2011b). Factors that lead to successful recovery included effective decision-making and coordination, integration of community recovery planning processes, well-managed recovery, a proactive community, engagement, public participation and public awareness, well-administered financial acquisition, organizational flexibility, and resilient rebuilding (FEMA, 2011a).

In term of reconstruction, the extent of damage, available recovery resources, prevailing pre-disaster trends, leadership, planning, and organization capacity were factors all directly related to the rate of recovery. "Both long-term trends and an urgent desire to return to normal, exert an important influence on the reconstruction processes" (Haas *et al*., 1977). In another study about housing recovery in rural counties affected

by Hurricane Katrina, the authors used a quasi-experimental research design and found that the most significant drivers of housing growth in the affected rural communities were domestic migration, percentage of mobile homes, and social capital during the recovery period (Ganapati *et al*., 2012). Lessons from Mississippi's post-disaster recovery demonstrate that the extent of physical damage did affect the on-going recovery pace, but the correlation between hurricane impact and the trajectory of recovery weakened over time (Burton, Mitchell, & Cutter, 2011). If the resettlement involved, the site choosing, layout of the settlement, housing design, and public participation in decision-making are critical influencing factors of success in post-disaster resettlement. Additionally, the socially and culturally derived needs and values of local people should be considered rather than only imposing modern, urban middle class values on rural populations (Oliver-Smith, 1991). Through examining housing recovery in two cities after the 1994 Northbridge earthquake in the U.S. and the 1999 Chi-Chi earthquake in Taiwan, Wu and Lindell proved that pre-disaster recovery planning can not only facilitate housing recovery speed, but can also help local officials integrate hazard mitigation into the recovery process (Wu & Lindell, 2004).

Rubin identified factors that are essential to an efficient and effective community recovery from the institutional perspective in her studies conducted during the 1980s. Effective intergovernmental relationships were essential to efficient recovery. The long-term recovery process was a dynamic process that involved both federal and state influence, community needs for action, and community planning and implementation capacity, including personal leadership and the ability to act and

knowledge of what to do (Rubin, 1985,1986;Rubin, Saperstein, & Barbee, 1985;Rubin & Barbee, 1985;Rubin & Popkin, 1990).

There are also some lessons from outside of the United States. The recovery results following the South Italian earthquake in 1980 showed that the pre-disaster development levels, relief decisions made during the emergency phase, the kind of material aid received, local leadership, and economic opportunities, were the primary factors associated with successful recovery (D'Souza, 1982). Through content analysis from interviews and secondary data, the authors found that governmental guidance, victims' willingness, and economic development conditions, were three critical determinants of the concentrated resettlement in rural China (Peng, Shen, Tan, Tan, & Wang, 2012). Social factors like gender, education, and age, combined with extreme poverty and marginalization, determined the coping ability and recovery from the riverbank erosion-induced displacement in Bangladesh (Mutton & Haque, 2004). Other factors including the relationship between citizens and local government (Bevaola & Quamrul, 2012), and public participation (Mustafa, 2003), would also affect the recovery after disaster.

In terms of rebuilding, Mulligan *et al.* found that the drivers of "building back better" in Sri Lanka after the 2004 Tsunami included the pre-disaster plan, strong local community development organizations, and community development approach (Mulligan & Nadarajah, 2012). For the donor-driven housing reconstruction model, some impediments were identified in Aceh, Indonesia after the 2004 Indian Ocean tsunami. These impediments included NGOs competency regarding resource procurement and competition for resources among aid agencies, and external hurdles like local transportation and supply capacity, insufficient government support, local

housing culture, and lack of community participation (Chang, Wilkinson, Potangaroa, & Seville, 2011).

Household/Family Recovery: Families can be seen as an open system that can use both internal resources, like insurance and savings, and external resources for disaster recovery. In a study conducted by Drabek *et al.* in Topeka, Kansas after the 1966 tornado, patterns of family recovery and the utilization of internal and external family resources were examined. Five major elements were included in their analysis: demographic characteristics, family recovery capacity, disaster event qualities, recovery response, and social impacts. They found that family recovery was accomplished largely through external sources, in addition to the less significant internal resources that were used. However, patterns of assistance were not uniform, with elderly, lower income, and ethnic minority populations being less frequently assisted. Families with strong group linkages before the disaster event had a greater possibility of receiving aid than those who were more isolated. Furthermore, they found that the bonds within kin and among friends became tighter, however linkages with neighbors were weakened post-disaster (Drabek & Key, 1984). They also found that families with higher income levels received more help from their informal networks compared with those with lower incomes. However, formal support from organizations varied, with high income families more likely to receive help from government agencies, and lower income families more frequently receiving aid from the Red Cross, the Salvation Army, and religious organizations. In term of ethnicity, whites in the lower income sample were more likely to receive help from kin and friends, while non-whites were more likely to receive help from religious organizations and the Red Cross. The elderly used more of their personal savings than

younger persons, with the elderly in the lower income sample receiving less help from mass care providers, employers, as well as relatives and friends (Erickson, Drabek, Key, & Crowe, 1976).

Haas *et al.* proposed a casual model of family recovery in their study in the 1970s. Housing recovery and perceived recovery were used as the dependent variables. Socioeconomic status, life cycle (age), and disaster impacts, were used as independent variables, while dislocation, institutional embeddedness, and kin embeddedness were used as the intermediate influencing factors of family recovery. The disaster impact, institutional embeddedness, and socioeconomic status variables had a positive effect on housing recovery, while kin embeddedness and life cycle had a negative effect. For perceived recovery, the direct, positive influencing factors were kin embeddedness and socioeconomic status, and the direct, negative influencing factor was life cycle (Haas *et al.*, 1977).

In Bolin's study of long-term family recovery, eight composited indicators were used as possible influencing factors of perceived recovery and life satisfaction: degree of impact, disruption, institutional embeddedness, kin embeddedness, family recovery, socioeconomic status, family life cycle (age), and housing recovery index. The results indicate that the more severe the disaster impact, the more likely it would be for a family to seek recovery aid from organizations and informal, personal social networks if possible, and the more likely it would be for that family to reestablish housing and have a higher rate of emotional recovery. Furthermore, families with a higher socioeconomic status were more likely to recover in both the housing and perception aspects. Older people tended to have housing rebuilt more slowly and were less satisfied with their current life at this later stage in the life cycle, making them less

likely to be considered recovered overall (Bolin, 1976). Another study compared the different determinants of disaster recovery in terms of economic recovery and emotional recovery between the white and black population. The results of the study demonstrated that there were differences in determinants of recovery between the two groups, including variations in losses, psychosocial impacts, aid utilization, and social support, but not demographic or socioeconomic factors (Bolin, 1986). The determinants of family recovery may be varied across different cultures. In one analysis using household survey data from Rapid City in the U.S. and Managua in Nicaragua, Bolin explored the effects of socioeconomic status, absolute disaster impact, loss ratio, aid, and access to resources as independent variables, and the objective recovery (income recovery, home size recovery, recovery of conveniences, continuity of employment) as intermediate variables on perceived recovery. The results indicated that disaster losses and aid received were the best predictors of recovery perception in Rapid City. However, in Managua, aid had little effect, and employment continuity had a noticeably stronger effect. For survivors in Rapid City, continuity of employment was not an important determinant of perceived recovery, however income recovery had a considerable effect. The absolute disaster impact variables had a more significant, negative effect on the respondents in Rapid City (Bolin & Bolton, 1983).

Benefits and restoration efforts are distributed unequally in the recovery process amongst different sub-populations according to their geographic locations, socioeconomic status, and different reconstruction programs. Bates and Peacock examined the recovery process in term of the Domestic Assets Index of households. In their empirical study conducted in Guatemalan after the 1976 Earthquake, the

household dataset variables (ethnicity, head's education, head's age, household size, pre-earthquake domestic assets, political status, and percent of Latino in the community) indicated that disaster impact and housing aid were the primary determinants of household recovery. The most important single determinant of household recovery was aid program involvement, including: permanent housing solution, one-room temporary house, third type of housing assistance involved the distribution of free or discounted sheet metal roofing, and no aid. The temporary housing program recipients failed to reach recovery levels even compared to those who received no aid. The permanent housing program had the best rate of recovery because they provided participants with long-term housing that was superior to pre-disaster housing in most cases. Other household characteristics like prior wealth, education, age, household size, ethnicity, and earthquake damage, also had significant effects on disaster recovery, but these effects varied by the type of aid received (Peacock *et al.*, 1987). The variation of recovery degree among different socioeconomic groups reveals an interesting pattern. The upper and lower socioeconomic groups appear to have better recovery levels post-disaster than the two middle groups. The lower middle group in particular had lagged behind in the recovery process (Bates, 1982).

Recovery experience in the Upper and Lower Ninth Ward in New Orleans after Hurricane Katrina revealed that the recovery outcomes could be best understood as the result of both pre-and post-storm conditions. The lagging recovery rate among marginalized groups had significant historical, social, and economic roots unrelated to the physical disaster damages. Limited access to rebuilding resources, limited municipal services, lack of potable water and electricity, temporary trailer settings

further from neighborhood, and a lack of flood insurance, were the major impediments to recovery among lower income residents in these neighborhoods (Green *et al.*, 2007).

Lessons from other places in the world also provide valuable knowledge about the factors that influence disaster recovery. A study about household reconstruction decision-making in Japan revealed that, in regards to the degree of disaster damage, having children in the home had positive effects on people's actual choice of reconstruction, with elderly people lacking children less likely to reconstruct their houses. Government reconstruction subsidies had a positive effect on helping the heavily damaged households and households with children, however such an effect was not seen for elderly people's households (Sakakibara, Murakami, Esaki, Mori, & Nakata, 2008). Another two-wave household study from India indicated that socioeconomic status was a significant influencing factor of perceived recovery; the lower income families had a lower perceived recovery, and the backward classes and scheduled castes (social classification) perceived a lower level of recovery (Arlikatti & Andrew, 2011). In a study that used quality of life as the recovery measurement for individual survivors after the Bam earthquake, it was found that there was a lower quality of life associated with females, the elderly, those living alone, those with severe earthquake-related injury, those with poor quality of living conditions, those with increased dependency in the activities of daily living, those living in an urban area, and those being temporarily housed (Ardalan *et al.*, 2011). In a study about the occupancy in Honduras after the 1975 Hurricane Fifi, the number of persons within a household, religious affiliation, and participation in construction programs were the three most significant determinants of content occupancy (Snarr & Brown, 1982). In another study about disaster recovery in Yunnan, China, the economic status of

households and outside aid (mainly government aid) were found to be the major contribution to recovery and was measured by the economic investment on housing and the time before moving into permanent shelters (Wang, Chen, & Li, 2012).

In summary, there are five major determinants of household recovery: the socioeconomic characteristics of the family; the external aid coming from informal personal social networks and local organizations; disaster impact and disruption degrees; macro community features like pre-disaster planning, post-event response and recovery, as well as the collective activities within communities; and higher levels of government assistance programs and policy support which could be common and especially important after a catastrophic event.

As demonstrated in the studies above, external aid is very important for family recovery. Quarantelli identified ten major characteristics of assistance recipients and seven major characteristics of aid providers. For the aid recipients, 1)“ Disaster victims tend to judge not only their losses but also what they obtain in recovery efforts in relativistic rather than absolute terms”. 2) “Certain pre-impact social locations or placements affect being helped in the recovery process. In general, those outside of the everyday mainstream remain outside in the post recovery period.” 3) “Some families/households receive more help from various sources than others with roughly equivalent losses/needs.” 4) “There is differential knowledge in terms of social status of where to go for help and how to obtain assistance.” 5) “For the great majority of victims, the major helping sources in the recovery period are relatives and kin.” 6) “The family socioeconomic status is important in the recovery process.” 7) “The later a victim family is in the life cycle, the less likely will there be recovery to a pre-impact level, everything else being equal.” 8) “There is a difference, and no necessarily strong

correlation between perceptual/symbolic recovery and economic recovery." 9) "The more temporary housing relocations occur, the more difficulties there will be in the recovery period." 10) "There can be positive as well as negative consequences from involvement in the recovery process, social psychologically as well as socioeconomically." For the aid providers, seven themes were identified: 1) "Almost all the assistance provided informally and also by relatives and friends is less noticed and reported, giving formal agencies the impression that they proportionately provide more recovery help than is actually the case"; 2) "A very typical characteristic of disasters is the appearance of new groups and new ways of doing things"; 3) "Even leaving emergent groups aside, there tends to be relatively little coordination among the formal organizations involved in recovery efforts"; 4) "The often overlooked are the personnel or staff problems of the organizations that undertake to provide recovery aid and assistance"; 5) "Unless there is systematic record keeping and a formal critique, there will be few lessons learned about organizational operations in recovery"; 6) "Unless there is systematic record keeping and a formal critique, there will be few lessons learned about organizational operations in recovery"; 7) "In many situations the recovery assistance is strongly affected by political considerations" (Quarantelli, 1991,1999). In the following section, the studies surrounding aid providers and beneficiaries are discussed in terms of social capital and government aid.

2.2.3 The Role of Social Capital

The concept of social capital has become a popular term and theory in the last two decades. Most researchers agree that the founding concepts of social capital come from Bourdieu, who takes social capital as a relationship immanent capital that provides useful support when needed (Bourdieu, 2008), and Coleman's rational choice

approach that defines social capital by its function (Coleman, 1990). Several more important and influential works about social capital include Putnam's civic view (Putnam, 2001;Putnam, Leonardi, & Nanetti, 1994), Burt's network approach (Burt, 2000) and Lin's resource perspective (Lin, 2002). Since my concern is mainly about disaster research, the review and discussion about social capital is narrowed in to focus on the areas related to disaster research.

Though early studies about disaster recovery had identified that the support from informal personal social networks like kin and friends was one of the most significant facilitators of recovering from disaster (Bolin, 1982;Drabek & Key, 1984), the concept of social capital was not explicitly defined and used during the 1960s or 1970s. The importance of social capital in disaster management and risk reduction only attracted disaster researchers' attention in recent years (Dynes, 2006;Nakagawa & Shaw, 2004;Wisner, 2003). Compared with the devastation to physical capital and human capital in a disaster scenario, social capital is less affected, and thus can provide essential resources for accomplishing critical tasks in the wake of disasters (Dynes, 2006). Dynes published an article which discussed the importance of social capital in dealing with community emergencies according to six different forms of social capital: obligations and expectations, information potential, norms and effective sanctions, authority relations, appropriable social organizations, and intentional organization, all of which come from work by Coleman (Coleman, 1990). Social capital, which can facilitate collective action, could improve the resilience at both the individual and community level and play an important role in all four stages of the disaster cycle.

The most fruitful studies about social capital and disasters may come from Aldrich (Aldrich, 2012). In his quantitative analysis using community data from nine wards in Kobe between 1990s and 2008, social capital was measured by the number of NPOs created per capita per ward, and it had a positive but hysteresis effect on recovery that was measured by population growth rate. The control variables included the disaster damage, economic inequality, welfare dependence, and population density (Aldrich, 2011a). In another similar analysis using the constructed data from 1922 through 1933 in 39 neighborhoods affected by the 1923 Tokyo earthquake, Aldrich concluded that social capital, which was measured as voter turnout in municipal elections in this case, was the best predictor of population recovery in post-earthquake Tokyo instead of earthquake damage, population density, human capital, or economic capital (Aldrich, 2012). However, Aldrich also noticed that social capital could be a double-edged sword in disaster recovery. For example, the communities with higher voter turnout had a significantly less number of trailer parks, which was perceived as a "public bad" after Hurricane Katrina. More connected and organized communities would push the unwanted "public bad" to other communities (Aldrich & Crook, 2008). A similar effect was also found in Nadu, India which was affected by the 2004 Indian Ocean tsunami. Using field observations and interviews, Aldrich discovered that high levels of social capital, which was captured as the presence of local organizations and linkages to outside aid organizations, simultaneously provided strong benefits as well as equally strong negative externalities, especially to disadvantaged groups. Strong social capital reinforced collective action for local organizations, speeding up their recovery and connecting them to external aid providers, however it also strengthened the obstacles to people on the periphery of society (Aldrich, 2011b).

The positive effect of social capital on post-disaster recovery has also been observed in other scenarios. In a study that examined the utilization of aid after Hurricane Andrew, the personal network context significantly affected five of the seven measures regarding utilization of formal aid (Beggs, Haines, & Hurlbert, 1996). Furthermore, social capital could play an important role in both evacuation and returning, though the resources embedded in personal social networks could be stratified (Fussell, 2006). As collective narratives, the bonding social capital had a positive incentive for people's returning to their community after evacuation from Hurricane Katrina because people thought their social network was not replicable elsewhere (Chamlee-Wright & Storr, 2011a). Even in diverse neighborhoods where residents only loosely connected, such bonding and community-based organizations can facilitate post-disaster recovery (Storr & Haeffele-Balch, 2012). Though social cohesion had a significant positive effect on recovery at the households and village level, such an effect may be weakened when all families within a village are impacted by disaster (Chowdhury, 2011).

However, it should be noted that social capital actually played a complex role during disasters. Social capital could effectively mobilize people and resources through pre-exiting associations that exist amongst one another, but it can also block or delay urgent decisions (Buckland & Rahman, 1999). Meanwhile, it may also facilitate the lobbying and rent seeking for available government resources and can cause community groups to re-orient their stocks of social capital away from mutual assistance (Chamlee-Wright & Storr, 2011b). The inequalities of social capital also have the potential to be increased over the course of a disaster, from early preparation to prolonged displacement and uneven return. Poor communities were less likely to

receive informal assistance because their closest friends and kin network were in a similarly vulnerable situation (Elliott, Haney, & Sams-Abiodun, 2010). Though people can use their personal social networks to get formal and/or informal aid, such utilization of aid is varied among different social groups. Disadvantaged groups that rely heavily on their social networks may weaken the speed of recovery when the majority of their network was similarly impacted by the disaster. Meanwhile, macro social capital in terms of trust was also found to significantly affect post-disaster recovery (Zhao, 2007). There are also some other drawbacks of social capital, though all participants may benefit from some kind of bonding and bridging of social capital. The bonding social capital within a community may influence some participants to stay despite having the resources and ability to evacuate from a hurricane or other natural disaster. The linkages and bridging of social capital were especially important for information sharing and resource procurement, as seen with lower-income survivors, whose lack of linkages and bridging from social capital affected their ability to access resources and services (Hawkins & Maurer, 2010).

Social capital may play a therapeutic or psychological role for disaster survivors, especially for women (Ganapati, 2012). In another study looking at people's perceptions of livelihood recovery, the formal network in the community, including the leadership of community-based organizations, were among the most positively influencing factors. The "elite capture" feelings and the semi-forced participatory method in the new established organizations negatively affected the livelihood recovery (Minamoto, 2010). A similar study was also conducted in an area affected by the Wenchuan earthquake in China. The trust in local officials was significantly and positively related with perceived recovery, while the personal network's effect was not

significant. In the survey of communities, disaster damages and a lack of full-time residency had a significant negative effect on recovery perception (Chen & Meng, 2010).

In short, the social capital, regardless of whether measured from the network approach or civic engagement method, plays an important and complex role in disaster recovery. It may have a therapeutic effect on recovery perception and facilitate the disaster recovery in terms of resource mobilization and procurement, collective action, cooperation, and collaboration. However, it could also impede urgent decision-making and cooperation between different levels of agencies, especially in regards to the perceived "public bad," but could be good for overall disaster response and recovery. Since social capital has a significant impact on disaster recovery, the social-capital-disadvantaged groups may be isolated and excluded from resources, services, and other benefits during the recovery process, especially when resources were limited. Finally, the strong bonding of social capital may also influence both evacuation and returning with unclear results. Therefore, there is a need to examine the role of social capital in disaster recovery more generally.

2.2.4 The Role of Government/Institution Support

Disaster declaration in the United States could provide an opportunity for local government and NGOs to acquire federal resources not normally available for economic development. Furthermore, community-based organizations and local NGOs could play an important role in assisting vulnerable disaster survivors with their unmet needs (Bolin & Stanford, 1998). After the 1994 Northbridge earthquake, the amount and distribution of federal funds was a major contributing factor in long-term disaster recovery and reconstruction. The communities that received more federal grants and

loans recovered both better and faster. However, disadvantaged populations (multi-family or rental) had difficulty in accessing federal residential assistance because the assistance was based on absolute disaster losses, and the federal disaster loans were determined by income level and credit history. Thus, the effect of federal funds on community recovery was actually confounded with the socioeconomic status of these families and communities, with richer communities benefitting more from government assistance and recovering much better (Loukaitou-Sideris & Kamel, 2004). However, it should be noted that while people with a higher socioeconomic status obtained more formal support from government agencies, lower income groups were more likely to receive help from mass care providers and religious organizations. Meanwhile, another study about long-term recovery after Hurricane Andrew indicated that existing sources of assistance were used more often than specific post-hurricane relief resources, and that the disaster relief effort had less impact on subjective long-term recovery than did job or income loss or housing repair difficulties (McDonnell *et al., 1995)*.

However, government assistance programs do not always play a positive role in facilitating recovery. For example, the uncertain promise of financial support may reduce people's motivation for fast efforts at the beginning of the recovery (Resosudarmo *et al.*, 2012). In a study examining the difference in housing recovery outcomes among homeowners, squatters, and renters after the 2001 Gujarat earthquake in India, the public assistance that was targeted toward homeowners (relatively rich people) and low-income squatters did facilitate in their recovery. However, the poor renters did not benefit from the government-funded housing recovery programs because the renter housing recovery policy only financed landlords

who were willing to re-build and re-rent their new housing to the current tenants instead of new renters. This was problematic because landlords preferred to use the post-disaster situation in India as an opportunity for new development, because before the earthquake they would not have been able to remove the long-term renters legally (Mukherji, 2010).

The role of institutional support from external NGOs is more common and is examined in developing countries because in underdeveloped areas, such as the areas affected by the 2004 Indian Ocean tsunami, the disaster relief effort generated by NGOs was extremely important to meeting many people's basic needs due to the absence of aid from the government (Rodriguez, Wachtendorf, Kendra, & Trainor, 2006). Evidence from Indonesia and Sri Lanka after the 2004 Tsunami demonstrates that mere available funds did not guarantee reconstruction results. The aid absorptive capacity of local organizations and cooperation between local agencies and donors may hinder the effective utilization of aid (Athukorala, 2012). Also, other factors may constrain the adaptation of aid from external NGOs and reconstruction effects at local levels, such as the use of unfamiliar methods for discussion and decision-making at the local level (Daly & Brassard, 2011), and the narrowed definition and participation of stakeholders (Ganapati & Ganapati, 2008).

2.2.5 Business Recovery:

It is very difficult to decipher the determinants of business organizations' recovery after disasters because tracking of businesses that go out of existence following disasters is not easy and it is difficult to disaggregate the macroeconomic influences from the effects of disasters (Webb, Tierney, & Dahlhamer, 2000). In Dahlhamer and Tierney's study about business recovery after the 1994 Northbridge

earthquake, the business size, disruption of business operations, earthquake intensity, and the utilization of external aid, were found as predictors of business recovery (Dahlhamer & Tierney, 1998). In another study which examined business recovery six to eight months after Hurricane Katrina through managers ratings, the authors found that the disaster impact and post-disaster problems like population dislocation (resulting in loss of customers and staffing) had a significant negative impact on business recovery. On the contrary, the pre-disaster emergency response plan, preparedness, and effective staff communication had no real impact on business performance (Corey & Deitch, 2011). Similarly, a qualitative study about small business recovery in the Gulf Coast of the United States after Hurricane Katrina revealed that lack of planning, cash flow interruption, lack of access to capital, serious infrastructure problems, and lack of federal assistance were the major impediments to small business recovery. Business owners believed that the individual assistance programs from FEMA actually discouraged people to work, and thus resulted in a lack of workers in the local job market. Small Business Administration (SBA) loans took too long from application to procurement of funding, and the reality of taking on a large debt also impeded small business owners' use of the available loans (Runyan, 2006). Disasters affected the business recovery not only in terms of direct physical damage, but also in terms of social and community disruptions.

Experience from developing countries reveals a slightly different picture. An empirical study about small business recovery from Pakistan indicated that the determinants of small business re-opening time were the average monthly sale, past disaster experience, dependency on utilities and public services, disaster damages, disruption in supply chain, personal social network support, knowing the recovery

priorities, and staff engagement (Asgary *et al.*, 2012). Another study from Sri Lanka following the 2004 tsunami showed that the lack of access to capital inhibited the recovery process, and the disruption in supply chains was especially important in influencing recovery of the manufacturing and services sector (De Mel *et al*., 2012). Following the theme of lacking capital for recovery, another study in Sri Lanka indicated that microfinance could be a useful tool for facilitating disaster recovery in poor and underdeveloped areas (Becchetti & Castriota, 2011). Though fast or large delivery of external aid could facilitate business recovery, it is often more advantageous to not make promises of financial support to enterprises if the timing of aid delivery is uncertain. Surveys of small and medium businesses in the Bantul District after the 2006 Java Yogyakarta earthquake displayed that the "promised" aid about six months after the disaster actually had a negative effect on recovery because it had an incentive to wait until the grant was delivered, resulting in a disincentive to exert greater effort to recover faster, though this effect diminished about one year later (Resosudarmo *et al.,* 2012).

Though the determinants of business recovery varied slightly between developing and developed societies, the external aid, regardless of whether from informal social networks or formal organizations, plays an important role in facilitating the recovery process.

2.3 Summary and Research Questions

The concept of disaster recovery has evolved from a linear model that placed emphasis on physical aspects, to a dynamic, multi-dimensional process with outcomes assessable over time. The determinants of disaster recovery include pre-disaster planning and trends, socioeconomic status, disaster impact and disruption, post-

disaster response efforts, external informal and formal assistance, and macro socioeconomic programs and policy changes. However, it should be noted that most of the empirical lessons in current disaster recovery studies are based on the United States' experiences, and there is a lack of knowledge from developing countries, especially from different societal and cultural backgrounds, which has limited theorization efforts in disaster recovery (Tierney & Oliver-Smith, 2012). Thus, more empirical studies and lessons from developing countries like China would be valuable for contributing to the knowledge of disaster recovery from other perspectives, to allow us to determine the extent to which empirical generalizations based on Western countries are applicable to China and other societies in the developing world is the goal of this study,

In order to assess the success or failure of recovery in term of outcomes and understand the dynamic process of recovery, the goals of recovery, levels of recovery, size of recovery unit, perspective on recovery, recovery from secondary or ripple effects of disasters, and the difference between recovery from disasters and recovery from catastrophes, should be taken into consideration (Quarantelli, 1991,1999). First, the inclusion of different social units such as individuals, families or households, groups, organizations, communities, or nation states is important and should be made clear (Dynes & Quarantelli, 1989) before a study is conducted. Based on the literature above and my expertise, the micro system, including household and community recovery, should be given priority. Thus, long-term recovery at the household and community level after the 2008 Wenchuan earthquake in China is examined in this study.

Besides the housing recovery and reconstruction issue, livelihood[1] recovery, which is one of the most important components of long-term recovery for rural residents in developing countries (Shaw, 2006), will be examined and discussed. The five livelihood assets: human capital, social capital, financial capital, natural capital, and physical capital will be used for analysis. Furthermore, this study will adopt a longitudinal research design to inspect the long-term recovery process and outcomes in terms of livelihood capitals, housing recovery, and perceived recovery.

This study investigates several aspects of recovery based on three field trips to one rural area affected by the 2008 Wenchuan earthquake in China. Five major research questions and hypotheses are proposed:

1. What are the processes (stages and patterns) of recovery in households and communities since the 2008 earthquake? How does immediate disaster response within a community would affect long-term recovery?

Hypothesis:

1) The household recovery process may be differentiated into several stages;

2) Families' recovery patterns may be varied according to their socioeconomic status and capacity of capturing opportunities available to them. ;

3) Through a comparison of two communities, the effect of immediate response and collective action within a community in regard to resource procurement and long-term recovery will be demonstrated and discussed.

2. How have families recovered from the disaster impact in terms of livelihood assets?

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[1] Detail review and discussion about sustainable livelihood studies will be available in the research design chapter.

Hypothesis:

1) Most of the families would have recovered in terms of livelihood assets, human capital, social capital, natural capital, financial capital, and physical capital, but some families would have been left behind;

2) With the increase of livelihood assets, the inequality between different families will be greater in the post disaster period.

3. Focusing on housing recovery; what are the changes in housing conditions since the earthquake? What is the role of social capital in housing recovery? How do government assistance programs affect the housing recovery outcomes and processes?

Hypothesis:

1) The housing condition in this rural area has improved;

2) Social capital will play an important role in housing recovery;

3) The government housing subsidy program will play an important role in housing recovery and there will be a substantial difference in housing recovery between households chosen as exemplary cases and others;

4. How do disaster survivors perceive their recovery four years after the event and what factors influence people's perception of recovery?

Hypothesis:

1) Most disaster survivors will perceive themselves as recovered, but there will be some families perceived that they have not recovered;

2) Social capital will have a significant and positive effect on recovery perception;

3) Physical recovery status should positively relate with recovery perception;

5. Is the sustainable livelihood analysis framework in development areas a very useful analysis framework for disaster and vulnerability/resilience research? This questions will be discussed in the conclusion part.

Chapter 3

VULNERABILITY CONTEXT, CATASTROPHE IMPACT AND POLICY CHANGES AFTER THE EARTHQUAKE

In this chapter, the impact of the Wenchuan earthquake, the vulnerable context of my fieldwork site, and policy changes, especially the disaster relief programs from government after the earthquake, are introduced. First, an overview of the catastrophic event's direct impact at the macro level is described in terms of deaths and injuries, economic losses, infrastructure damages, and social disruptions. Then the vulnerability context of my fieldwork site is presented and the direct disaster impact within the county is displayed. Finally, the policy changes, disaster relief programs, and disaster recovery housing assistance programs employed by the government are introduced and discussed.

3.1 Wenchuan Earthquake and Its Impacts

On May 12th, 2008, at 2:28 pm (Beijing time), a mega-earthquake measured at 8.0 on the Richter Surface Magnitude Scale/7.9 (Moment Magnitude Scale) hit the southwest of China in Sichuan Basin. Since the epicenter of the earthquake was in Wenchuan County, and it happened on May 12, this earthquake was named and is well known as the Wenchuan earthquake or 5-12 Earthquake in China. In some western countries, it was reported and discussed as the 2008 Sichuan earthquake or Great Sichuan earthquake, however, it should be noted that all of these descriptions are referring to the same event.

3.1.1 The Complexity and Cascaded Disasters

The Wenchuan earthquake affected a large area and population in China. It impacted an area of about 124 million acres (500,000 km^2) and 46.25 million people in ten provinces, 417 counties, 4,667 major towns, and 48,810 communities or villages (NCDR-MAC & UNDP, 2009).

Besides the major quake on May 12th, hundreds of aftershocks happened within this area. Looking solely at aftershocks measuring over 4.0 (Richter scale) for example, 191 occurred in May, 34 in June, 18 in July, followed by another 18 in August. Among these aftershocks, eight were over 6.0 on the Richter scale[2]. In addition to the impact from the major quake and aftershocks, heavy rain and previous human activities in this mountainous area exacerbated the damage by causing thousands of geological hazards like landslides, mudslides, and quake lakes. A primary report showed that 9,556 geological incidents happened within the first month after the major quake: 5,117 landslides, 3,575 collapses, 358 mudslides, and 34 quake lakes. The direct economic damage from these incidents reached RMB 43.8 Billion (USD 7.2Billion) (Zhang *et al.*, 2008).

As a source of professional and intelligence support to the National Disaster Reduction Center, Shi *et al.* assessed the earthquake impact using measures of seismic intensity, death and missing numbers and rate per 10,000 residents, housing collapse numbers and housing collapse rate per 10,000 households, geological threats numbers, and evacuation numbers. Finally, 10 counties/districts were identified as the most severely damaged counties, 41 were identified as severely damaged counties, and

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[2] Statistics of aftershocks after the Wenchuan earthquake(updated to May 12th, 2010) http://www.csndmc.ac.cn/newweb/wenchuan/wenchuan_aftershocks.htm

another 186 counties were recognized as more generally damaged counties (Shi *et al*., 2008).

3.1.2 Deaths and Injuries

According to the National Disaster Reduction Center (NDDC) at the Ministry of Civil Affairs (MCA) of China, it was confirmed that 69,227 people lost their lives, 17,923 were missing, and 374,643 were injured as of September 18th, 2008 (NCDR-MAC & UNDP, 2009), about four months after the major earthquake. Sichuan province was the most devastated province in this earthquake, but the southern areas of Gansu province and Shanxi province were also severely affected because the seismic waves of the major quake occurred along a NW-NE direction.

The death and injured numbers were reported through a bottom-up method and confirmed by each level of government, with a final calculation conducted by the Ministry of Civil Affairs. The final direct deaths and injuries were updated until September 18th, 2008.

3.1.3 Infrastructures, Utilities and Economic Losses

The earthquake caused severe infrastructure damages and utilities service disruptions. Take the transportation in Sichuan province for example. It destroyed 299 km of road surfaces, 181 bridges, 10 tunnels of highways; 3,026 km of road surfaces, 577 bridges, and 12 tunnels of major inter-province roads; 18,800 km of road surfaces, 563 bridges, and 42 tunnels of local roads. One of the most damaged roadways, and the only major road to the epicenter of the quake, was closed for almost twenty days due to the earthquake damage and landslide. The road could not be reopened until the end of May (OEM-Sichuan Province, 2008).

According to the National Bureau of Statistics of the PRC, the direct economic loss from this earthquake was about 845.1 billion Yuan (about $121 billion) (National Bureau of Statistics of the PRC, 2009). Two methods were used to estimate the economic losses: one from the report of local government officials, and another from the estimated results of disaster impact models using socioeconomic and infrastructure data. The reported direct economic damage from the three most devastated provinces, Sichuan, Gansu and Shanxi, was about 1,239.83 billion Yuan. However, later estimates using economic and disaster loss models by the Ministry of Civil Affairs (MCA) of China were about 894.31 billion (Zou *et al*., 2008). Therefore, the final economic losses number adopted by the National Bureau of Statistics was 845.1 billion, which was quite close to the number reported by the MCA.

3.1.4 Convergence and Social Disruption

The tragedy of the 2008 earthquake inspired a burst of volunteerism and patriotism in China. Donations and volunteers flooded to the earthquake-affected area and overwhelmed the local government and nongovernmental organizations, which had never experienced such challenge before. In a study which interviewed 24 workers and volunteers from the Sichuan chapter of the Chinese Red Cross, the local Red Cross workers expressed their inability to handle such pressure: with only six fulltime staff, they could barely manage the donations. The headquarters of the Red Cross of China had to mobilize 30 more staff workers from other local chapters in order to support their work. According to statistics from the Sichuan Communist Youth League, which was one of the major agencies to coordinate and manage volunteers in China, over one million volunteers had arrived to serve in the first three weeks after the tragedy (Zhang, Wang, Zhang, & Xu, 2008).

The local institutions in rural areas experienced a severe shortage of human resources after the catastrophe. Many young people migrated to cities to work there temporarily, mainly leaving behind only the very old and very young in rural villages (Zhang, 2011). The catastrophe event caused massive personnel loss. For example, in Beichuan, one of the most disrupted counties, 568 local cadres in the 3,441 total government personnel died with 172 more cadres severely disabled, accounting for a total of 21.5% of the personnel (Hu, Salazar, Zhang, Lu, & Zhang, 2010).

3.1.5 Disaster Response

The central government's quick response to the earthquake was widely praised by the public (Hu *et al.*, 2010). About two hours after the major quake, the Premier of China, Wen Jiabao, went to Chengdu to help the disaster response, and the National Wenchuan Earthquake Response Council was established that night. Soon, financial, physical, human, and technical resources were deployed and mobilized nationally to the affected area. A series of policy supports for emergency response and disaster relief were also made quickly. In the following section, the disaster assistance and recovery programs directly related to families and households are described.

3.2 Disaster Assistance and Recovery Programs

The current disaster prevention and assistance mechanism in PRC was initiated in the 1950s. Since the 1980s, a series of reform efforts have evolved including decentralization of the disaster assistance financing with less Central Government responsibilities, combing relief with self-reliance, and linking disaster relief with poverty alleviation (Hu *et al.*, 2010). The Ministry of Civil Affairs (MCA) of China is the main agency holding the majority of the responsibility for disaster response and

relief at the central government level. Housing reconstruction in rural areas after disasters is one of their jurisdictions.

Three disaster assistance programs were improvised after the Wenchuan earthquake. The first one was the Temporary Living Stipend (TLS) program, which was initiated about one week after the disaster event and lasted three months. The central government provided 300 Yuan ($50) per month and half a kilogram of grain per day to each disaster survivor who had no sheltering, no income, and no life security ("three-no" people). In practice, all the disaster survivors in rural areas were eligible and covered by this TLS program. Those who were disabled, childless, and orphaned (known as "three-orphaned") as a result of the earthquake, as well as those who fell into this category before the disaster, were enabled to receive a 600 Yuan ($100) stipend each month during those three months. By July 12th, or within the first two months, 8.8 million people, including the "three-no" people and 261,000 "three-orphaned" people, had received benefits from this program (Hu *et al.*, 2010).

In July, another Continued Temporary Living Stipend (CTLS) program was launched, allowing the temporary living stipend for the disadvantaged disaster survivors to extend for another three months, from September to November, once the temporary living stipend ended. This continued living stipend covered the existing and earthquake-related disabled, childless, and orphaned, families with members that died or were severely injured in the earthquake, displaced families and families without housing due to the earthquake, and other disaster survivors who had difficulty in making a living. Through the CTLS program, which was also financed by the central government, each beneficiary could get 200 Yuan (about $35) each month and the "three-orphaned" people were able to receive an even higher subsidy.

The Rural Housing Recovery (Reconstruction/Repair) Assistance (RHRA) was the third aid program with wide coverage for families in rural areas who experienced severe damages. For housing reconstruction in rural areas, if a family chose to reconstruct their house, they could receive a 10,000 Yuan (about $1,500) subsidy from the central government and another 10,000 Yuan aid from the province government. Furthermore, with the endorsement of local government, they were eligible to apply for 10,000 to 30,000 interest-free personal loans from commercial banks. The government would cover the interests of the housing reconstruction loans for the first three years, after which the families had to pay the loans and interests themselves. Families who only wanted to repair their houses were eligible to join the housing repair program and receive a 3,000 Yuan ($500) subsidy from central government. Though the policy had detailed procedures of housing damage assessment within communities, which was mainly used to determine housing damages and the eligibility of the housing recovery programs, participation in either the repair program or reconstruction program was mainly based on disaster survivors' willingness instead of the disaster damages in practice. If a family wanted the housing reconstruction subsidy, they had to demolish their damaged house and rebuild a new house with earthquake resilient materials. Therefore, though the housing reconstruction program was available to every family in rural areas severely affected by the earthquake, a small portion of the poor families actually choose to participate in the repair program despite the unsuitable state of their homes because they did not have enough resources to rebuild a new house even with the subsidies provided by the government.

The very political and symbolic Counterpart-Aid (Mutual Aid) program played an important role in infrastructure and public facilities recovery in the areas disrupted

by the catastrophic event. With the coordination of the central government, twenty of the comparatively wealthier provinces in the east of China would provide financial, human, physical and intellectual support to the twenty most devastated counties (One Province to One County), or in other words each province or big city in the wealthier category of provinces would help one county affected by the disaster. In short, each of these provinces would provide no less than 1% of their annual GDP financial support to their counterpart county and this support would last for three years. The restoration of public facilities and infrastructure like hospitals, schools, utilities, social welfare service facilities, agricultural facilities, and transportation systems would mainly rely on this Counterpart-Aid program. Meanwhile, some communities were selected as exemplary reconstruction cases, with houses within these communities also eligible to participate in the counterpart-aid program. Once a community was selected as a showcase, each family would get a house with limited decoration and three rooms with each room approximately 20 square meters, however they would no longer be eligible for the housing reconstruction fund. Furthermore, the whole community would be planned and developed by those providing the aid, with limited participation of local residents. These communities would always include modern, city-life styled recreation and public service facilities. Overall, these exemplary showcase communities would have a much better recovery speed and outcomes, largely in part to the most burdensome housing reconstruction being left to their counterpart help providers.

3.3 The Fieldwork Area: Wen County

Wen County is a mountainous area located in the southernmost corner of Gansu Province, bordering Sichuan and Shanxi province. The entire geographic

coverage of the county ranges 112 km from east to west and 82.5 km from south to north, with a total land area of 1234,044 acres, of which only 4.3% is arable. Before the earthquake, there were 66,400 households and 246,000 people (218,500 of which were rural residents) living in the 305 villages and 20 major towns (one is minority town) within the county in 2007. Wen County was also one of poorest counties in China, with about 20,200 residents living under the poverty line in 2007. The annual disposable income of city residents in 2007 was 5,215 Yuan per person, compared with the 1,354 Yuan per person in rural areas such as those in Wen County. However, it should also be mentioned that before the earthquake there was a steady economic development trend in terms of GDP, fixed investment, and local government revenue. In 2007, the gross local government revenue reached about 110 million Yuan[3].

[3] From the Eleventh Five-Year (2006-2010) Development Plan of Wen County (2006)

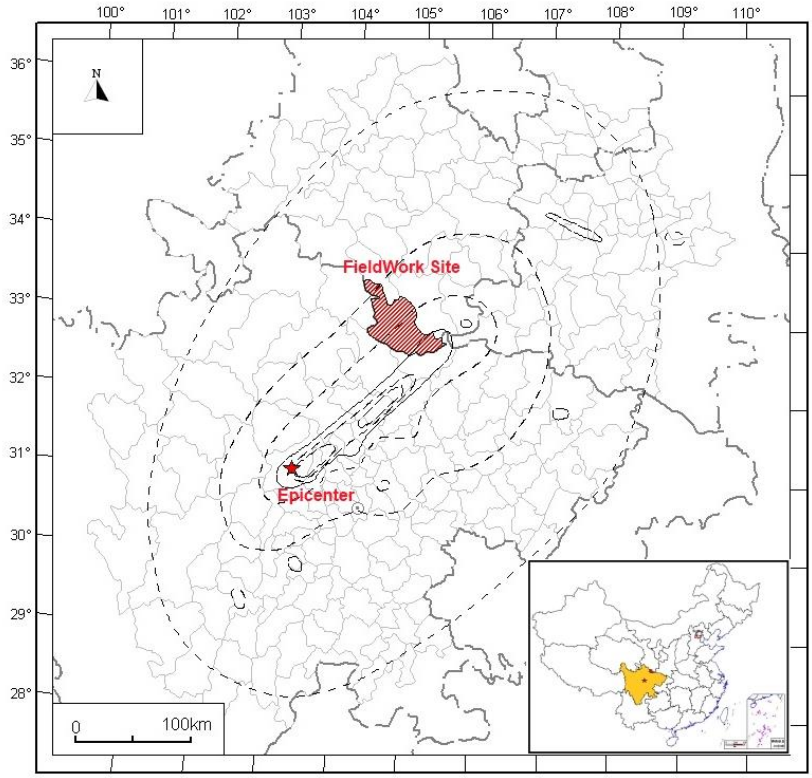

Figure 3.1 Fieldwork Site Location

Figure 3.2 The Biggest Town in the County (Photo shot on May 20th, 2008)

3.4 Disaster Impact, Response and Recovery at Local level

3.4.1 Disaster Impact

Wen County was identified as one of the 41 severely damaged counties by the National Wenchuan Earthquake Council, ranked in the second category of severity of losses, second only to the 10 most severely damaged counties. It was also the most disrupted county in Gansu Province. The major quake and aftershocks, combined with the later heavy rain, hail, and landslides, caused a large number of casualties and property losses. In total, 111 people died and 1,454 were injured due to the earthquake, with another 120 victims in serious conditions. The estimated direct economic losses

reached about 11.8 billion Yuan, which was about 13 times the total annual GDP in 2007. There were about 8 billion of losses from civil housing damages, 2 billion from infrastructure damages, and the final 1.8 billion from public service facilities and private business losses. About 77.32% of the total houses in the county were severely damaged or collapsed, with another 22.68% in need of repair[4].

Figure 3.3 Housing Structures and Damages (Photo shot on July 2nd, 2008 at FB)

[4] From the Wenchuan Earthquake Impact Assessment Report of Wen County (2008)

3.4.2 Disaster Response

The slow disaster response in Gansu was criticized by both public and local residents, especially when the government efforts were compared with neighboring Sichuan province's swift action. For quite a long time after the major quake, this area was isolated and neglected from public attention and disaster relief. It was said that no outsiders actually recognized the severity of the situation in this area until an online post spread quickly on the Internet after communications were restored. During our first travel in late June of 2008, about one month after the major quake, we heard lots of complaints about the local government and local officials. Disaster survivors in this area were still lacking food and clothes even as their neighboring province was filled with disaster relief materials. As one of our interviewees complained, "When disaster victims in Sichuan have enough meat to eat, we're still hungry"[5]. The local residents believed that it was the local officials' underestimation and underreporting of the disaster damages that caused the lack of public media attention and concern from the central government, resulting in the lack of outside aid in terms of both materials and non-material assistances. Local residents perceived the existence of role abandonment of local government officials, amplifying the public's dissatisfaction and mistrust of local officials. The case widely cited was that: "After the major earthquake, one NGO came to this area from the south (Sichuan) with several trucks of mass care materials. They failed to find any local government officials to accept and distribute these materials, and finally, they had to head to other areas."[6]

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[5] Interview 2008-W-HQ-Villager03

[6] Interview 2008-W-BK-Villager01

We did confirm this in our later interviews with local government officials. On the one hand, there was a lack of developed organizations in rural China aside from the local government, especially in the underdeveloped west area. Consequently, the outside NGOs could not find any local organizations that had the credibility and capacity to accept and distribute donations except the local government. Local government officials had no experience dealing with these situations and outside NGOs before, because terms like NGOs and volunteers were still not familiar to the public at that time. Furthermore, the local government officials resisted accepting and distributing limited donations if they were not enough to cover everyone within the community, because the distribution of the donations would be seen as a government activity and the residents' desire of absolute equality would make dividing up the distribution of the limited resources a major challenge (Han, Hu, & Nigg, 2011).

Therefore, the institutional disruption and limited knowledge of what to do after the catastrophe made the local government react slowly. Consequently, the local government's disaster response was criticized was not considered to be satisfactory by the local residents, especially at the early response stage.

3.4.3 Overall Recovery

In pace with the National Wenchuan Earthquake Reconstruction Plan, Wen County also set a three-year reconstruction plan from 2008 to 2010. The reconstruction plan aimed to restore the damaged infrastructure and public facilities, integrate the reconstruction with urbanization development, improve the business and economic development through upgrading industry, and to achieve long-term sustainable development and harmony. Also, the reconstruction priority was set to occur within a time period of three years. For the first year of 2008, necessary power,

transportation, communication, temporary sheltering, and public facilities like schools and hospitals, were put into consideration first. Afterward, rebuilding of permanent sheltering, hospitals, and local government buildings was planned to be finished in 2009, with a goal of restoration of all other infrastructure and roads to be finished 80% by the end of the year. The major tasks covered in 2010 included other transportations facilities, dams of lakes, and other major buildings for government agencies[7].

For permanent housing recovery, 123 communities/villages would have to be rebuilt, 12,460 households in 83 villages/communities would be rebuilt in the same locations, and 3,808 households in 40 villages/communities would be relocated locally. Meanwhile, 39,935 families would be in the self-rebuild model, and another 11,053 households would have their houses repaired. Since the Housing Recovery Assistance Program was funded by the central government, it also covered all the households in this area. In the implementation stage, the subsidy worked as follows: if one household preferred the repair program, the 3,000 Yuan subsidy would be given to the family directly; if one family preferred the reconstruction program, they had to demolish their old house first, and then they could get the first 10,000 in aid; the second 10,000 would not be delivered until the main building of the house was finished. If the family applied for the interest-subsided loan (10,000 to 30,000) from a commercial bank and got approved, the loan would be delivered with the government subsidy. However, in reality, poor families had huge difficulties receiving loans or could only get a small amount of the loan, though they had the policy support or government endorsement.

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[7] From the Wenchuan Earthquake Reconstruction Plan of Wen County (2008)

Overall, the disaster recovery had good outcomes in terms of infrastructures, public facilities, and housing. By the end of 2010, the total fixed investment for disaster recovery programs reached 5.1 billion, including 639 projects. The public transportation, especially the roads to the very remote villages, utility services, like water, electricity, and cable services, public service facilities, like hospitals, schools, and public recreation facilities, had been restored and improved and were much better than it was the case before the earthquake. In terms of finances, the disposable income for city residents of this county reached 8,160 Yuan per person in 2010, with the net income for people in rural areas estimated at 1,981 per person. Meanwhile, the local government revenue in 2010 reached 223 million, compared with 110 million in 2007[8].

3.5 Summary

The Wenchuan earthquake was the second deadliest and the most costly natural disaster in the history of the People's Republic of China. It impacted a huge area, disrupted millions of people's lives, and caused thousands of deaths and billions in economic losses. Beyond the pessimistic parts, it also boosted the development of volunteerism and patriotism, especially in the disaster response and early recovery period. The swift response and comprehensively covered disaster assistance programs from the central government played an important role in disaster relief and were widely praised by the public.

The place where I conducted my study was a severely damaged county and was a relatively neglected area at the beginning of the disaster response. It was a remote, impoverished, and undeveloped area and a relatively closed society before the

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[8] From the Twelfth Five-Year (2011-2015) Development Plan of Wen County (2011)

earthquake, sharing many common characteristics with other rural areas in the west of China. Though the local government's disaster response was not fast and satisfactory according to the local residents in terms of resource procurement at the response stage and the beginning of the recovery process, the local government did seize the opportunity for reconstruction and improvement of infrastructures and public facilities within the county. Despite these facts to this day, there is a lack of n-depth information on households and communities in this county. Thus, this dissertation examines household and community recovery in this area through a mixed-method longitudinal study.

Chapter 4

RESEARCH DESIGN: THEORETICAL FRAMEWORK, DATA COLLECTION AND ANALYSIS STRATEGIES

This research uses a longitudinal design and a mixed-method design. In this chapter, the research methodology is thoroughly described and discussed. First, the evolution of this study and research design is introduced. Afterward, recovery-related theoretical frameworks are reviewed, followed by a description of the Sustainable Livelihood Approach in disaster studies. Later in the chapter, the data collection and analysis methods, including sampling, investigator training methods, and the detailed procedures, are presented. Finally, a validity and reliability justification and methodology discussion is made at the end of this chapter.

The Evolution of This Study: In June 2008, about one month after the Wenchuan Earthquake, I went to a hard-hit area as a member of a disaster quick response research team. Within the two-week research period, we visited four counties in this area and spent most of our time in the most devastated county---Wen County, where my fieldwork was conducted. Informal interviews with local government officials, community leaders, disaster survivors, volunteers, journalists, and military soldiers were conducted in nine towns in Wen County during this quick response trip. After that, we realized that the primary challenge for residents in this area was the recovery of their livelihoods. This was one of the poorest areas in China. People lacked the ability to lift themselves out of poverty. The disaster only made the livelihoods of these people much worse and could possibly trap some of them in

poverty for the long-term. Therefore, we initiated a small project to investigate the livelihood conditions and the impacts of the disaster on the survivors.

In January 2009, about eight months after the earthquake, the first wave of data collection was conducted. 515 household surveys and 50 in-depth interviews from nine villages in three towns were obtained. All of the questionnaires were administered by trained local college students using face-to-face interviews. Participants in the in-depth interviews were not limited to common disaster survivors, but also included community leaders in each village. Although at that point we did not have a clear picture of a potential follow-up study, we planned a longitudinal design by collecting each household's contact information with the permission of our respondents. Three years later, I returned to the area to conduct a follow-up study for my PhD dissertation. Consequently, a second wave of data collection was undertaken from July through August of 2012. The follow-up survey repeated many of the same questions as the first survey. Additionally, some new questions on long-term recovery were added. Similar to the first wave of data collection in 2009, a mixed-method research design was adopted for the second wave of data collection, including a large-scale questionnaire survey combined with in-depth interviews. Through exhaustive efforts, we completed 415 household surveys and 46 interviews in the second wave of data collection. Data from both data collection waves will be analyzed for use in this dissertation in order to explore long-term recovery after disasters in poor rural areas.

4.1 Recovery Theoretical Framework

Disaster theorizing is still in its infancy. The systems theory, vulnerability theory, sociopolitical-ecology theory, feminist theory, and emergent-norm theory are the most commonly used theoretical frameworks. However, for disaster recovery, the

application of these frameworks is limited, and a sustainable, holistic approach is needed (Phillips, 2011). A recovery is considered to be sustainable if it includes participatory processes, ensures quality of life, economic vitality, equity, and environmental quality, and incorporates future disaster resilience (Natural Hazards Center, University of Colorado, 2005).

Haas *et al.* proposed a Sequential Model that included four ordered, interrelated stages of recovery activities: emergency, restoration, replacement reconstruction, and betterment reconstruction (Haas *et al.*, 1977). In Rubin's long-term recovery process framework focusing on the organizational aspect, personal leadership, ability to act, and knowledge of what to do in communities, were the three key elements of successful recovery and mitigation. The recovery process was a dynamic, interactive process of intergovernmental relationships and local needs (Rubin, 1985,1986). Miles and Chang proposed a community recovery model from an engineers' perspective. The community recovery included neighborhoods recovery and lifeline restoration. The recovery was a dynamic process comprised of the impact of disasters, households, business recovery within communities, as well the lifeline restoration process (Miles & Chang, 2007,2006).

The most fruitful model of family recovery came from Bolin and her colleagues. In their conceptual model of family recovery, family recovery has multiple dimensions including: housing recovery, emotional recovery, which reflected the perceived life happiness and satisfaction, as well as economic recovery. The disaster's impacts, socioeconomic status, and life cycle position, were factors influencing recovery. The subjective impact (disaster anxiety), formal institutional embeddedness,

and informal social network, were the intermediate determinants (Bolin, 1982,1994,1976).

After an analysis of the recovery models mentioned above together with my knowledge in the development area, I decided to use the Sustainable Livelihood Approach (SLA) for my research design framework, which has been widely used in the anti-poverty and development fields. A detailed description of the SLA framework and its application in disaster studies is introduced in the next section.

4.2 Sustainable Livelihood Approach and Disaster Study

4.2.1 Introduction to the SLA

The concept of the sustainable livelihoods approach came from the evolution of thought about poverty reduction in the 1980s, when poverty became recognized as a multi-dimensional issue rather than lack of income alone The effectiveness of development activity using this theory in practice facilitated the evolution of this concept, and organizations like the United Nations Development Programmme (UNDP), Department for International Development of the United Kingdom (DFID), CARE International, and Oxfam became main supporters and advertisers of this theory in the practical field (Ashley & Carney, 1999). Drawn from earlier literature, the most influential definition of sustainable livelihood was developed by researchers from the Institute for Development Studies (IDS).

"A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks, maintain or

enhance its capabilities and assets, while not undermining the nature resource base" (Chambers & Conway, 1992;Scoones, 1998).

The IDS sustainable rural livelihood framework was comprised of five elements: vulnerable context, livelihood assets, livelihood strategies, institutional process, and livelihood outcomes. Given a particular context and the livelihood resources available, when households/communities were stricken by disasters or other stressors people would take different livelihood strategies according to the impacts and institutional change process, and finally feedback outcomes as livelihood assets and sustainability (Scoones, 1998). Since many poverty reduction organizations adopted the sustainable livelihood concept, different conceptual and analytical models were generated with adjustments for the varied purposes. Take the UNDP, CARE and DFID frameworks as examples. The UNDP and CARE models tended to facilitate program planning, while the DFID's sustainable livelihood approach was more of a basic framework for analysis, though it was also used to design and assess on-going projects. Furthermore, the CARE model focused more on the community level, whereas the UNDP and DFID frameworks emphasized not only the household and community livelihoods, but also the policy environments and institutional processes (Krantz, 2001). With a strong commitment to poverty reduction and the adoption of the sustainable livelihood approach, the DFID's sustainable livelihood framework became one of the most widely accepted (Ashley & Carney, 1999;Farrington, Carney, Ashley, & Turton, 1999).

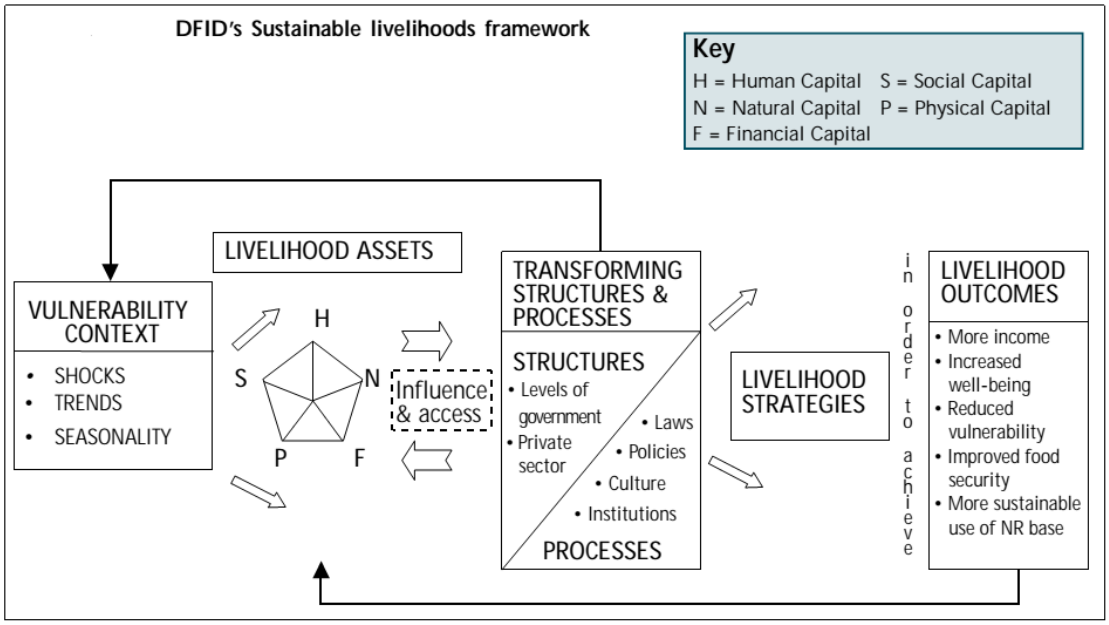

Figure 4.1 Sustainable Livelihoods Analysis Framework (DFID, 1999).

The main characteristics of the SLAs included being people-centered, empowering, responsive and participatory, sustainable, multi-level and holistic, conducted in partnership, disaggregated, long-term, and flexible (Carney, 2003). The rise of the livelihood approach in rural development in the 1990s did make a difference, and the extensive use of this approach for program development in developing countries like Zambia, India, Kenya, Pakistan, Nepal, South Africa, Zimbabwe, Latin American countries, and Russia demonstrates the flexibility of SLAs (Ashley & Carney, 1999). However, current concerns with the impacts of globalization, and its engagement, power, and politics, and the failure of dealing with long-term environmental challenges (like climate change) and agrarian shifts, requires new insights to meet these challenges (Scoones, 2009).

4.2.2 SLA and Disaster Research

Natural disasters are frequent in less-developed countries, and the poor are always the most vulnerable and hardest hit due to the obstacles in accessing low cost assets. Thus, disasters are one of the most common threats to development and reducing vulnerability to these events is one of the fundamental requirements for meeting poverty reduction targets. Through the reinforcement of people's livelihoods, and strengthening of people's base-line conditions like health and nutrition, people can become more resilient to hazards (Cannon, Twigg, & Rowell, 2003). Consequently, the livelihood approach has been adopted in disaster and risk studies in recent years because the understanding of vulnerability in the sustainable livelihood approach is very broad. Furthermore, the five livelihood assets can serve as important sources and a checklist for identifying people's capacity for disaster response (Birkmann, 2006). The SLA has been proposed as a vulnerability analysis framework (Birkmann, 2006), especially for holistic assessments of vulnerability to climate changes (Abeygunawardena et al., 2009;Scoones, 2004;Task Force on Climate Change, Vulnerable Communities and Adaptation, 2003). The use of the livelihood approach for analyzing climate change vulnerability and adaptation can be found in studies conducted not only in Asia, (Uy, Takeuchi, & Shaw, 2011) but also in developing countries in Africa (Hahn, Riederer, & Foster, 2009). Lessons from the practice in the field also indicate that unsustainable livelihoods strategies, like deforestation and over-cultivation, can exacerbate hazards and in turn those hazards can undermine livelihoods, such as land erosion in the case of deforestation and over-cultivation (Practical Action, 2010). The livelihood assets are central to both the definition of livelihoods as well as household resilience because they largely determine how people respond to external threats like climate change (Task Force on Climate Change,

Vulnerable Communities and Adaptation, 2003). Therefore, a sustainable strategy for disaster reduction must focus on building livelihood assets (Vatsa, 2004), one in which it is necessary to integrate disaster risk reduction, climate change adaptation, and sustainable livelihoods together in order to achieve a sustainable development target (Practical Action, 2010).

Similarly, the sustainable livelihood approach has been used in other disaster-related scenarios. For example, it has been used to examine the risk management in volcanic scenarios through an overview of case studies. The SLA was important in its application in this study because it helped to understand, communicate, and manage vulnerability and risk beyond immediate threats, to maximize the benefits to communities, and to manage crisis, reconstruction, and resettlement after the crisis (Kelman & Mather, 2008). Additionally, the sustainable livelihood approach was used for guiding analysis of disaster risk management in Indonesia after the 2004 Indian Ocean Tsunami (Alexander, Chan-Halbrendt, & Salim, 2006), and has been used for developing community-driven livelihood projects in the field (Yodmani, 2001).

In short, researchers have put forth efforts to integrate the sustainable livelihood approach, which was developed in the anti-poverty area, into disaster risk reduction and vulnerability assessment areas. Hazards are one of the main threats to poverty reduction and it would be unrealistic to manage disasters and risks successfully without considering livelihoods issues. This is especially true in developing countries. The core component of the framework-the five livelihood assets, is the root determinants of people's capacity to respond to disasters. The vulnerability context and institutional process are also critical to understanding long-term changes from a macro perspective. Therefore, the sustainable livelihood approach is a useful

analysis tool for disaster and risk management and was adopted as the main analysis framework for this research.

4.3 Research Tools Design

Livelihoods research is essential to carry out at the micro-level (households and communities). But it is also necessary to understand the relevant macro historical and institutional context, policies, and social relations, if we want to examine livelihoods changes (Murray, 2001). Therefore, the mixed-method approach (Creswell, 2013), which combines large-scale questionnaire surveys and participant research approaches like semi-structured interviews and focus group discussions, is used to understand the complexity of rural livelihoods (Ellis, 2000). Large-scale questionnaire surveys and qualitative data collection methods, like participant observations and in-depth interviews, were adopted with secondary data collection after the first pilot quick response travel.

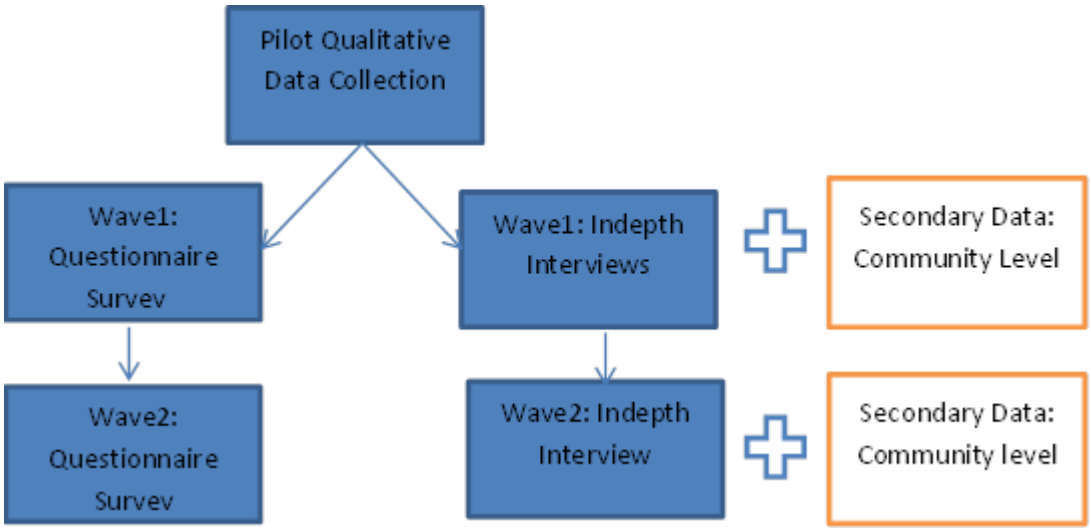

Figure 4.2 Data Collection Strategies

4.3.1 Questionnaire

Since the five livelihood assets are the core components of the sustainable livelihood analysis framework, the questionnaire survey mainly captured these assets and changes. Additionally, the varied livelihood strategies, and awareness and implementation of government recovery policy and programs, were also included in the questionnaire.

Human Capital: "Human capital represents the skills, knowledge, ability to labor and good health that together enable people to pursue different livelihoods strategies and achieve their livelihood objectives" (DFID, 1999a). Drawing upon earlier studies, the human capital variable included two dimensions: labor (workforce ratio within a household) and education (Shivakoti & Schmidt-Vogt, 2009). Thus, basic demographic variables like age, gender, ethnicity, religion, education, and work status were used. In terms of human capital indicators within a family, four variables were used to construct the human capital indicator including: the number of full-time labor within family, the number of part-time labor within family, total number of family members, and the highest education level within family. This human capital indicator is presented in the formula below. The education level indicates the skills and knowledge required for gainful employment, and the family labor ratio represents the ratio of working to non-working persons within a household. The product of highest education level and the workforce ratio was considered a good indicator for reflecting human capital within a family.

$$\text{Human capital index} = \text{Education} * \frac{\text{N(fulltime labors)} + 0.5 * N(parttime\ labors)}{\text{N(family members)}}$$

Social Capital: "Social capital means the social resources upon which people drawn in pursuit of their livelihoods objectives that developed through networks and

connectedness, membership of more formalized groups, relationships of trust, reciprocity and exchanges." (DFID, 1999a) Organizational membership and network embeddedness, trust and solidarity, and collective action were the three largest groups of indicators proposed by the World Bank social capital assessment tool (Grootaert, 2004;Grootaert & Van Bastelaer, 2002). Inherited from the World Bank social capital measurement and its application in livelihood recovery after disasters (Minamoto, 2010), the social capital used in this study also comprised three groups of proxy indicators: institutional/organizational membership, social support, and community cohesion and trust. The organizational membership indicator had three components, organizational affiliation, activity degree, and leadership (whether or not a leadership position in the organization was held). The social support indicator captured available social support from nine proposed sources, which included both informal social networks like friends, neighbors, close relatives, and other relatives, and formal organizations such as village committees, town government, banks, local financial organizations or other organizations. Lastly, the social cohesion and trust within community's indicator was measured by the participant's response to six statements.

Natural Capital: Natural capital denotes the natural resources that are useful for livelihoods. The total land owned by a family was recognized as the indicator of natural capital in this study. It should be noticed that the land in this study included the irrigable, non-irrigable, orchard, woodland, pond, pasture, newly developed land, and all other land that was owned by family members.

Physical Capital: Basic infrastructure and producer goods are the two main elements of physical capital. In this study, the value of housing and producer goods owned by a family constitutes the physical indicator. In addition to the housing size,

building material type information was also collected as an aspect of physical capital. Access to utility and public facilities such as hospitals and schools were also perceived as physical capital elements, but were mainly demonstrated at the community level because the characteristics of such information were uniform for most people within a village.

Financial Capital: Financial capital includes all the financial resources that people can use to achieve their livelihood objectives. These resources could be savings, regular inflow of money, or credits/debts. In this study, the annual income from 16 potential items including crops, livestock/poultry cultivation, salary, aid, among others, was used as the financial capital indicator. Additionally, the maximum money people could obtain from their informal and formal networks in emergency scenarios was also used as a dimension of financial capital.

The measurements of these assets are represented in the table below.

Table 4.1 Livelihoods Assets Indicators

Assets	Indicators	Description
Human	Workforce ratio	The ratio of worked people within family
	Education	The highest education level within family.
Social	Organizational membership	Affiliation with organizations.
	Social support	Perceived social support degree from nine possible sources.
	Social cohesion and trust	Perceived cohesion and trust degree within community.
Natural	Land	Total land owned by family members.
Physical	House	Estimated house values
	Utility and accessibility to public service	Utility use and estimated time to public service access at community level.
	Producer goods	Estimated value of the tools owned.

Financial	Income	Annual income in 2008 and 2011.
	Credits	Maximum money can borrowed from social connections in emergencies

Livelihood Strategies: There are three clusters of livelihood strategies: agricultural intensification, livelihood diversification, and migration. The agricultural intensification could be capital-led or labor-led. The diversification strategies could be investments for accumulation, or adaptation to adversity either temporarily or permanently. In some cases, especially after disasters, migration locally or nationally could be a special livelihood strategy (DFID, 1999b;Scoones, 1998). In this study, the livelihood strategies included mainly the activities of crop cultivation, livestock cultivation, business management, and temporary migration (work in cities). In addition to the questionnaire survey, the impact of the disaster event on livelihood activities and people's diversified recovery strategies was mainly collected through semi-structured in-depth interviews.

Transforming Structures and Processes: Policy changes and questions related to government assistance programs were the core consideration of institutional processes after the earthquake. A comprehensive collection of related policies from both central government and local government were implemented and incorporated into the questionnaire design. Meanwhile, informal discussions with key informants like local officials and residents were also used to guide the design of related questions. Two government assistance programs for individuals/households were paid special attention to in this study: the Temporary Living Stipend (TLS) program, which lasted three months after the earthquake, and the housing recovery assistance program for rural residents. The awareness, perception, and accessibility of our respondents to these two assistance programs were collected as the main evaluation criteria. In addition, information regarding public infrastructure (e.g., transportation), utility

changes, and public service facilities (e.g., schools, hospital changes) was also collected to facilitate the understanding of the macro institutional change processes.

Perceived Recovery: The last part of the questionnaire covered topics of perceived recovery. This section started with a question inquiring about the overall recovery degree from the perception of our respondents. If the respondent perceived that they had recovered at time of the survey, an estimated time of being fully recovered was obtained. If they chose the answer of not being recovered, the expected recovered time would be asked. In addition to the recovery status, proposed questions about the facilitators and barriers of household recovery were used to understand the determinants of recovery perception. Meanwhile, several questions related to mitigation efforts during the recovery process were also included in the recovery perception section.

4.3.2 Interviews Guideline

Semi-structured interview guidelines were generated differently for in-depth interviews with disaster survivors compared with key informants. For general survivors, the guideline started with a greeting or general question about their disaster recovery status, before moving into more detailed questions according to the respondents' answers. Finally, some demographic information from the respondents and their family members was obtained. For example, when we tried to understand their livelihood recovery process and changes in quality of life we would raise a question like, "How about your recovery and life since the earthquake?" If they did not give an adequate response, we would keep asking questions like, "Are there any good things or bad things that have happened to you or your family since the earthquake? For example, has someone got married, had a grandson, passed away or

became seriously ill?" If they began to say something but stopped after several sentences, we would always follow up by inquiring, "Would you please say more about that? Or can you give us more details?" Interviews went more like a "chat" model rather a traditional "question and answer" model. In this study, the interview guidelines were mainly used as a reminder of the contents we needed to cover rather than as a strict "step by step" instruction because we did not want the guidelines to confine our improvisation during the interviews. Some interviews were longer while others were short depending on the respondents' talkative personality or lack thereof, but on average each interview lasted about one hour.

The interview guideline for key informants such as local officials or community leaders covered more topics about community recovery and macro information. The information included demographic changes, community culture and cohesion status changes, public facilities changes, and utility services changes within villages before and after the earthquake. Additionally, the overall reconstruction decision-making process, interaction between government agencies at different levels, and the determinants of community recovery from their perspectives were paid special attention to during the interviews,

This section presented the contents of the research tools (questionnaire and semi-structured interview guideline) used for this study. In the next section, the data collection and analysis method will be introduced.

4.4 Data Collection and Analysis Strategies

In this section, the data collection and analysis strategies are represented. The contents that follow start from the sampling and interviewee selection strategy,

followed by the detailed procedures of the data collection, and finally end with data entry and analysis methods.

4.4.1 Survey Sampling and Interviewees Selection

The empirical data for this study was collected from Wen County, Gansu province, which was severely affected by the 2008 Wenchuan earthquake in China. It was located about 200km from the epicenter, and was one of the most devastated counties according to the National Wenchuan Earthquake Response Council's assessment.

Questionnaire survey sampling**:** A mixed-method sampling method (Teddlie & Yu, 2007) was used for the first wave of data collection in January 2009. This multi-level sampling method included three stages: the first stage was the three town selection using a stratified sampling method; in the second stage three villages in each town were chosen using a purposive sampling approach; finally, in the third stage, data from 60 households in each village was planned to be collected using a convenience sampling method. There were 20 towns in the Wen County, and three towns were randomly selected based on their economic status. Before the data collection began, economic statistics data including 2007 GDP in each town was obtained from local government. Using this data, the 20 towns were divided into three groups: high, medium, and low, reflecting their economic development situation. Finally, one town from each group was selected randomly as the target for data collection.

Table 4.2 Mixed-Sampling Methods for Questionnaire Survey: Wave1

Three towns from Wen County:	Stratified sampling method: according to

Chengguan, Zhongmiao, Tielou	their economic situation.
Three villages in each town, nine villages total	Purposive sampling method: according to their geographic location.
60 households in each village, 540 households total, finally, 515 questionnaire obtained.	Convenience sampling.

Since this was a mountainous area, the villages' geographic location played a critical role in their overall socioeconomic situations. In general, villages on the mountaintop were the most vulnerable communities, characterized by a lack of farmland, transportation, public infrastructure, and utility services. Some villages located at the mountainside had a much better situation compared with the people living on mountaintops. The most resilient villages were the ones located at the foot of mountain or valley. People in these villages owned the most fertile land and had access to convenient public infrastructures. Therefore, they were the richest people in the local area in general. Considering this situation, a purposive sampling method was adopted for the villages' selection. After consulting with local experts, including local officials and community leaders who had rich knowledge about their hometowns, nine villages in total, and three villages respectively out of three towns, were selected. Geographic location was the key criteria for village selection. One of the three villages in each town would represent people from the mountaintop, another would represent people at the mountainside, and the last one would represent people located in valleys.

60 households from each village were anticipated for the first wave of data collection in 2009. Thus, there would be 540 questionnaire surveys. The convenience sampling method was used for household selection in each village. For most of the time, the trained interviewees were divided into three groups. When we arrived at each village (of course, we would make contact with local community leaders before we arrived), we asked the local community leaders or villagers to help us "divide" their

village into three blocks of similar size, and each group would cover one block. Since the questionnaire interviewers were trained to consider the "diversity criteria" for data collection, 20 households in each block were selected according to their judgment and convenience. If they couldn't finish all the 20 surveys in their block after exhaustive searching, the task would be re-arranged within the same village after the first round of effort. Finally, 515 completed household questionnaire surveys were obtained from the first round of data collection. A distribution of the households in each village can be found in the table below.

Table 4.3 Survey Sample Distributions

Villages	Year 2009	Year 2012	Missing	Followed Percentage
A1ZTB	61	49	12	80.33%
A2CHB	60	47	13	78.33%
A3TLC	60	49	11	81.67%
B1QSP	60	49	11	81.67%
B2FCS	55	44	11	80.00%
B3JCC	60	58	2	96.67%
C1XJB	51	44	7	86.27%
C2HQC	63	54	9	85.71%
C3KJS	45	21	24	46.67%
Total	515	415	100	80.58%

For the second wave of data collection, there was no "sampling" consideration for questionnaire survey. Since demographic and contact information were included in the first data collection with our respondents' consent, we printed out the contact information of the households including names in each village. We hoped to follow up with all the same households if possible, however, after an exhaustive search, 415 follow up surveys were obtained, yielding a follow-up rate about 80%.

Interviewees Selection**:** During the initial research design process, we hoped to conduct one interview with a community leader and three interviews with villagers in each village. The interview with a community leader would focus on the macro level information, such as the community's overall socioeconomic situation, public infrastructure and facilities, the disaster impact on the community, and the primary recovery plans and processes. Of course, questions related to the community leader's family would also be covered. Interviews with villagers highlighted their livelihood capitals, the disaster impacts, their coping strategies, and their plans for future. The three interviewees would represent the "rich", "medium" and "poor" people within the village. The selection criteria were mainly based on the interviewers' judgment from the interviewees housing condition, information obtained from community leaders, and informal discussion with local villagers.

Nine community leaders and 41 villager interviews were conducted in the first wave of qualitative data collection. The interviews with community leaders were carried out as expected before the fieldwork, one in each village. However, interviews with individuals in the households were different and showed a relatively large variation. The average number of villager interviews in each village was about 4.5, with a maximum value of seven and minimum value of two. A detail of interviewees'

distribution in each village is shown in the table below. Since families in rural villages in China live quite close with one another, some interesting cases emerged as the interviews went on. For the real data collection in the field, in most cases, more than three interviews were conducted, and in some cases, fewer interviews were implemented.

Table 4.4 Interviewees Distributions

Town	Village	Wave I		Wave II	
		Community Leader Interviews	Villagers Interviews	Community Leader Interviews	Villagers Interviews
TL	ZTB	1	3	1	5
TL	CHB	1	7	1	6
TL	TLC	1	4	1	5
CG	QSP	1	7	1	3
CG	FCS	1	6	1	5
CG	JCC	1	4	1	3
ZM	XJB	1	3	1	3
ZM	HQC	1	5	1	5
ZM	KJS	1	2	1	2
Total		9	41	9	37

For the Wave II interviewee selection, one community leader in each village was necessary for us to get the holistic information within communities. We also expected to conduct three villager interviews in each village, so there would be 27 villager interviews in total. For the villager interviewee selection, we first considered the ones who had been in both the questionnaire survey and in-depth interview lists from the data collected in Wave I data collection, allowing us to follow up with the same families. If the number in the village in both lists was less than three, we gave

the interviewee list from Wave I data collection higher priority than the questionnaire survey list, which suggested that we would select the families in the wave I interview list first. If we still could not fulfill the requirement for three villager interviews in each village, a random selection from the families in the village was conducted until we finished the interview requirement.

4.4.2 Procedures

This research mainly included two waves of data collection. Before the development of the research instruments, related literature and materials were explored. Since we had done a quick response pilot study in this area before, the instrument design also reflected our understanding and knowledge obtained from the field site. When we finished the instrument design, both the questionnaire and semi-structured interview guideline were sent to local community leaders and acquainted college students via email. We requested them to go through these instruments and provide some critical comments and suggestions, then we adjusted and revised the questionnaire accordingly.

Trained local college students mainly conducted the questionnaire surveys, while the two principal investigators mainly conducted the in-depth interviews. Both the questionnaire survey and in-depth interviews were conducted in person.

The local college students conducted the questionnaire survey. They asked the interviewees questions and filled the questionnaire according to the answers obtained from the respondents. It is not allowed to have respondents fill out the questionnaire themselves. College students were recruited locally at least one month before the field travel and the questionnaire with a page of instructions were emailed to them at least two weeks in advance. When all the members gathered at the first major town in this

area, three days were used for face-to-face training and pilot interviews. The first day was used to do a face-to-face training by the principal investigators. The investigators explained the research purpose, indicators or measurements chosen, logic flow between questions, among other important matters. These local college students were encouraged to ask any questions about what they didn't understand or provide comments on any indicators that they thought inappropriate according to their local knowledge and life experience. After the training and discussion on the first day, pilot interviews were conducted in near villages (not in the sampling list). Each student was required to conduct two face-to-face interviews in order to help them warm up and acquire interviewing skills. Also, they were required to take note of if they met any unclear questions or expressions during their interviews. After the pilot interviews, a group discussion was organized to summarize their experience and findings from the interviews, and all inaccurate questions or expressions were corrected. On the third day, the members were again sent out for pilot interviewing this time in another village. A similar pattern was used to test the questionnaire until no more issues were found in the process. After these pilot interviews and detailed follow up discussions, the final version of the questionnaire was produced and printed for the real large-scale survey. The interview guidelines were also tested before it was put into use. The interviewer trainings and pilot interviews testing followed a similar pattern in both waves of data collection.

For the nine villages, we spent about one day in each village for data collection, and after the data collection in each town (three villages), we had a break and spent one day to review the completed questionnaires. If any unclear data was found, a follow-up call or revisit to the interviewees' home would be conducted for

clarification. After the data collection in all of the nine villages, we spent another two or three days revisiting the families that we did not catch in the first attempt. Therefore, the total data collection in each wave lasted about 15 days.

In the previous sampling section, I illustrated how the respondents in each village were selected in Wave I data collection. A convenience sampling method was used therein. Each village was "demarcated" into three blocks to match our three groups of trained interviewers. The detailed procedure to finish one questionnaire survey occurred as follows. Each trained interviewer was designated to one area and he/she would select several households based on their judgment of the representativeness of "diversity." The interviewer went to one house and knocked on the front door. If somebody answered, he/she showed his/her identity and the purpose of the visit and explained the survey to the target interviewee and responded to any of their concerns. If they agreed to spend time to answer the questions, the trained interviewer would ask the questions in order and complete the questionnaire. After each interview, the respondents' willingness to participate in the possible follow-up research was also determined and their contact information was collected based on their willingness. If the interview was interrupted, for example if the respondent had to answer a phone or go to work, a revisit would conduct with their agreement.

For the second wave of data collection conducted in 2012, the respondents' contact information was drawn from the first wave database. Since we had ten trained interviewers, each interviewer was assigned to six households when we arrived at one village. They asked local people where the respondents lived and went to their house directly. Then the interview would begin following a similar pattern I introduced in the previous paragraph. When they finished one interview, most of the time, they

would ask the interviewees to help locate the next respondent's house, similar to the "snowball" method, but the difference here was that we knew our next target already. If we could not find anybody in a household who could answer our questions, before moving forward to the next household, interviewers would mark the questionnaire and check with the household's neighbors about the accessibility to the family members. If they were out for work at our visiting time, we would conduct a second visit on the same day. If they had relocated to nearby villages, we would try to obtain their new address and visit them on another occasion. If they migrated to other cities for temporary work, we still wouldn't give up until we exhausted all available opportunities to get in contact with them. When some interviewers finished their tasks earlier, they were assigned to help others until we completed all the attainable revisits in the village.

The two project principal investigators mainly conducted the in-depth interviews with the assistance of a trained local college student. The general procedure was as follows. One PI worked closely with one assistant, a trained local college student. When the interviewee had been selected, the PI asked questions, and the assistant would take the interview notes. Though a "record machine and transcribing" method was not used for interview, we tried to keep the notes as "original" as possible. The interview assistants were guided to write down almost exactly every word the interviewees said and to minimize any summary and translation to "written language". The questions followed most of the interview guideline, but we would not let the guideline become a barrier to our interview process. For some situations, when interesting things came up or stories emerged, some "improvisations" and "follow up" inquiry would be proposed. After interviews in each village, the interview assistants

were required to transcribe their notes into digital Microsoft word version. The in-depth interview procedures between local community leaders and villagers were a little different. The interviews with local community leader not only included their family's livelihood capitals and strategies, but also their knowledge on the holistic information of the community.

4.4.3 Data Entry and Analysis Strategies

As mentioned previously, trained local college students conducted the questionnaire surveys. The students did the interviews using the hardcopy questionnaires and filled the blanks according to the answers from the respondents. All the questions were coded and entered using a "double control entry method" in EpiData Project tools (EpiData Manager and EpiData EntryClient)[9]. The "double control entry method" requires two different people to enter one questionnaire separately. If the two entries of the same variable were different, a warning message would pop up, and then the person who was in charge of the specific questionnaire entry would double check the original content to make sure that the entry was kept as accurate as possible to what was depicted on the hardcopies. As far as I know, the "double control entry mechanism" is the most common way to reduce the possibility of entry errors when transferring hardcopy survey data into digital data. Therefore, this method was used to increase the reliability.

Though recording machines were not used for in-depth interviews, our notes were detailed enough and as "original" as possible to reflect our interviewees' stories.

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[9] For more information about the Epidata software, please visit: http://www.epidata.dk/

More importantly, I knew the people and stories well enough because I did most of the interviews. All of the interviews recorded in hard copy were transcribed into digital format, using Microsoft word, for further analysis.

The quantitative data were mainly analyzed using the statistics software Stata 12.1. Descriptive analysis and standardization method was used to generate the livelihood capitals index. In order to explore the determinants of recovery, regression models and probit models were used. In addition, the qualitative data was coded and analyzed with the assistance of NVIVO.

4.5 Validity and Reliability Justification

The decision to use each of the methods in this study that I presented above required long deliberation. Reliability, which captured the extent of knowledge on repeated measurement, and validity, concerned with the relationship between concepts and indicators are the two basic properties of empirical studies (Carmines & Zeller, 1979). Combined with the feasibility of implementing the study, the issues of validity and reliability will be discussed in this section.

Mixed research method**:** Mixed-method research has its advantage to understanding complex issues compared with using quantitative or qualitative research methods alone (Creswell, 2013). Considering the complicated characteristics of sustainable livelihoods in rural areas, a mixed method that includes surveys, participant observations, and interviews is necessary to understand the complexity of this issue (Ellis, 2000). In one respect, the household questionnaire survey can provide rich information about livelihood capitals and strategies from the macro level. It can capture the patterns of knowledge from a large, representative sample, and predict the trend if possible. However, the quality of this quantitative method is based

on the quality of design of the questions/indicators, as well as the representation of the samples. For rural livelihoods and disaster recovery, which is complicated and diverse in different societies and cultures, there is a lack of absolute standards of measurement. Knowledge for research design should be drawn from both academic research and local knowledge, abstracted from qualitative information. Consequently, qualitative research methods, like participant observations and in-depth interviews with local leaders and disaster survivors, would be necessary not only for designing the survey tools but for understanding the stories at a deeper level. Therefore, a mixed method research design can provide knowledge not only about "what happened" but can also provide insight about "why this happened" and "how this happened", and thus represents the best currently available approach for livelihoods and disaster recovery studies.

Research tools: The contents of the questionnaire and interview guidelines were mainly developed from the DFID's sustainable livelihood approach framework, which has been used widely in livelihoods studies in many countries. Additionally, the indicators measuring livelihood assets and strategies were modified according to application in the Chinese context (Li, Dong, Rao & Zhao, 2007) based on literature and local knowledge from the review of local materials and informal discussions with key local informants during our first disaster response fieldwork. Furthermore, as I illustrated in the data collection procedures, all the tools were tested before the final survey implementation, thus the validity and reliability of these measurements were assured in the study.

Sampling**:** Before the first wave of data collection, all the households in Wen County were considered as the population since this study was intended to explore the

livelihoods recovery at the micro-level. Ideally, the samples should be drawn randomly from all the families in this county. Unfortunately, a list that included all the families was not available and thus a stratified sampling method was adopted: first three towns were randomly selected according to their economic conditions, then three villages in each town were purposively chosen based on their geographic locations, and finally target households were identified using a convenience sampling method. When the villages were selected, we had thought about requesting a household list from local officials and randomly selected our respondents within villages, but several reasons made us give up this method. First, our face-to-face data collection method required us to visit every household separately. We could not just draw a list and ask the local officials to help us locate them. This would give local officials an unnecessary burden, especially in some villages where the local officials and villagers did not maintain a harmonious relationship. Furthermore, we wanted to collect the most realistic information without "outsider" disturbance. If we asked the local officials to first contact the residents for us, their selection preference may, to some extent, impact the data quality We decided to use the most reliable data collection method according to our own rich experience of conducting research in rural China, only asking local officials to provide necessary information and identifying the targets ourselves. For example, in this research, we only asked local officials for their help in dividing the village into three blocks, and then we sent our interviewers to each block to do data collection without any influence from local officials. The target selection within each individual block was given to our questionnaire interviewers.

For the second wave of data collection, we followed up with about 80% of our original samples. The main reason for losing a respondent household was because they

were not at home and were not available during our visit. Most of these difficult cases had migrated to other places such as cities to live because it was easier to make money in cities and they needed money to pay back their reconstruction debt. Actually, residents in rural China were very nice and cooperative with researchers and students most of the time. For example, in this study, we did not encounter any family that refused an interview if they were available. After introducing whom we were and what we were going to do, all of them were very glad to answer our questions. If they were not available at the time, they always would ask us to come later. In the several villages that were located in very remote areas, our respondents even provided accommodation and food for us because there were no restaurants or hotels there. Of course, we left some cash later as compensation to express our gratitude. For the first data collection in 2009, we brought some candies with us when we did the surveys and interviews because it was near the Spring Festival in China. We gave a bag of candy to every family we interviewed. We took many photos during our data collection. Some of the photos reflect the situation of these communities, some recorded our work scenario, and some were taken for the villagers and our respondents because it is not very common or convenient for them to take photos. We later printed all of these photos and sent them back to them. This method was very successful at strengthening our emotional connection, because when we returned for the second data collection in 2012, three years later, many of them still remembered us and had pictures with us on their walls. Consequently, the follow-up data collection was met with no problems regarding cooperation, with the biggest challenge being locating some of the families that we had interviewed three years earlier. Therefore, the information collected in this

longitudinal study was solid enough to reflect the reality of livelihoods recovery from the 2008 earthquake.

In-depth interviews**:** In-depth interviews were mainly adopted for first-hand qualitative data collection. Though semi-structured interview guidelines were developed before the data collection, a new life-story interview method (Hammack, 2006) was implemented during the second data collection in 2012. This method required the respondent to draw a curve between two time points with fluctuation, with the turning points and trends reflecting life changes. Miyamoto adopted this method in his study about disaster recovery in Japan, and this method has proven to be useful in capturing the respondents' life trend and stories (Miyamoto & Atsumi, 2009). However, after several attempts in the first two days of our data collection, we had to give up this method, and resorted back to our old tradition of asking questions using a chat model with the guidance of the interview guidelines. Our respondents had expressed confusion when we asked them to draw a curve to describe their life changes, even after our detailed explanation and demonstration, finding the exercise to be too abstract. When we asked them to try, the curves they would draw always just went up or went down without fluctuation. It is unclear as to whether cultural or educational differences contributed to this discrepancy, with education level likely contributing a more significant effect. Only one person who had a high school education indicated good understanding of this method among our attempts. In contrast, most of our respondents had a relatively low level of education, and this method proved too abstract for them. Consequently, we abandoned this method and turned to our traditional method of using semi-structured guidelines.

In summary, the discussions above indicate that the research design and data collection of this study could capture the reality of livelihoods recovery and both the design and methods could be generalized in other similar studies in future. Thus, the findings and conclusions drawn from this study should be validated and reliable.

4.6 Summary

The research design and methodology was presented in this chapter. Starting with a review of theoretical frameworks related to disaster recovery, I argued that the Sustainable Livelihood Approach would be a useful analysis framework for long-term disaster recovery research. Following an introduction of the SLA framework and its application in disaster and risk reduction studies, the feasibility of using the SLA framework for this study was demonstrated. Then the research tools, including a questionnaire and interview guidelines that were developed based on literature review and local knowledge, were discussed. A mixed method approach that combined a large-scale questionnaire survey, participant observation, and in-depth interviews was adopted for data collection. Finally, the sampling method, data collection procedures, and data analysis strategies, as well as the validity and reliability of this study, were discussed. In the following chapter, the research findings and analysis results will be presented.

Chapter 5

HOUSEHOLD RECOVERY PROCESSES AND PATTERNS

In this chapter, the household recovery stages and processes will be explored using the qualitative interview data from all three waves of data collection: June 2008, January 2009, and the summer of 2012. Before the presentation of the results from the qualitative data, a review of the transformational macro socioeconomic changes in rural China will be displayed. Afterward, the post-disaster household recovery processes (behavior aspect) will be categorized, and the major household recovery activity, house reconstruction patterns, and determinants of the decision-making, will be explored. Finally, the long-term livelihood strategies changes, adaptations, and prospects will be demonstrated and discussed.

5.1 Introduction

The pre- and post-disaster social development patterns and social change trends are critical factors shaping post-disaster recovery processes and outcomes (Tierney & Oliver-Smith, 2012). Thus, it would be unrealistic to understand the recovery processes and results without knowing the macro social development patterns and changes in rural China. Especially important are macro labor market and economic development trends, rural-urban migration patterns, as well as the social welfare changes in rural areas, which are closely related to livelihood adaptation and decision-making strategies.

It is well known that China has experienced steady, fast economic development in the last three decades. In one respect, the large off-farm rural people provide a rich low-cost labor force to meet industry needs, supporting China's claim of "the world factory". These rural migrants can also earn relatively more money working in cities than on farms. The global financial crisis in 2008 also affected rural families, especially those who had family members working in cities as part-time or temporary workers. Though there was a significant increase in unemployment and decrease in earnings for the rural labor force after the financial crisis, the situation made a turn for the better in late 2009 (Huang, Zhi, Huang, Rozelle, & Giles, 2011).

During the process of transformation from a traditional, agricultural society to a modern, industrial country, the continuing domestic rural-urban migration and fast urbanization have been two prominent social changes in China. Though there are millions of floating migrants working in cities, the dual rural-city household registration system (*Hukou*) constrains their stay in cities because they cannot access public housing, public medical insurance, or other social welfare programs in cities (Hu, Cook, & Salazar, 2008). Thus, these rural-urban migrants tend to follow a temporary and circular pattern, moving between cities, provinces, and their hometowns in search of improved opportunities. In a recent study about the migration patterns of the floating population in eastern China, the researcher found that off-farm rural people are still the major component of the floating population in cities who also tend to be young, less experienced, and less educated. The floating population migrates frequently between cities seeking better opportunities. Meanwhile, the young and old migrants are less stable than the middle-aged group and the married. The people who have more experience tend to have a stable job and residential status. In

terms of spatial trajectory, though the flows to megacities are still the majority, more and more migrants are moving to middle-sized and small-sized cities, or lower income urban areas, especially with the increase of migration frequencies (Tian, 2013). In less developed areas, the returning migrants play an important role in promoting rural entrepreneurial activities, helping to revitalize rural economies and alleviate poverty (D E Murger & Xu, 2011).

Besides the rural-urban migration, which is a major income resource for households in less developed rural areas, there are some other ongoing social policy changes in rural China in last decade, particularly since the year 2008. These social welfare programs mainly include free education in public elementary and middle schools, the new rural cooperative medical insurance system, the pension program for rural residents, assistance to low income families (Dibao), and assistance to children, the disabled, or elderly without dependents ("three-orphaned") (Wubao). Meanwhile, the agricultural tax was abandoned nationwide in 2005 and rural families can benefit from some projects like the crop cultivation subsidy and reimbursement for if they reconvert their farmland into forest, grassland, or lakes depending on the varied locations.

These ongoing changes of economic development and labor market needs, fast urbanization and rural-urban migration patterns, as well as the social development in rural areas, has shaped post-disaster recovery processes and results in the areas devastated by the 2008 earthquake together with local conditions.

5.2 Post-Disaster Recovery Processes

Since there is no clear cutoff between the disaster response and disaster recovery period, this section explores all the stages of human reaction to the

earthquake event. Questions like, “What were you doing when the earthquake happened?” and “What things have you done since the earthquake to now?” were used to obtain the immediate response behavior of our interviewees when we did the first field travel in June 2008. In January 2009, about eight months after the disaster event, questions like, “Have you started the reconstruction yet?” and “What have you done since the earthquake?” were used. For the third data collection, questions like “What major things have you done in the last four years since the earthquake?” or “Were there any good events or bad events that happened to you or your family in the last four years since the earthquake?” were used to inquire about our interviewees’ activities since the earthquake. When they reported some events or some activities, we always used one or more follow up questions to get the whole scenario and descriptions. The major patterns of their response after the disaster event predominately included the following six stages.

1. Self-Protection: The first reaction to the earthquake was self-protection or danger avoidance, which may last minutes to hours. Regardless of whether the respondent was having a class in a building, walking on a street, or working on their farmland, the first question that came to their mind when they felt the quake was “what happened?”. Then they realized that it was an earthquake, though some of them did not realize that in the first several seconds. They then would run to the nearest open space as soon as possible, screaming to inform others. Fox example, the students and teachers in schools chose the playground, and farmers working on their land preferred the open space far from the steep slopes. The first reaction reflected an intuitive thinking and decision-making process that “operates automatically and quickly, with little or no effort and no sense of voluntary control” (Kahneman, 2011).

2. *Safety Information Seeking/Rescue*: After the major shake, when the respondent was sure of their safety, they would turn to assessing the situation of their family members, friends, relatives or other familiarities. If a family had children, the children's safety was always the first concern. Then the information regarding other family members, extended family members, close friends, or other acquaintances came into the picture, one by one. This effort may last minutes, hours, or even days depending on the degree of disruption of communication systems and physical distance to the people of concern. If there were injuries or deaths nearby, or a search and rescue effort needed nearby, the safety information seeking effort may be postponed or lightened for the emergency needs. If the survivor had a public role, such as being a local government official or community leader, the undertaking of the responsibilities of their public role would also be initiated at this stage. The local cadre would check the damage of schools, hospitals, and other key infrastructures first, and then expand the assessment to other public facilities and disaster damages. Some local leaders may initiate an emergency response team or activate an emergency response plan if they had one. This situation was more likely to happen when the local leader was in the ground zero area, had decisive leadership or emergency actions were needed.

3. Family Reunion and Temporary Sheltering with Uncertainty: The third stage was characterized by a family reunion effort, prevalent but light psychological problems, and continued search and rescue activities. The family members attempted to reunite if they were not at the same place (e.g., home) during the event. This was especially true for students in boarding schools or the "returners" who worked outside of their hometown. This population movement would start immediately when the

condition was relatively stable, and lasted days to weeks due to the relative physical distance. Affected families would seek nearby temporary shelters or established temporary shelters by themselves. For some families, they would share the same shelter together and help each other with necessary needs. Food came mainly from undamaged groceries at home, or nearby grocery stores, as well as some fast foods distributed by government agencies. Communications and transportation started to be restored during this period, and the first batch of disaster relief materials and volunteers from the outside arrived. If numerous building collapses occurred within the community, the life search and rescue activities may be continued with the help of available high-technology search and rescue tools, but the number of lives to be saved would be limited. The disaster survivors would have several negative psychological issues, especially with the occurrence of continued aftershocks or with the injuries of family members. Some of the common psychological impacts expressed by the respondents were losing confidence in their future life, feeling numb and not wanting to do anything, and re-experiencing the disaster scenario. In some communities, emergency response teams were organized to do tasks including community watch, life search and rescue, shelter establishment, and road repair, but in other communities there was a lack of organized activities.

4. Self-Rescue and Waiting in Temporary Shelters: With the decrease in frequency of aftershocks, the disaster survivors started to maintain their "damaged normal" life with limited resources and to think about recovery in the future. Buried edible food and usable furniture would be rescued and recycled from the ruins or half-damaged buildings, and the temporary shelters would be reinforced or decorated for long-term use. Meanwhile, necessary lifeline services and public services were

restored and partially functioning within communities. Most people restored their routine social roles as well. From the psychological aspect, people started to accept the reality of the disaster and recover from the shocks, though worry and uncertainty about the future still existed. Severe post-disaster trauma was less likely to happen unless severe death or injuries of family members or close friends had occurred. The allegation of help from the central government and wide media coverage of donations and volunteer activity provided a sense of care and confidence regarding the recovery for these survivors. The widely covered government disaster relief stipend and food assistance were the main living supports during this stage. However, at the later period of this stage, disaster survivors would slow down or suspend their recovery effort due to promises from the central government being made but lacking a detailed policy or implementation guideline, which were still in development and vague at the time. During this period, very limited cases of "enjoying every living day" were observed, with some relatively rich families "abandoning" their damaged homes and planning "vacation" travel.

5. Housing Repair or Reconstruction: The fifth stage was the permanent shelter restoration period, which usually would start months after the disaster event and last for years. The officially declared reconstruction period started about three months after the earthquake event (the Temporary Living Stipend lasted for three months) and would last three years. With huge central government investment and help promised from the Counterpart-Aid partners, some local government officials believed that they could finish the entire reconstruction task in two years, and the slogan of "Three-year plan, two-year work (三年重建，两年完成)" was widely used. However, from our observations and interviews with disaster survivors, some families

still lagged in reconstruction four years later in the summer of 2012, though the overall housing reconstruction had finished and the public facilities and infrastructure had been restored and improved. Our questionnaire survey results from the 415 households indicated that about 30% of our respondents perceived they had not recovered from the earthquake impact yet, and 7.2% of the unrecovered families believed that they would never recover from the impact.

Generally, there were two trajectories of housing restoration: damaged and repaired, or damaged, demolished, and reconstructed. This two-trajectory typology method was also adopted by the government housing recovery assistance programs design. The central government of China initiated two kinds of housing recovery assistance programs for families in rural areas, the Housing Repair Assistance Program and the Housing Reconstruction Assistance Program. The repair assistance program would provide 3,000 Yuan to each family if they applied and repaired their damaged house. The reconstruction assistance package included 10,000 Yuan from the central government, 10,000 Yuan from the province government, and between 10,000 and 30,000 in government-endorsed, three-year interest-free loans. If a family wanted to use such a reconstruction aid package, they had to demolish their old house and rebuild a new one. The eligibility of each program was mainly determined by the disaster-related degree of housing damage and the willingness of each family. Though there were detailed procedures regarding housing damage assessment in the policy guidelines, the assessment of housing damage was not followed very strictly, with enrollment into each program mainly dependent on the family's willingness in practice. Since the assistance policy (particularly the loan policy) was very vague and there was a lack of operational guidelines at the beginning, many families lingered between the

two choices, which may have slowed down the individual reconstruction effort and speed. For families that had minor building damages, they often preferred the repair program. For families with severe building damages and the capacity of rebuilding with the assistance of government, they would choose the reconstruction program. However, for families that had medium degrees of damage, they had difficulty making up their minds. On the one hand, they wanted to use the government aid, but on the other hand, they were worried about the affordability of rebuilding since the government aid was clearly not enough to cover all the rebuilding costs. Thus, some families may have delayed their decisions or changed their decisions during the reconstruction period. For example, some families chose the repair program first, but later changed their mind and applied for the reconstruction program.

The housing restoration was the most burdensome task in the recovery process, at least from the perspective of most of our respondents. Actually, many of them perceived the recovery as the housing reconstruction. If they finished the housing reconstruction, they would perceive their life as recovered from the impact of the earthquake. However, other individuals, including local elites who had higher education or locals who had travelled or worked out of the region, also mentioned long-term livelihood recovery; how to make a living and keep sustainable development for the long-run. Thus, the long-term livelihood recovery was categorized as the last stage of the recovery process in this analysis.

6. Livelihood Recovery: The last stage of the household recovery process was the long-term livelihood recovery period. Based on the available livelihood assets (human capital, social capital, financial capital, natural capital, and physical capital) and opportunities that emerged after the disaster, different families would adopt varied

livelihood strategies. The main livelihood strategies of residents in this rural area included crop cultivation, livestock/poultry cultivation, small business management, and temporary blue-color labor jobs in cities. The livelihood recovery process may start soon after reconstruction activities, without a foreseeable end point.

For most of the families, their major effort was put into housing reconstruction in the last three years. Meanwhile, they continued their pre-earthquake livelihood strategies to maintain a survivable life. Though families (particularly those with rich human capital) could benefit from the increased demand for a labor force during the reconstruction period due to the large need for construction workers, their housing reconstruction cost would increase as well and they did not have much energy and time to offer their labor to others. However, for some relatively rich families or families which seized the business opportunities after the earthquake, they would contract out their housing reconstruction need and seek other desirable jobs or opportunities. The details of long-term livelihood adaptation patterns and changes are presented and discussed in section 5.4.

5.3 House Reconstruction Patterns and Determinants: a Primary Model

Since housing reconstruction was the core part of disaster recovery in the view of most of our respondents, the patterns and influencing factors of housing reconstruction were extracted from our interview data and are presented in this section.

Of the 415 households in our survey, 283 of them (68.19%) reconstructed their houses after the earthquake. According to the Wen County Reconstruction Plan, the reconstruction effort of the rural communities would be integrated with the National New Rural Development Plan and the urbanization process, focused on improving the quality of design and public service facilities using a concentrated development model.

If 50% or more of the houses in one village were damaged, the whole community could be re-developed. Four models of rebuilding were proposed, rebuild at the same place, rebuild within the village but at another open space, relocate within the county to another place, or relocate to another place (migration model). However, the migration model was not achieved in the reconstruction period due to huge coordination challenges, which were beyond the capacity of local government. Finally, 123 rural communities were agreed upon to be rebuilt; 83 of them would be rebuilt at the same place, and 40 of them would be relocated nearby.

In the real reconstruction practice later, there were actually four models of housing reconstruction in this rural area. The first one was Unified Reconstruction with the Help of Counterpart Assistance (URwHCA), and the village QSP was this model in my study. In this model, the local government would select and provide a land large enough for the whole community's relocation, and the counterpart assistance providers would take on the community design and reconstruction responsibility. At the end of the project, a newly designed community with all the necessary public facilities and utilities would be delivered to the community. Each family within the community could get a house with three undecorated rooms in totaling 60 m^2, and another 30 m^2 space with fences, for further development. The project beneficiaries did not have to pay any reconstruction cost, but they had to pay the land purchasing cost. Meanwhile, they would no longer be eligible for the housing reconstruction subsidy.

The second reconstruction model was the Unified Reconstruction without Help. In this case, the local government would take on the land acquisition and community design responsibility, but the relocated families had to rebuild their houses either by

themselves or using contractors. Meanwhile, they had to pay the land cost or obtained the land using an exchange method. The families in this model were eligible for the Housing Reconstruction Assistance Subsidy. The third one was the Combined-Reconstruction model, which was similar to the second model, but with limited household members (several households combined together), and the households had to acquire the land and rebuild the house themselves. The local government would provide some coordination effort for their land procurement, and they could also apply for the Housing Reconstruction Assistance Subsidy. The last model was Self-Reconstruction, which indicated clearly that the household had their free will to rebuild their new house anywhere and in any way, however they had to take the full responsibility of land pursuing and rebuilding effort themselves. With this model, some families adopted the market-oriented rebuilding method and contracted either the entire or the majority of the rebuilding task out. However, most preferred a traditional model, purchasing the reconstruction materials and rebuilding the house by themselves with the help of relatives and friends, excluding certain jobs that required special skills. Of course, all the families that chose the Self-Reconstruction model could also benefit from the Housing Reconstruction Assistance Program if they followed the reconstruction requirement.

During our first travels to the area in June 2008, many disaster survivors expected a unified construction model led by government. They hoped the government could help them to rebuild a new community with an appropriate design and to improve public facilities to replace their current chaotic, spontaneously developed community that had existed for many years. However, some realized that it was impossible to rely heavily on the government because the catastrophe had impacted so

many people and such a large area. Consequently, very few villages captured the reconstruction opportunities and successfully utilized the Counterpart Aid programs, or other support programs from upper level government, to achieve their long-dreamed development expectations.

Available household resources, community collective action, and higher government support not only influenced individual decision-making, but also determined the results of reconstruction. The community collective action was critical for the utilization of higher government support. A primary model of the influencing factors of reconstruction decision-making and reconstruction results is presented in figure 5.1.

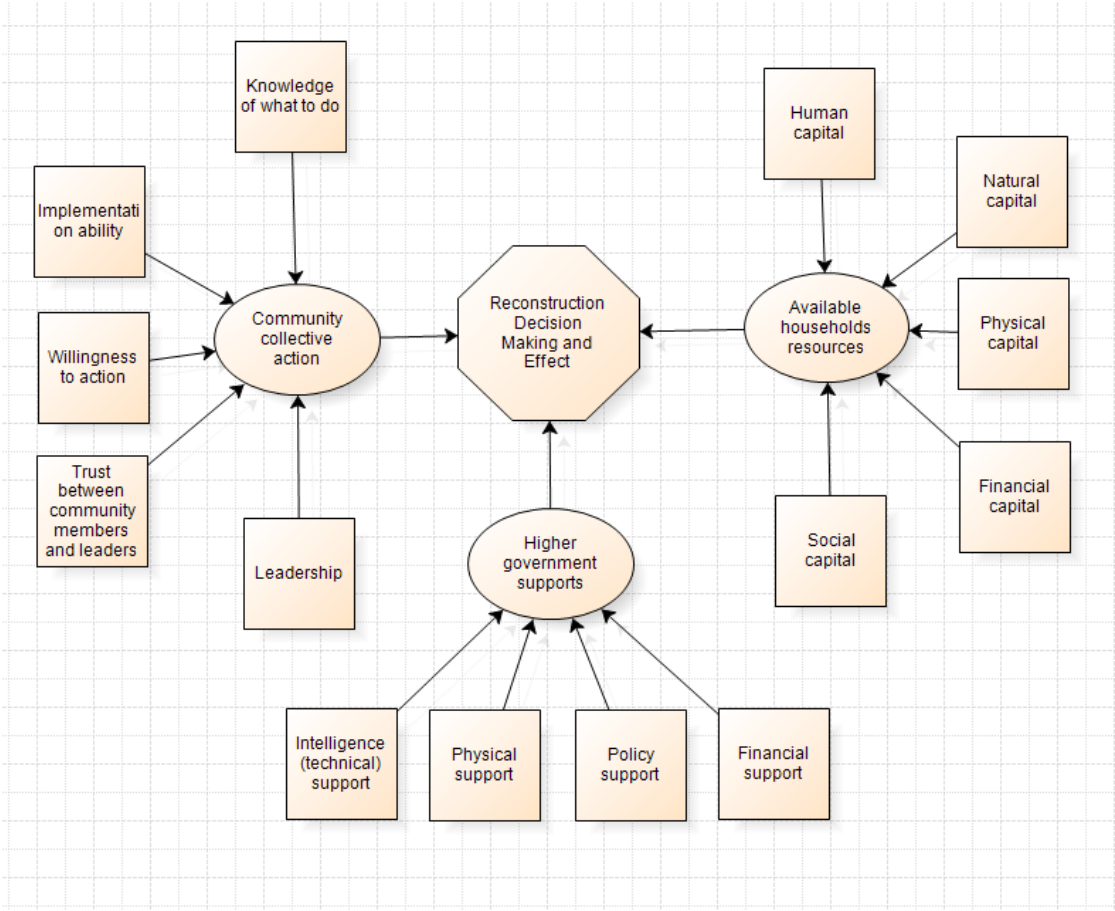

Figure 5.1 A Primary Model of Reconstruction Decision-Making and Results

Available resources for households were the first cluster of determinants in the recovery and decision-making process. The financial capital, social capital, human capital, natural capital, and physical capital available were the five sub-indicators of the available household assets. For example, when a medium damaged family hesitated between reconstruction or repair programs, the major concern for them was whether or not they could afford the reconstruction cost, regardless of whether they intended to use savings, the government subsidy, or loans from their personal social network. Most of our interviewees had a clear cost and investment list in their mind

when we asked about their reconstruction decisions. Their available financial asset (savings and expected incomings), financial help from their personal social network, available free labor aid from relatives and friends, estimated reconstruction materials cost, and government policy and actions were the major factors they considered. Since almost all the households within their personal social network were also impacted by the earthquake and had their own reconstruction needs, most of them expected very little financial support from their informal social network. Furthermore, the traditional mutual-aid within relatives and neighbors for housing reconstruction may have also been weakened because all the families had such needs, and they had to arrange and coordinate the reconstruction activities and priority arduously.

In a centralized political system like China's, the top-down national policy is critical for decision-making in local governments, communities, and among individuals, especially in catastrophic scenarios like the Wenchuan earthquake, where the allegation of "Converging the nationwide resources for the post-disaster reconstruction" was made. Both the local officials and disaster survivors alike paid close attention to the national ad hoc policies of the disaster relief and recovery due to the political allegation from top political leaders at the very beginning of the response period. However, the lofty expectations and overreliance on the actions of central government or special policies delayed the recovery speed and individual's effort for a while until the policies and assistance programs became clear and detailed. Even during our second field trip, some households were still struggling with whether to rebuild or not, because they did not know how the government endorsed loans operated at the local level. If they got the loan successfully, they would have enough

financial support for rebuilding. However, if they could not get it successfully, they would give up the reconstruction or switch to other ways of rebuilding.

The third cluster of determinants was community collective action and related capacity including local cadre's leadership, knowledge of what to do, implementation power (Rubin & Barbee, 1985;Rubin & Popkin, 1990), and trust relation between community members and their local leaders(Han *et al*., 2011). This cluster of factors played a critical role in the utilization of higher level of government's support in my study. Though I believed the pre-disaster community planning should be part of this cluster of determinants, there was no such observation in my study due to an absence of pre-planning within these villages. This category of influencing factor was not mentioned by our interviewees directly, except for some complaints about their local cadre's willingness to fight for their interest or overall criticism of their community cadre's leadership. Since households were the units embedded within communities, the overall community response and recovery efforts would affect households significantly in resource procurement, particularly the support from higher government.

Disaster recovery is a dynamic process, with prior actions and decisions resulting in different consequences. The reconstruction patterns I displayed in this section had an important impact on the household's long-term livelihood strategy adaptation, especially for those who relocated during the reconstruction period. In the following section, livelihood strategy adaptation and changes are discussed.

5.4 Livelihood Strategies: Adaptation and Changes

As illustrated earlier, of the nine selected villages for this study, three were in the valley area, three were on the mountaintop, and three were located on the

mountainside. After the earthquake, three of the villages that used to be located on mountaintop or mountainside relocated to the lower valley area. Among the three villages that remained in their original place, those in the mountaintop had very strong collective willingness and desire to move during the initial period after the earthquake. The other two villages had households both at the mountainside and in the lower area, thus the rebuilding relocation happened individually within these villages.

Socioeconomic trends including the macroeconomic situation in China, the 2008 global financial crisis, as well as local economic development and available livelihood assets, together affected the local individual's livelihood strategy adaptation, especially for the relocated families. Overall, there were four patterns of livelihood strategy changes.

Relocated and "New Normal" Life: The first pattern was mainly found in relocated households that had much more diversified livelihood strategies. For the families relocated from the mountaintop or mountainside to the lower area, the daily communication between their shelters to other places (e.g., major towns) became much more convenient. Take the FCS village for example, before the relocation there was only one walkable access trail to their village, which would take two hours walking one way from the nearest road. Consequently, the villagers almost could not do anything except the limited farming work. After the relocation, many of the relocated families could run some small business, like a small convenient store or transportation service, or find temporary work in the major towns. With the diversification of livelihood strategies, the importance of on-farm activities decreased, and most of the families chose to only keep the nearest land that could provide needed grains and abandon the more difficult to reach farmland. Furthermore, they had to

abandon the upper farmland because the activities of wildlife (e.g., boar) increased very quickly with the dwindling of human activities. Overall, most of the relocated families had a more diverse livelihood strategy combination and a better life than before, though they were under the pressure of indebtedness from housing reconstruction.

Relocated but Kept "Old Normal": Though some families had relocated to lower areas, they followed similar livelihood strategies to those they had before the earthquake because they could not adjust to the new situation, mainly due to a lack of skills or other human capital related factors. These families kept most of their farmland and on-farm activities, though the distance from their new shelters to their farmland was much further than it had been before. Most of these families only had old family members, and some of them kept "communicating" between their old shelters and new houses because the old shelters were closer to their farmland.

Pursuing More Reciprocative Livelihood Strategies: The third category included those who had financial pressure from the reconstruction and needed relatively higher paying livelihood activities. For many of those who had their houses reconstructed, they were in serious debt compared with their pre-earthquake income standard and their perception. Thus, when they finished the reconstruction, or at least finished the main structure, they required more financial resources to continue the reconstruction or to pay the loan from the bank back. Most of these rural residents did not have a stable income source, and the products from the poor farmland could only provide necessary grains for their daily living. Thus, many families had great financial pressure, requiring them to adjust their livelihood strategies and put more time, energy and human capital into relatively higher paying activities, such as pursing work

opportunities in big cities instead of enjoying their pre-earthquake self-sufficient, subsistence lifestyles.

Return to "Old Normal": The last category included those who had almost the same livelihood strategies compared with their pre-earthquake situation. Most of these families had their house reconstructed at the original place or just got the house repaired. They did not have much financial burden in terms of housing reconstruction, and the community environment did not change a lot. Thus, these families adopted a similar pre-earthquake livelihood strategy pattern, focusing on on-farm livelihood activities.

In short, there were four livelihood strategy change patterns in the disaster recovery process. The relocated households were more likely to adjust to the new environment and diversify their livelihood strategies, except the families that had only the old. Some of the un-relocated households also switched their major livelihood strategies to the higher paying activities due to the financial pressure of reconstruction, while some of them did not change much and kept a similar pattern to their pre-earthquake situation.

5.5 A Tale of Two Villages: How Community Collective Actions Affect the Disaster Recovery

As I presented in Section 5.3, the community collective action played a critical role in utilizing higher government support and outside resources, and thus may boost the overall recovery effects and efficiency within a community. In order to support such an argument, a comparison of two villages is presented including how the collective response action affected the resource procurement and the later recovery process, as well as recovery results (Table 5.1).

Table 5.1 A Comparison of Two Villages

	QSP	ZTB
Pre-earthquake	Mountainside, near the major town, majority community.	Mountaintop, far from the major town, minority community.
Pre- earthquake livelihood strategies	On-farm activities, small business, occasional workers within this area.	On-farm work, migrated workers in cities.
Disaster impact	Severely	Severely
Disaster Response	The community leader reported the disaster impact to the local government immediately (about one hour later), organized response team, and repaired the roads to the community.	The community leader only reported the disaster impact passively according to the requirement from higher government request. No community response team and collective action.
Early Recovery	Many high level political officials visited and disaster relief materials flooded to the community.	Very limited outsiders came.
Expectation for recovery	Move down to the valley area.	Move down to the valley area.
Reconstruction	Whole community relocated, and the community was selected as an exemplary reconstruction case, and the counterpart-aid providers helped the reconstruction.	Didn't move down successfully through little efforts. Self-reconstruction model.
Public facilities	New lanes within community, a clinic, a community activity house, and public recreation facilities were reconstructed and provided by the counterpart-aid providers.	A new community activity house was rebuilt, a new and the only road to the community from the major road opened.
Livelihood prospect	More convenient to transportation and major town, diversified	Kept a similar livelihood combination, mainly relied on farm-related strategies.

	livelihood strategies, shifted from farm-related activities to more off-farm activities.	

Both the QSP and ZTB villages were located on the mountainside or mountaintop before the earthquake. There were very limited access methods from the major roads to both of these villages. Compared with ZTB, QSP was much closer to the major town, and there was a small navigable road to the village. On the other hand, ZTB was much further from the major town and only had a walkable trail to the village. The ZTB was a minority community, which could have been an advantage for fighting for government support in this situation. For example, many major towns wanted to relocate after the earthquake, but only one (Beichuan) successfully got the support, because the majority of people within this town were Qiang, a unique ethnicity.

The earthquake had a similar impact on both communities. They both faced possible geological hazards in the future, and villagers in both communities expressed willingness to move. The villagers in ZTB had an even stronger eagerness to move down which had been present for many years, because about 100 years earlier they were forced to move to the mountaintop from valley. Compared with their counterparts in the valley area, many villagers said that their life was left behind at least twenty years in such a harsh environment.

When the earthquake happened, the community leaders in QSP inspected the disaster damage and reported to the local government quickly. Afterward, a disaster response team was organized within the community, and they decided to repair the damaged road as soon as possible by themselves. Three days later, when the major road to this county was accessible, the vice governor of that province arrived at the

local county government. When he inquired about the disaster impact and wanted to do a field check in the rural areas, the QSP village became the top recommended candidate because the local officials had very limited information and QSP was almost the only accessible village at that time based on their information. Then many higher-level government officials stopped by, and this village gained lots of attention and media coverage as well as assistance resources, not only from government agencies but from NGOs and volunteers as well. This village was selected as the first batch of exemplary recovery villages, and the whole community was relocated to the valley area where the new community was designed and rebuilt by the counterpart aid providers, the Shenzhen government.

Though the villagers in the ZTB community had very strong willingness to move down to the valley, many perceiving the earthquake as an opportunity and their minority identity as an advantage, they did not really seize the opportunity. After the earthquake, the village autonomy committee members only collected the disaster damage information and reported to local government passively according to the requirement. No community leaders emerged or stood up to organize any collective action to fight for an opportunity. Some families tried to purchase a land for reconstruction in the valley area that belonged to another village, but they were rejected by the village owning the land[10]. Though the community leaders in ZTB did

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[10] The rural land related law is one of the most confusing issues in China, which is under the ongoing reformation. Literally, all the villagers within the community own the land in the rural area collectively. The individuals only have the "right to use" the land. However, land transactions between individuals are very common in reality because only the title of "land using right" is transferred. But without the agreement of village autonomy committee members, the land transaction deal is almost impossible to happen. Without a higher-level government official's intervention and coordination, purchasing a land in another village is almost impossible. From our interviews with

make some efforts to negotiate with the community leaders from the village in which they wanted to purchase their land, they also required local government officials' involvement, but they did not make it through. Consequently, the opportunity to move down was not actualized.

In terms of livelihood recovery and sustainable development, the QSP village gained much more than ZTB in the long run. In one respect, the villagers in QSP had a much more convenient environment for accessing business, job opportunities, and public service facilities, and their livelihood strategies were more diversified and resilient. Meanwhile, the households in QSB received their finished houses with a low price from their counterpart-assistance providers, and avoided the condition of indebtedness.

5.6 Summary

In this chapter, the household post-disaster recovery process was presented and discussed. Overall, there were six stages of post-disaster activities: self-protection, safety information seeking/rescue, family reunion and temporary sheltering with uncertainty, self-rescue and waiting in temporary shelters, housing reconstruction/repair and livelihood recovery. For the most burdensome housing reconstruction, the unified reconstruction with counterpart assistance, the unified reconstruction without outside help, combined-reconstruction, and self-reconstruction,

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local officials, how to acquire or coordinate the land for reconstruction needs was listed as the first challenge most of times. If unified relocation or collective relocation was involved, the needs of land acquirement were almost inevitable. Thus, many local officials would keep from this trouble as far as possible.

were the four patterns of reconstruction. The major determinants of household reconstruction patterns and results included the available individual/household resources, higher government support, and community collective action. After the housing reconstruction, families adopted different livelihood strategy combinations to respond to the changed environment. If relocation was involved, it was quite possible to diversify people's livelihood strategy, except for the families with only the old. The families without much financial pressure or lack of necessary human capital were more likely to adopt the "old normal" livelihood strategy combination, while the families with financial pressures were more likely to pursue higher paying off-farm work. From the field observations and interviews, I found that collective action after the earthquake, especially in the response period, played a critical role in determining the overall community reconstruction, benefits of households within the community, as well as long-term development. Finally, a comparison between two communities was used to support such a conclusion.

Chapter 6

RECOVERY AS OUTCOMES: IN TERMS OF LIVELIHOOD ASSETS

In this chapter, the recovery outcomes will be examined in terms of livelihood assets: financial capital, human capital, social capital, physical capital, and natural capital. Survey results from the 415 households in both waves will be used to make the comparison. The research hypotheses are: 1) overall, all the five livelihood assets have increased in 2012 compared with the 2009 data; and 2) the inequalities in terms of standard deviations of the five livelihood assets have also increased during this time period. In order to examine the two hypotheses, the livelihood assets measurements, results, and changes, will be presented in order. Meanwhile, the results of other questions related to livelihood assets will be reported along with each livelihood capital. Finally, a set of livelihood assets indexes will be constructed and standardized from the five livelihood assets, and the results and changes among livelihood assets will be discussed.

6.1 Financial Capital

Financial capital consisted of three components in this study: annual income, savings, and maximum credits (i.e., money that can be borrowed from others). Since the first data collection was conducted at the beginning of 2009, both pre- and post-earthquake annual information were acquired, including the annual incomes, savings, and credits in 2007 and 2008. During the second survey period in the summer of 2012, the annual income, savings, and credits of 2011 were obtained. Thus, the income

indicator actually captures three time periods: the year before the earthquake, the year when the earthquake happened, and a year in the long-term recovery process.

16 kinds of possible income sources were identified through literature review and consultation with local experts. Thus, a table that included 16 questions was constructed to obtain detailed income information from each category. These 16 income resources can be clustered into five subsets: income from crops, income from livestock cultivation, salaries, assistances or subsidies from either government or nongovernment organizations, and other sources of income (e.g., revenue from running small businesses). Except the relatively objective measures of the incomes, we also proposed the question "Compared with the situation before the earthquake, how do you think your income has changed now?" to capture the perceived income changes at each time of the data collection. The possible answers to this question were "Increased", "Almost the same" and "Decreased".

Instead of inquiring about family savings directly, which may sensitive for some respondents, the interests information from saving accounts were collected and then the savings were re-calculated according to the annual interest rates. The maximum credits were obtained from the question, "how much cash can you borrow from the following sources if you're in an emergency and need as much money as possible?" Banks, relatives/friends and other organizations/individuals like microfinance providers were the sources proposed. All the information of the pre-earthquake year in 2007 and the 2008 data were obtained in January 2009, and were adjusted to the value (RMB) of 2011 by the China annual CPIs (Consumer Price Index)

that was obtained from the World Bank online database[11]. In conclusion, the financial capital index was the sum of annual income, savings, and available credits.

$$\text{Financial capital index} = \sum(\text{Income, Savings, Credits}) \qquad 6.1$$

Table 6.1 Financial Capital

	Mean			Standard Deviation		
	2007 (RMB)	2009 (RMB)	2012 (RMB)	2007 (RMB)	2009 (RMB)	2012 (RMB)
Financial capital	18847.81	33900.35	40962.11	24934.4	29726.88	38360.26
Total Income	10686.72	20449.62	22254.84	9186.463	14073.65	18059.99
Crop	1793.666	1395.593	1754.458	1416.139	1422.669	1665.693
Livestock	2764.072	2616.943	3582.988	4096.545	6218.114	8395.738
Salary	5662.89	4494.997	14046.02	8107.813	7671.402	12824.62
Aids	161.482	4564.8	2187.228	905.4721	2900.463	4574.55
Others	264.6625	7376.902	640.7711	1712.416	10199.49	4589.147
	Perceived income changes (2009 VS Pre-EQ)			Perceived income changes (2012 VS Pre-EQ)		
	Freq.	Percent		Freq.	Percent	
Increased	69	16.63%		98	23.61%	
Almost the same	107	25.78%		159	38.31%	
Decreased	239	57.59%		158	38.07%	
Total	415	100%		415	100%	
	2007 (Mean)	2009 (Mean)	2012 (Mean)	2007 (Mean)	2009 (Mean)	2012 (Mean)
Increased	9998.707	18941.82	21047.46	10575.02	22218.91	29901.53
Almost the same	9382.643	19061.03	20300.65	10841.4	19904.51	21857.33
Decreased	11469.19	21506.59	23478.3	10600.35	19900.76	17911.99
	Mean			Standard Deviation		

[11] World Bank CPI Data Page: http://data.worldbank.org/indicator/FP.CPI.TOTL.ZG

	2007	2009	2012	2007	2009	2012
Savings	492.6861	763.6345	471.8433	3711.798	5176.928	3526.908
Credits	7668.399	12687.09	18235.42	21662.39	23296.62	30699.16
Credits sources	2007(Count Percent)		2009(Count Percent)		2012(Count Percent)	
Friends/Relatives	224	79.72%	175	58.92%	263	71.08%
Banks	51	18.15%	119	40.07%	99	26.76%
Others	6	2.14%	3	1.01%	8	2.16%
Total	281	100.00%	297	100%	370	100%

The financial capital related results are presented in Table 6.1. First, the means and standard deviations of financial capitals, annual incomes, savings, and credits are reported. Next, the perceived income changes compared with the pre-earthquake situation, and the average value of objective income measures in each perceived change category, are presented. Finally, the credits sources from where the respondent could borrow money at each time are reported. Since the currency exchange rate between the US dollar and Chinese Yuan is dynamic, all the economic-related results in this study were measured and reported in RMB if no specific explanation is used. As I explained earlier in this section, the 2007, 2009 and 2012 income data actually were the annual income in 2007, 2008, and 2011. The savings and credits of 2007, 2009, and 2012 actually indicate the savings and credits before the earthquake, soon after the earthquake, and four years later.

Both the income and income inequality between different families increased in the wake of the earthquake. The average income of each family in 2007 was 10,686.72 Yuan, and this number increased to 20,449.62 in 2008, and then arrived at 22,254.84 in 2011. Similarly, with the mean value, the standard deviation also increased from 2007 to 2011. Comparing the data between 2007 and 2011, the mean value had a similar increase rate with the standard deviation. However, if the income data from 2008 and 2011 were compared, the standard deviation had a much higher increase rate

(28.32%) than the mean value (8.83%). This trend indicates that the income gap between different families enlarged faster than the overall increase trend of income during the disaster recovery process.

The aid from government and other informal temporary opportunities was one of the most important sources of income in 2008, when people's lives were interrupted by the disaster. After the earthquake, the central government of China launched a Temporary Living Stipend program, which covered almost all disaster survivors in rural areas. The central government provided 300 Yuan each month to each person, lasting for three months. If one family had four people, the total income from the central government after the catastrophe would be 3,600 Yuan. Of course, there were several other formal and informal assistances programs from local government and nongovernment organizations in addition to this widely covered, comprehensive assistance program. Additionally, construction and other opportunities emerged after the disaster. Some people benefited from these opportunities, and their income leveraged the average value in our sample. However, it should be noted that all the traditional income sources from crops, livestock/poultry cultivation, and salaries decreased in 2008, the year of the earthquake. This data structure was reasonable, because the earthquake had damaged some of their lands and had also caused a large number of deaths of livestock/poultry. Meanwhile, many people returned home from big cities where they could have a relatively well-paid job. Consequently, the disaster interrupted their main livelihood strategies as temporary migrant workers.

Comparing the income structures over the three years, we found that people earned more from their salaries in 2011. The traditional incomes from crops and livestock/poultry cultivation had decreased. Available aid and business opportunities

were only temporary income sources after disasters and did not last long. The salary took a much larger proportion (63.11%) of the total income in 2011 than in 2008 (21.98%), and this proportion was even larger than the situation before the earthquake (52.99%). On the other hand, the share of income from traditional sources like crops (16.78% before the earthquake, 6.82% in 2008 to 7.88% in 2011) or livestock/poultry cultivation (25.86% in 2007, 12.80% in 2008 to 16.10% in2011) decreased from 2007 to 2011. These changes in income structure reflected the livelihood strategies shifts among these disaster survivors. Before the earthquake, this area was a poor and relatively closed society; people had a more self-sufficient lifestyle. Crops from farms and livestock/poultry raised could maintain their subsistence lifestyle. Some people went to big cities or other areas that had more job opportunities temporarily each year to make additional money. After the earthquake, people depended more on their salaries rather than the outputs from farms. On the one hand, the reconstruction after the earthquake provided many jobs and opportunities, but on the other hand, the arrival of outsiders brought new thoughts, values, and lifestyles. People balanced their investments and outcomes from farmland and the "market economy" and finally made their livelihoods choices.

Besides the objective measurements of income, the question "How do you think your income has changed compared with the pre-earthquake situation?" was used to capture perceived income changes from the respondents. At the beginning of 2009, about 57.59% of people said that their income level was less than the year before the earthquake, 25.78% perceived it to be the same, and 16.63% reported an increase. Compared with their income before the earthquake, about 23.61% of the respondents said that they had earned more in 2011, 38.31% reported a similar income

level, and only 38.07% perceived a lower income. Then the mean values of the objective incomes were tabulated based on the perception of the income changes. It is very interesting that people who reported an income decrease in 2009 actually had the highest income levels both pre- and post-earthquake, combined with the biggest improvement, and this trend expanded to 2011. The people who had lower incomes pre-disaster were more likely to report an increase or stability of income after the earthquake in 2009. However, this trend reversed in the comparison using the 2007 and 2011 data. The people who perceived an income increase had the highest income in 2011 (29,901.53) and the biggest improvement (19,326.51), and people who perceived a decrease in income had the lowest income level in 2011 (17,911.99) and the least improvement (7,311.64). The families who chose the answer "almost the same" were almost always located at the second income level and had the second largest improvement in the comparison. Why did people's perception of income change more accurately reflect the "reality" four years after the disaster rather than eight months? This paradox was actually more reasonable after rumination from our observation in the field and the interview data. The evaluation and judgment about the income change in the summer of 2012 was more rational because the physical recovery had almost finished about four years after the earthquake. People's perception of change was not only affected by the longitudinal changes in the time dimension, but also by their current situation among their "peers". Thus, the relatively rich families would perceive an increase compared with the relatively poor families. In contrast, when all the families were immediately struck and recovering from the earthquake, the government assistance program was a major source of income for the first three months and covered almost all the families. Such an assistance program,

which was designed based on needs, played a more important role in poor families compared to rich ones. Also, poor families were more likely to benefit from some nongovernment organizations or other pro-poor programs, thus the poor families were more likely to perceive an income increase at that time.

Savings and available credits were the other two components of financial capital used in this study. The survey data showed that these families didn't have a lot of savings, whether before the earthquake, immediately after the earthquake, or four years later, and only a small portion of these families had savings. Compared with the average value of savings, the standard deviations were relatively high. The maximum available credits for emergency needs also displayed an increasing trend, from 7,668.399 in 2007 to 12,687.09 in 2008, and then toward 18,235.42 in 2011. However, the available credits sources were different between "normal" times and post-disaster times. Before the earthquake, the first and most available financial support came from informal personal social networks (i.e., relatives and friends). Only a very limited portion of the sample (18.15%) could get cash support from formal organizations like banks. However, after the earthquake, the available financial support from friends and relatives decreased, and the available formal assistance from banks increased, with about 40.07% of the respondents able to get loans from banks at that time. When life returned to normal, the situation became similar to the pre-earthquake situation once again; personal informal social networks were the first and most available source of financial support for individual emergency needs, and formal support from banks and other organizations was quite limited. These numbers actually reflect a truth and fact that commonly exists in rural China. It is very hard for residents in rural area to get financial support from formal organizations like banks, and informal social networks

actually play the role of risk pool for most of families. The increase of support from banks this time was the result of the special housing reconstruction loan program that was endorsed by government.

In summary, financial capital including annual income, savings, and credits available had increased and exceeded the pre-earthquake situation about four years after the disaster. With average value improvement, the inequality between the rich and poor also increased. Meanwhile, the disaster survivors' livelihood strategies had shifted, which can be reflected from the changes in income structure. People depended more on their salaries and relied less on traditional income sources like crops or livestock and poultry cultivation. When their lives were still in chaos after the disaster, rich families were more likely to perceive an income decrease, while the poor tended to report an increase in income. This perception pattern reversed when their lives were relatively back to normal, four years later. Generally, the surveyed families did not have much savings, and their financial support came mainly from their informal social networks like friends or relatives. Support from formal organizations like banks only emerged after the disaster due to special policy requirements and, though ephemeral, this support was quite important.

6.2 Human Capital

The variables related to human capital in this study included the total number of family members, the number of full-time laborers within a family, the number of part-time laborers within a family, and the highest education level obtained among family members. In addition, the average number of family members by gender and age group was also reported to help understand the demographic picture of these families. Whether a family member was a full-time laborer was obtained by a "Yes" or

"No" question, and the total number of full-time laborers within a family was calculated by counting the number of "Yes" answers. People who were more than 14 years old but not full-time laborers were considered as part-time laborers, and a 0.5 weight was given when calculating the labor force within a family. The education level was a categorical variable with a series values ranging from one to five, representing illiteracy, primary school education, middle school education, high school education, college level, and above. However, these numbers from one to five were treated as meaningful scales when the human capital index was constructed in this analysis. First, a family labor ratio was calculated by using the sum of full-time labor and half of the part-time labor counts, divided by the total number of family members. Then, the product of the family labor ratio and the highest education level within family members was used as the human capital index for this study. Consequently, the human capital index was a continuous number ranging from one to five.

$$\text{Human capital index} = \text{Education} * \frac{\text{N(fulltime labors)} + 0.5 * N(parttime\ labors)}{\text{N(family members)}} \quad 6.2$$

Table 6.2: Human Capital

	Mean			Standard Deviation	
	2009	2012	Change Rate	2009	2012
Human capital index	2.326	2.486	6.89%	0.978	1.112
Labor load ratio	0.749	0.730	-2.48%	0.169	0.178
Number of family members	4.101	4.467	8.93%	1.214	1.436
Number of fulltime labors within family	2.571	2.814	9.47%	1.197	1.347
Number of part-time labors within family	0.966	0.870	-9.98%	1.037	0.931

Highest education within family	3.067	3.342	8.96%	0.976	1.133
Number of males within family	2.067	2.142	3.61%	0.854	0.941
Number of young within family	0.802	0.795	-0.90%	0.816	0.848
Number of adults within family	2.930	3.130	6.83%	1.252	1.329
Number of olds within family	0.354	0.340	-4.08%	0.623	0.631

From 2009 to 2012, the average human capital index in these 415 families increased about 6.89%, from 2.326 to 2.486. However, this increase was mainly attributed to the improvement of education, because the family labor load ratio actually decreased a little from 2009 to 2012. On average, each family had more members in 2012 than 2009, and the number of full-time laborers within the family also followed a similar trend. On the contrary, the average number of part-time laborers within families decreased about 10%. This phenomenon can also be reflected from the age perspective. Both the number of young (age under 18) and old people (age above 65) within families decreased, but the number of adults increased since 2009. If we examined the family human resource capacity from the gender perspective, the average number of males within families also increased from 2.067 to 2.142, about 3.61%. However, this number did not mean that each family had more male members or less female members. Actually, the increase of male members within a family was consistent with the fact that each family had more members on average. The number of male family members' contribution to the total number of family member was 50.40% in 2009 but changed to 47.95% in 2012. This fact indicates that there were more female members within families than males. In this study, each family member's education level was obtained and compared, and finally, the highest education level within family members was taken as a sub-indicator of human capital. It can be seen that the highest education level within families increased significantly, from 3.067 to 3.342, about 8.96%. Therefore, compared with the situation in 2009, the

total human capital index increased due to the improvement of education, though each laborer had to raise more family members on average.

After examining the standard deviation of all these variables, we found that all the standard deviations had increased except the number of part-time laborers within a family, meaning that the distributions of these variables were spread out. Thus, it can be assumed that compared with the human capital distribution in 2009, the gaps between families with rich human capital and the families with poor human capital increased. Though the families' human capital had increased since 2009, the inequality of human capital between different families had also increased.

6.3 Natural Capital

In this study, natural capital was measured by all the land owned by family members. The total acres of the land were calculated as the natural capital index, which was a continuous variable. During our first data collection in January 2009, we asked our respondents to describe their land situation before the earthquake. Thus, the land information before and after the earthquake were obtained. The new information measured their land situation in 2012 and was collected during our second round of fieldwork in the summer of 2012. Consequently, the land information actually contained three waves: the pre-earthquake situation, 2009 information, and 2012 data. The lands owned by families were categorized into eight categories: irrigable, non-irrigable, orchard, forest, pond, pasture, newly developed land, and other.

Table 6.3: Natural Capital

	Mean			Standard Deviation		
	Pre-EQ	2009	2012	Pre-EQ	2009	2012

Natural capital index (acres)	0.649	0.585	1.004	0.664	0.642	2.164
irrigable	0.041	0.020	0.018	0.093	0.056	0.059
non-irrigable	0.417	0.388	0.421	0.390	0.375	1.487
orchard	0.008	0.008	0.011	0.065	0.065	0.065
woodland	0.026	0.025	0.334	0.143	0.139	1.434
pond	0.000	0.000	0.000	0.002	0.000	0.008
pasture	0.019	0.016	0.002	0.328	0.323	0.040
new developed land	0.109	0.099	0.212	0.294	0.281	0.521
others	0.029	0.029	0.005	0.188	0.188	0.078
Compared with pre-disaster in 2008, how did your land changed (2012 data)?					Frequency	Percent
	Increased				4	0.99%
	Decreased				216	53.47%
	The same				184	45.54%
Reasons for land loss	Damaged by earthquake				85	39.35%
	Used for reconstruction				58	26.85%
	Sold to government for reconstruction				24	11.11%
	Others				49	22.69%

The land data presented in the natural capital table (Table 6.3) were measured by acre. On average, the total land owned by families decreased after the earthquake, and then increased in 2012. On first look, it is very astonishing that the average land owned by each family almost doubled in 2012 compared with the data from 2009. However, a detail investigation about the types of the lands explained such confusion. In this region, only very few families had limited pond, pasture, or orchard. The irrigable and non-irrigable lands were the main kinds of land used for crop cultivation. Almost all the irrigable lands were located in the valley area or at the foot of the mountains, and they were limited flat areas fit for human habitation. The non-irrigable and newly developed lands were mainly located at the mountainside or mountaintop. Though these places were not good for human habitation, many villages had been developed here due to the scarcity of lands.

After the earthquake, some villages and households successfully moved down to the lower area and rebuilt their new houses in places that were relatively less risky. Thus, the irrigable lands kept decreased from 0.041 acres before the earthquake, to 0.020 in 2009, finally to 0.018 acres four years later. Since many households located at the mountainside or on the mountaintop moved down to the valley areas, some of the old houses or villages were redeveloped into farmland. Consequently the average non-irrigable land decreased from 0.417 acres before the earthquake, to 0.388 acres in 2009, and finally to 0.421 acres in 2012. Similar to the non-irrigable land, some families planted fruit trees on their old building lots when they had new houses elsewhere, and thus, the orchard area increased slightly in 2012.

The major contribution to the land increase was from woodland. The earthquake had little effect on the forest owned by these families, but the average value almost increased 15 times in 2012 compared with the data from 2009. Detailed information about the woodland data was examined by the authors, and we found that the large mean was mainly caused by the "outliers". More than 80% of these 415 households had no woodlands, but in 2012 about 5% of them had a large area of woodlands (i.e., more than ten acres per family). Some families raised cows or sheep when they lived at the side or the top of mountains, but these pastures were abandoned after they moved down to the valley. The value of 0.002 reflects the vanishing pastureland.

In the wave II data, we had a question about the respondents' perception of their land change compared with the pre-earthquake situation. About 53.47% of them reported that their land owned decreased since the earthquake, and 45.54% said that the lands were almost the same. Only four households indicated an increase in land.

Furthermore, the reasons behind the land decrease were investigated. 39.35% of the respondents who reported a decrease of land picked the choice "damaged by the earthquake", and 37.96% of them said their land was used for reconstruction, with another 22.69% citing other reasons.

In summary, the natural capital also increased compared with the pre-earthquake situation, but land used for crop cultivation decreased. Meanwhile, the enlarged standard deviation indicated that the gap between landowners also increased.

6.4 Physical Capital

The houses and producer facilities owned by families were considered as the physical capital components in this study and were used as the physical capital index. For buildings, the construction materials, number and size of rooms, utilization purpose of rooms, and estimated value of houses, were investigated. According to the building materials, houses in this area can be categorized into four categories: grass & mud, wood & mud, wood & brick, and concrete. For the first data collection in 2009, the same information regarding their houses before the earthquake was also obtained through the retrospection of our respondents. Thus, the housing related data actually reflected the situation at three time periods: before the earthquake, eight months after the earthquake, and about four years later. There were three reconstruction options for residents in this area which also reflected the degree of housing damage from the earthquake: demolish & reconstruct program, repair program, minor damage & none of the above. The information regarding which of the aforementioned programs they were in was also obtained.

In terms of producer goods or fixed assets within families, a list of 18 items covering all the possible tools of production and large equipment owned by families in

this area was generated according to literature, local newspapers, and suggestions from local residents. Since the livelihood-related physical assets were the concern in this study, the consumer-oriented products (e.g., TVs) were not included in our fixed assets list. In addition, livestock (e.g., cattle, donkeys) were also considered to be fixed assets in the list, because they were mainly used as production tools by families in this area. The current values of these items were estimated by our respondents and were used for the final analysis. However, it should be noted that the housing related data had three waves, whereas the fixed assets data only had two waves. Finally, the sum of housing values and fixed assets values were used as the physical capital index.

$$\text{Physical capital index} = \sum(house\ values, \sum_{1}^{18}(estimated\ fixed\ assets\ value)) \qquad 6.3$$

Table 6.4: Physical Capital

	Mean			Standard Deviation		
	Pre-EQ	2009	2012	Pre-EQ	2009	2012
Physical capital index		39697.14	139968.9		38404.35	116210.5
Estimated House value(RMB)	48155.93	34417.3	133921.3	44030.12	37525.67	115664.1
Fixed assets value(RMB)		5279.83	6047.568		8047.30	10272.96
House space(m^2)	115.87	84.89	142.78	62.491	64.31	85.86
Material type	Pre-EQ Total(m^2)		2009 Total(m^2)		2012 Total(m^2)	
Grass & Mud	5428		4040		550	
Wood & Mud	23616		16500		14754	
Wood & Brick	14120		10630		14732	
Concrete	4920		4060		29218	
Material types(Living)	Pre-EQ Total(m^2)		2009 Total(m^2)		2012 Total(m^2)	
Grass & Mud	120		40		20	
Wood & Mud	21576		15200		14024	

Wood & Brick	13240	10070	13672
Concrete	4640	3680	28178
House reconstruction program		Frequency	Percent
Damaged and reconstructed		283	68.19%
Mildly damaged and repaired		116	27.95%
Minor damage		16	3.86%
Total		415	100%

The physical capital index, measured by the estimated value of houses and producer goods, increased from 39,697.14 in the early recovery period to 139,968.9 in 2012 on average. However, this increase was mainly attributed to the value of houses because the estimated value of houses displayed a similar pattern of improvement, increasing from 34,417.3 in 2009 to 133,921.3 four years later. The estimated value of fixed assets did not improve a lot in the disaster recovery process.

The habitation condition had a big improvement in the recovery process regardless of the category of building materials or from the perspective of the housing size and estimated values. Before the earthquake struck this area, each family had about 115.87 m^2 for habitation. This number decreased to 84.89 m^2 after the earthquake, and then climbed back up to 142.78 m^2 in 2012. The average house value estimated by our respondents was 48,155.93 Yuan before the earthquake. This value decreased to 34,417.3 after the earthquake, but increased sharply to 133,921.3 in the summer of 2012. The building construction materials also reflected this improvement. Before the earthquake, only 4,920 m^2 of total houses in our sample were built with concrete, but this number increased significantly to 29,218 m^2 in the year of 2012. For the most vulnerable houses that were built by grass & mud, the total size decreased from 5,428 m^2 before the earthquake to 550 m^2 in 2012. Since cottages and barns had been counted as rooms during our data collection, a variable that captured the utilization purpose of each room was used. It can be seen that almost no family used

grass & mud as their main habitation rooms (living room/bedroom) materials in 2012. Before the earthquake, wood & mud type houses were the most common buildings in this area, with wood & brick houses ranked second, grass & mud ranked third, and concrete houses as the least common type. However, after the reconstruction in 2012, concrete became the most common building material. The wood & brick houses maintained a similar proportion, whereas the wood & mud and grass & mud houses decreased significantly.

Out of all of the 415 households, 68.19% of them had severely damaged houses and participated in the reconstruction program that was supported by government. Another 27.95% had chosen the government's housing repair program because they thought their houses were mildly damaged by the earthquake. Only 4.1% of participants reported that their houses were minimally damaged, and they did not participate in any government housing recovery program.

In conclusion, the physical capital had increased significantly during the reconstruction period. The housing condition had improved from all aspects, including in construction materials, estimated values, and size. The estimated value of fixed assets also increased slightly, though not as much as the estimated house value. Besides the mean value of these indicators, it should be noted that the standard deviation of all these indicators had increased, indicating that the inequality of physical capital had increased in the recovery process.

6.5 Social Capital: Changes and Patterns

Social capital was measured in three dimensions in this study: the participation in formal organizations, the degree of social support, and the social cohesion and trust culture within communities. In this section, the changes and patterns of the social

capital in each dimension are first presented, followed by a presentation and discussion of the composited social capital index and sub-indicators.

6.5.1 Organization Participation

In order to capture the respondents' participation in formal organizations, we generalized a list of twelve possible organizations within the area based on our prior literature review and field trip. Afterward, we inquired about our respondents' membership within the following twelve organizations: the Communist Party (local branches), the Communist Youth League (local branches), community watch guards, the Women Association, the Workers Union, Village Autonomous Committee, community voluntary organizations, the elders association, religious organizations, recreation/hobby based organizations, agriculture producer cooperation, or other NGOs/NPOs. Three variables were used to measure the participation in organizations. The first variable was a dummy variable representing whether or not the participant was a member of one of these organizations. A second question was used to capture their activity degree, with a final question related to their leadership position within these organizations. The activity degree was divided into two categories, "not active" or "active", with a score of "one" designated to the "not active" response and a score of "two" designated to the "active" choice. A similar method was used for the leadership measurement. Afterward, the product of the three variables was calculated as each family member's organization participation score, ranging from zero to four. Finally, the sum of the family members' organization participation score was used as the organization participation indicator of each household.

The organization participation before the earthquake was also collected through the retrospection of the respondents in our first questionnaire survey. Thus,

the final data obtained actually revealed the organizational participation condition in three time periods: before the earthquake, soon after the earthquake, and four years after the earthquake.

Table 6.5 Participation in Organizations

	Pre-earthquake		2009		Year 2012	
Number of family members in organizations	Freq.	Percent	Freq.	Percent	Freq.	Percent
None	286	68.92	257	61.93	212	51.08
One	81	19.52	86	20.72	102	24.58
Two	35	8.43	47	11.33	57	13.73
Three or more	13	3.13	25	6.02	44	10.6
Leader position						
None	394	94.94	397	95.66	395	95.18
One	21	5.06	18	4.34	20	4.82
Active members						
None	291	70.12	298	71.81	273	65.78
One	77	18.55	72	17.35	101	24.34
Two	34	8.19	32	7.71	30	7.23
Three or more	13	3.13	13	3.13	11	2.65
Total	415	100	415	100	415	100

The frequency distribution and proportion of the organizational participation are reported in Table 6.5. Overall, the participation in formal organizations displays an increasing pattern since the disaster, with more families reporting organization membership since the earthquake. Leadership and activity within these organizations had a slight decrease after the disaster, however, this trend stopped and recovered in the long run. Before the earthquake, about 31.08% of the 415 families in our sample had family members in organizations. This number increased to 38.07% after the earthquake at the beginning of 2009, and then rose to 48.92% in 2012. For the families who had members involved in formal organizations, most of them only had

one family member involved, with very few reporting three or more. The change patterns of the three kinds of families (family with one member, family with two members, or family with three or more members in organizations) were similar with the overall change pattern of the number of families that had organization affiliation, both of which kept a stable increase since the earthquake. For the families that had membership within organizations, 21 of the families possessed a leadership position in the organizations before the earthquake, 18 of them still had a leadership position eight months after the disaster, and 20 had a leadership position about four years later. Of the 415 families, about 29.88% of them reported that they had at least one family member active in the organizations. This percentage changed to 28.19% in January 2009, and then increased even further to 34.22% in 2012.

Another issue I want to point out is that the development of formal organizations has been very poor in rural China. In our sample, only four kinds of organizations were reported among the respondents, though we had proposed twelve possible local organizations. Two of the reported organizations were political-related (the Communist Party and the Communist Youth League), and the other two were faith-based organizations (Buddhism and Christian).

6.5.2 Social Support

The question "If your family were in difficulty, where could you get help?" was used to capture the degree of social support. Nine possible sources were proposed according to prior studies about social support and social capital in China. The five scale Likert measurements were used, with the values from one to five indicating "definitely cannot get help," "maybe cannot get help," "not sure, ""may get help," and "definitely can get help," respectively. The average rates of these questions are

reported in Table 6.6. Principal-component factor analysis method was used to explore the clustered attributes of these nine questions, and the factor loadings, as well as the unique variances after an orthogonal varimax (Kaiser off) rotation. The results are represented in the Table 6.7.

Table 6.6 Social Support Scores by Sources

Social Support	Year 2009		Year 2012	
	Mean	Std. Dev.	Mean	Std. Dev.
Friends	3.84	1.15	3.87	1.32
Neighbors	3.83	1.09	3.94	1.28
Close relatives like children/parents	2.60	2.34	3.34	2.18
Other relativities	3.88	1.08	4.27	1.08
Village committee	**2.80**	1.24	**2.73**	1.40
Town government	**2.54**	1.16	**2.11**	1.15
Banks	**2.27**	1.16	**2.17**	1.23
Local financial organizations	**2.31**	1.19	**2.04**	1.08
Others	1.55	1.43	2.24	1.08
Question: "If your family were in difficulties, where can you get help?" Answers: 1 "definitely cannot get help", 2 "maybe cannot get help", 3 "not sure", 4 "may get help", 5 "definitely can get help".				

The mean values indicate clearly that people can receive more support from formal organizations like the village committee, local town government, banks, and other local financial organizations at the beginning period of the recovery process compared with four years later. In contrast, the informal support from friends, neighbors, and relatives could provide more support during relatively normal times, at least from the perception of our respondents. Overall, the informal social support scores were higher than the formal support scores not only in crisis, but also during normal times. Such differences reveal the fact that the main social support for people in rural China comes from their informal social networks rather than established

organizations. However, when most of the personal social networks were impacted after catastrophes, formal organizations could play a more important role in helping people than in normal times. However, these supports were still lower than the assistance from informal personal networks.

Table 6.7 Factor Loadings and Unique Variances of Social Support Sources

	Year 2009				Year 2012		
Variable	Factor 1	Factor 2	Factor 3	Uniqueness	Factor 1	Factor 2	Uniqueness
Friends	**0.84**	0.11	0.08	0.27	**0.84**	0.05	0.30
Neighbors	**0.85**	0.18	0.04	0.24	**0.87**	0.03	0.24
Close relatives like children/parents	0.19	0.12	**0.67**	0.51	**0.40**	-0.08	0.84
Other relatives	**0.73**	0.02	0.16	0.44	**0.79**	-0.03	0.37
Village committee	0.41	**0.58**	-0.02	0.50	**0.48**	0.39	0.62
Town government	0.28	**0.75**	0.03	0.36	0.13	**0.69**	0.51
Banks	0.04	**0.90**	0.13	0.18	0.00	**0.89**	0.21
Local financial organizations	0.05	**0.87**	0.08	0.23	-0.01	**0.90**	0.20
Others	0.06	0.12	**0.81**	0.32	0.02	**0.47**	0.78
Method: Principal component factors analysis; Rotation: orthogonal varimax (Kaiser off) Cumulative proportion: 0.6604 (Year 2009); 0.5476 (Year 2012)							

The factor analysis results revealed the differences in social support factor loading patterns at the beginning of recovery in 2009 and three years later in 2012. For the 2012 data, the Stata software kept two main component factors that could explain about 54.76% of the variance. However, for the 2009 data, three factors were retained after the principal component factor analysis, and the cumulative explanation power of the three factors was 0.6604. It is clear that friends, neighbors, and other relatives were clustered as the informal support factor, and town government, banks, as well as other

local financial organizations were grouped as the formal support sources in both waves of data. The village committee swung between the informal factor and formal factor. During the early recovery period, it loaded more on the formal support, but during normal times in 2012, it was perceived more as an informal support source. Unlike the situation during normal time when close relatives like children and parents were weighted similar as other informal supports, it came out as a separate factor with others (e.g., volunteers) in the data of 2009, eight months after the catastrophe. Most of the "others" were reported as volunteers here. This result indicates that during crisis or emergencies, close relatives or family members could provide special social support to disaster survivors, and this support was different from other informal supports or formal assistances. Also, survivors always held gratitude for volunteers, especially after they had experienced such tragedy. Volunteers were perceived as close as intimate relatives, not only because "other" and "close relatives" were grouped together, but also because they had a similar mean value in 2009 (the average value of the others was 2.64 if the "not applicable" data were excluded).

In addition, the information about new outsiders who were helpful to the respondents was examined. In the 2012 data, 60 of the 415 households reported that they knew some helpful outsiders during their disaster recovery process, and 111 families said that they connected with more new people outside of local communities after the disaster in the 2009 data. More than 50% of these helpers were volunteers. The second share of these helpers was reconstruction partners from other provinces, coordinated and deployed through the coordination of the central government. The last kind of helper was government officials who were natives of these areas. One open question was used to collect information about the activities and help from these

supporters, and the answers were coded using an inductive strategy. Codes included: 1) Mental health/psychological issues related consultation services; 2) Voluntary behaviors like debris removal, housing/infrastructure/utility restorations; 3) Donations including both cash and materials support; 4) Public education and knowledge (both disaster and policy related) outreach.

In conclusion, residents in rural China generally had two kinds of social support systems, one from informal social networks like friends, neighbors, and relatives, and the other from formal organizations, especially local governments. Due to a lack of grassroots organizations, and a relatively low level of trust in local government officials (Han *et al.,* 2011), the informal social support system played a more important role than the formal social support system during the recovery process. However, the informal social network could provide less support at the beginning of the recovery period than during normal times, because most of their social networks were locally based and also severely impacted by the catastrophe event. On the contrary, the limited support from formal organizations, especially from government agencies, increased during emergencies as compared to normal times.

6.5.3 Social Cohesion

Table 6.8 Social Cohesion Culture within Community

	Year 2009		Year 2012	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
1. If you need help, most of people in this village would help you;	3.79	0.82	4.09	0.80
2. If you sacrificed for the public goods, other villagers will support you;	3.57	0.88	4.09	0.86
3. Most of the people in this village can be	3.69	0.70	3.83	0.66

trusted;				
4. If someone need money for emergency, most of people would lend to him/her;	3.54	0.78	3.65	0.75
5. If you had children, you would ask your neighbors to take care of them when you're not available;	3.53	0.90	4.00	0.75
6. If your family had a wedding or funeral, most of the villagers would come to help	4.25	0.69	4.61	0.60
Question: How do you agree with the following statements? Answers: 1. Totally disagree, 2. Disagree, 3. No opinion, 4. Agree, 5. Totally agree				

The social cohesion and solidarity culture was measured based on the agreement rates to six statements used in this study. Similar with the measure of social support, the answers to these six statements used a Likert scale ranging from one to five, representing "totally disagree" to "totally agree," respectively. As shown in Table 6.8, all the mean values of the six rates had increased from 2009 to 2012, suggesting that the social cohesion and solidarity culture improved during the disaster recovery process from the beginning of 2009 to the summer of 2012. Meanwhile, all the standard deviations in 2012 were smaller than the standard deviations in 2009, indicating that people's consent with these statements were more homogeneous in 2012 than in the early recovery period.

Table 6.9 Community Cohesion and Solidarity: Factor Loadings and Uniqueness

	Year 2009		Year 2012		
Variable	Factor	Uniqueness	Factor 1	Factor 2	Uniqueness
1. If you need help, most of people in this village would help you;	0.76	0.43	0.73	0.24	0.41
2. If you sacrificed for the public goods, other villagers will support you;	0.69	0.53	0.85	-0.04	0.27
3. Most of the people in this village can be trusted;	0.78	0.39	0.45	**0.49**	0.56
4. If someone need money for emergency,	0.69	0.52	0.00	**0.93**	0.14

most of people would lend to him/her;					
5. If you had children, you would ask your neighbors to take care of them when you're not available;	0.52	0.73	0.60	0.16	0.61
6. If your family had a wedding or funeral, most of the villagers would come to help	0.55	0.70	0.68	0.01	0.54
Method: Principal component factors analysis; Rotation: orthogonal varimax (Kaiser off) Cumulative proportion: 0.4504 (Year 2009); 0.5781 (Year 2012)					

Additionally, the principal component factors analysis was used to explore the group dimensions of these six statements. The factor loadings and uniqueness values after an orthogonal varimax rotation are reported in Table 6.9. Only one factor was generated from the first dataset in 2009, and two factors were retained in the data from 2012. The finance-related statement was separated from the others. Furthermore, the trust-related statement had similar loadings in both factors in the analysis using the 2012 data. In a more secular, materialistic, and undeveloped society like rural China, people may value money more than their time or labor, because money should be a relatively more scarce resource. For example, it is not difficult to ask villagers to contribute their labor or time for public affairs, but it is difficult to collect cash for public goods. Also, it is known that the Chinese have a culture of savings, but this attitude toward money changed for a while among the disaster survivors after the tragedy, with people valuing the quality of life and value of family more than ever. Like some people said, "Life is unpredictable, what is the meaning of savings for us if we died in the earthquake?" One interesting story we heard from several people during our first and second visits to the disaster-impacted area was that the sale of luxury cars increased sharply after the earthquake. A significant number of rich people bought new cars and went traveling in the wake of the catastrophe. These changes in people's attitudes are reflected in our data. When life went back to normal in 2012, people

started to think about their future and started to treat financial issues more seriously, especially after they spent almost all their savings on their new houses or were indebted because of reconstruction.

In summary, the data from this study indicates that the social cohesion culture within communities increased significantly after the disaster. Not only the overall rated scores had improved, but also the inequality among different members had decreased. During emergencies or immediately after disasters, people treated finance, trust, labor, among other variables, more similarly than in normal times. With the recovery process eventually reverting back to normal status, the financial and trust related cohesion culture was separated out subconsciously from other social cohesion influencing factors.

6.5.4 Social Capital Index Construction

The social capital index was generated by the aggregation of the organization membership score, average social support score, and the community cohesion score presented above (Equation 6.4). The organization membership/participation indicator of a family was the sum of all of the family members' organization participation. For each family member, the organization membership indicator was the product of their leadership (had a lead position, 1 or 2), activity (active or not, 1 or 2), and membership (0 or 1) within an organization. Thus, the minimum of each family member's organization membership would be zero if he/she did not participate in any organization, and the maximum value would be four (1*2*2). The social support indicator was the average support scores from the nine social support sources presented in Table 6.6. The social support indicator was divided into two sub-indicators, formal support and informal support, according to the factor analysis.

Similarly, the mean of the social cohesion and solidarity culture scores from Table 6.8 was used as the community cohesion indicator. This indicator was then split into two sub-indicators: the labor related social cohesion indicator and money related cohesion indicator.

$$\text{Social capital index} = \sum\left(Organization\ participation(leadership * activity * membership), \overline{social\ support\ score}, \overline{community\ cohesion\ socre}\right) \quad 6.4$$

Table 6.10 Social Capital Index and Sub-indicators

Variable	Mean			Std. Dev.	
	2009	2012	change rate	2009	2012
Social capital index	7.796	8.519	9.27%	2.292	2.291
Organization indicator	1.188	1.506	26.77%	2.013	2.012
Social support indicator	2.879	2.968	3.09%	0.744	0.704
Formal support	2.330	2.257	-3.12%	0.863	0.819
Informal support	3.539	3.857	8.99%	0.987	1.060
Maximum money borrow	11734.700	18235.420	55.40%	21547.790	30699.160
Cohesion indicator	3.729	4.045	8.47%	0.529	0.465
Labor-cohesion	3.766	4.124	9.51%	0.540	0.510
Money-cohesion	3.542	3.646	2.93%	0.776	0.750

Overall, the social capital had increased during the disaster recovery processes. The average social capital index had increased about 9.27%, and the standard deviation of the social capital index actually decreased, indicating that the social capital inequality among the earthquake survivors had narrowed from the very beginning of the recovery period in 2009 to the summer of 2012. Meanwhile, the three social capital sub-indicators displayed a similar trend to the overall social capital index, with the average value increasing while the gap decreased. This trend remained even

after splitting the social support indicator into formal support and informal support, or divided the cohesion indicator into labor-related cohesion and money-related cohesion.

6.6 Livelihood Assets Indexes Standardization and Comparison

In the analysis above, the financial capital index and physical capital index were presented as the estimated value of Chinese Yuan, the natural capital was reported as the acres of land, and separate scores were used for the human capital index and social capital index. Obviously, such a diverse format made a comprehensive comparison between different capital indexes difficult. Therefore, a formula from UNDP's Human Development Index technical notes (UNDP, 2010) was adopted as the standardization method for the following comparison. For each capital index, we used the absolute value subtracted from the minimum value, and then divided the difference between the maximum and the minimum value. This resulted in the actual capital values being transferred into a standardized score between zero and one[12].

$$\text{Dimension index} = \frac{actual\ value - minimum\ value}{maximum\ value - minimum\ value} \qquad 6.5$$

The average value of the standardized livelihood capital indexes are presented in Figure 6.1 and the standard deviations are reported in Figure 6.2. On average, the livelihood capitals owned by these households showed improvement in all five dimensions in 2012 compared with the 2009 data. Physical capital had the largest improvement, with the average score increasing almost four-fold, from 0.0785 in 2009

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[12] In the data analysis practice of this study, the 99% value was used as the maximum value due to an outlier concern that may make the index too small.

to 0.2779 in 2012. Human capital had the least increase, from 0.403 in 2009 to 0.4343 in 2012. Second from last was social capital, which increased about ten percent. The financial capital and natural capital saw a medium boost. The financial score increased from 0.2178 to 0.2631 and the natural capital score arrived at 0.1402 from 0.0873.

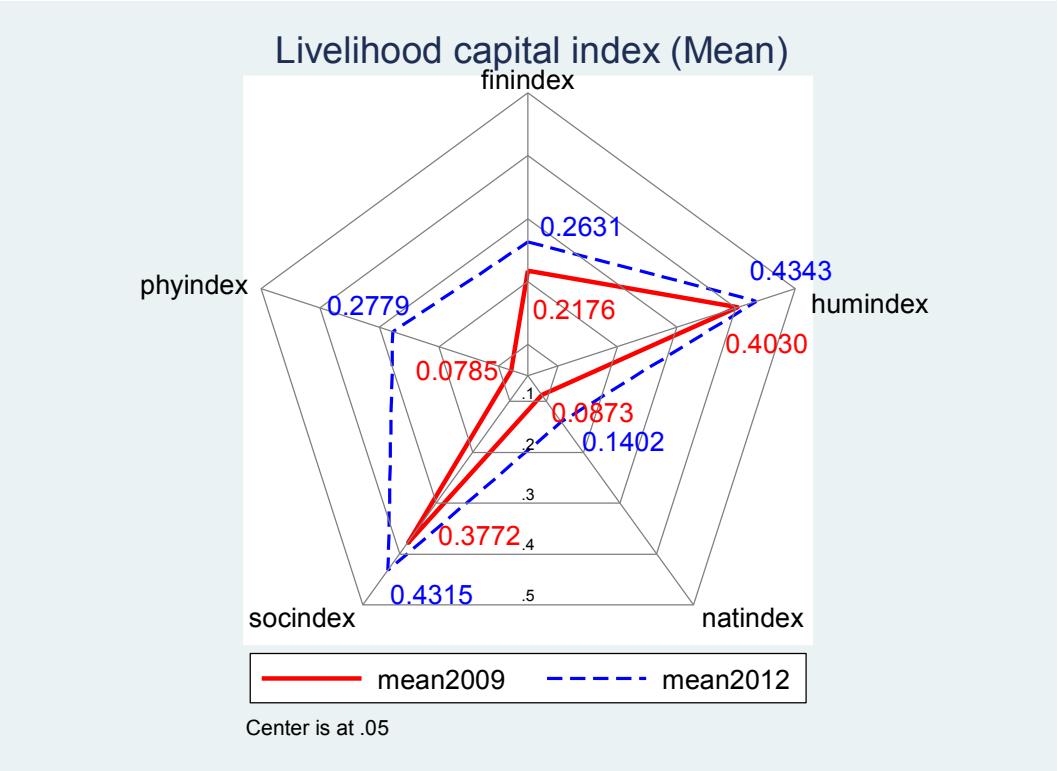

Figure 6.1 Livelihood Capital Index (Mean)

Previous studies had shown that inequality would increase after disasters, and this conclusion also proved to be true in this study; all the livelihood assets indexes' standard deviation increased with the exception of the social capital index. The economic-related gap had the largest increase; the physical capital index's standard

deviation almost tripled since 2009, and the financial capital index's standard deviation also rose from 0.1914 in 2009 to 0.2470 in 2012. Meanwhile, the standard deviation of the natural capital index also increased about 2.5 times. The standard deviation of the human capital index also had a small increase, from 0.1899 to 0.2157. However, the social capital index's standard deviation did not increase during the recovery process, in contrast, it had a slight decrease from 0.1723 in 2009 to 0.1722 in 2012. Though the economic inequality increased within these households, gaps in social support and bonding within these families became smaller during the recovery process.

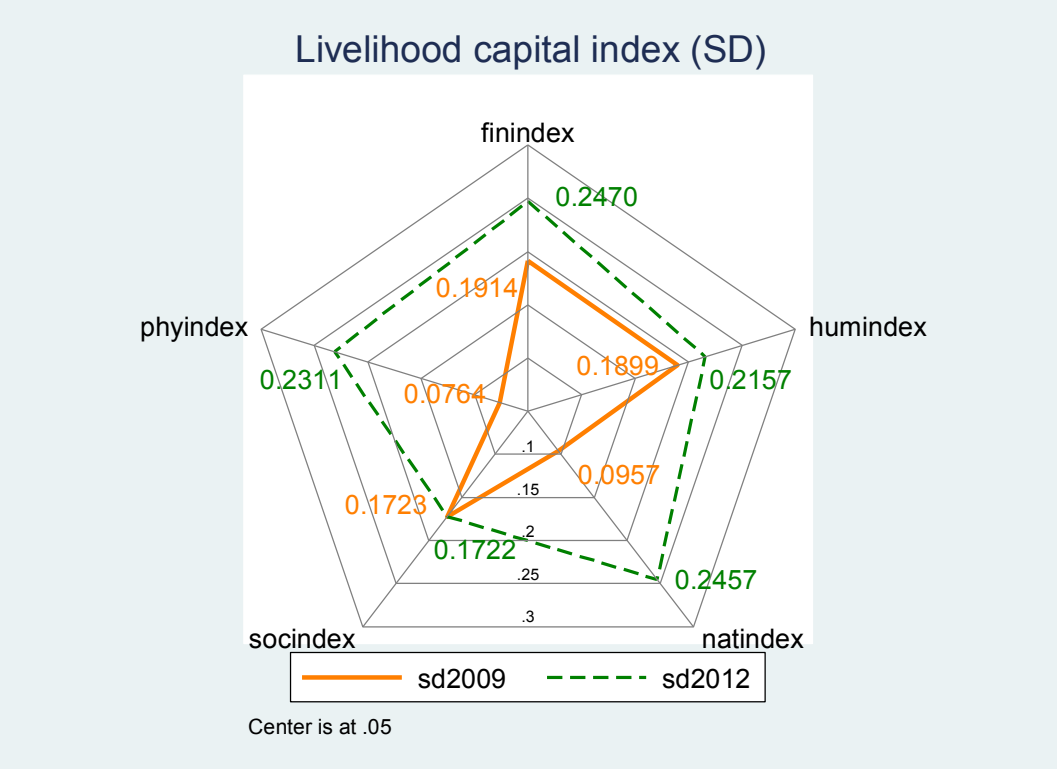

Figure 6.2 Livelihood Capital Index (Standard Deviation)

6.7 Summary

In this chapter, the survey results of the five livelihood assets (financial, human, physical, natural, and social) were reported sequentially and a standardized livelihood assets indexes was constructed. Comparisons of the results between the situation in the early recovery period (i.e., 2009) and three years later (i.e., 2012) were made using descriptive analysis, including mean values and standard deviations. Additionally, the distributions of some other related variables were reported. Finally, principal factor analysis method was adopted in the social capital analysis section for exploring the clustered attributes of social capital.

Overall, all the livelihood assets increased in 2012 compared with the data from 2009. Physical capital, which mainly included fixed assets and house values, had the biggest improvement. Next were natural capital, which was measured by the size of land, and the financial capital, which included incomes, savings, and the available credits. The social capital and human capital indexes, which were composed from several indicators, also showed a significant increase since 2009. With the increase of these livelihood capitals, most of the standard deviations also increased with the exception of the social capital index. Though all the households had a livelihood improvement since 2009, they did not follow a similar recovery speed. Some families recovered significantly quicker compared to others. Thus, the inequality, especially in economic-related gaps among these households, increased during the recovery process. However, these economic gaps did not impair the social capital within these families. On the contrary, the social capital index gap actually decreased in 2012 compared with the situation in 2009.

Researchers have noticed that natural disasters tend to magnify the pre-disaster social trends, particularly those relating to the levels of inequality in society (Bolin &

Stanford, 1991;Morrow & Peacock, 1997;Oliver-Smith, 1990). However, from the early therapeutic/altruism community response view (Barton, 1969;Fritz & Mathewson, 1957), researchers have also noticed that disaster often produces a shift in social values and norms (Perry & Lindell, 2003). Though researchers like Dynes and Quarantelli have doubted the enduring condition of the decrease in conflict and the increase in consensus following disasters (Quarantelli & Dynes, 1977), this empirical study does provide evidence of the increase in social capital within communities after disasters, though there may be conflicts regarding the distribution of resources (Tierney, Lindell, & Perry, 2001) or distrust in local government officials (Han *et al*., 2011).

Chapter 7

HOUSING RECOVERY: THE ROLE OF SOCIAL CAPITAL AND GOVERNMENT ASSISTANCE

7.1 Introduction

Housing recovery is important because it is a basic human need. Furthermore, it constitutes the highest property losses and recovery burdens for the most part when disasters occur, like earthquakes. It can be argued that housing recovery should be one of the most well studied recovery topics in disaster literature. The terms "sheltering" and "housing" are used repeatedly in disaster studies, but they are not used clearly. Quarantelli distinguished the issue of housing after disasters into four periods: emergency sheltering, temporary sheltering, temporary housing, and permanent housing. The emergency sheltering referred to, "actual or potential disaster victims seeking quarters outside of their own permanent homes for short periods: house in many cases, overnight at most". Temporary sheltering could be used to describe the condition of people's temporary displacement into other quarters, with an expected short stay. If the move involved occupying permanent, residential facilities, the housing term should be used, The difference between temporary and permanent housing was distinguished in that the latter involved disaster survivors returning to their homes and household routines, either through having those homes rebuilt, repaired, or migration (Quarantelli, 1995). However, it should also be noted that there is no single pattern of progression through such stages. It is possible to skip phases or move back and forth among the different stages (Cole, 2003).

The measurements of housing recovery were varied in prior literature. Sometimes it was measured as housing units, or net changes of housing units, within a geographic location (Ganapati *et al.,* 2012). Other times it was explored using the repeat photography method over a long time period (Burton *et al.,* 2011). In a study conducted in Florida after Hurricane Charley of 2004, the authors examined the phases of housing recovery over time using multiple data sources like building permits, remotely sensed imagery, and property appraiser information (Rathfon *et al.*, 2012). Nevertheless, there are limitations to measuring housing recovery as the number of permanent housing units built in a timely manner, and context-specific, process- and outcome-oriented measures are needed (Ganapati, 2013). The social dimensions of housing recovery (Oliver-Smith, 1990) and perceived building recovery (Arlikatti & Andrew, 2011) should be integrated into the housing recovery research.

Therefore, the permanent housing recovery from the disaster survivors' perspective and the role of social capital, as well as the role of government housing assistance program, will be explored and discussed in this chapter. First, the housing recovery outcomes will be presented in terms of estimated value changes, living space changes, and construction materials changes, through a comparison of the two waves of data from 2009 and 2012. Next, the role of social capital in housing reconstruction will be explored using both qualitative data and quantitative models. Finally, the awareness and utilization of government housing recovery programs will be demonstrated and the role of government housing recovery assistance programs will be discussed.

7.2 Housing Recovery

Before the presentation of the data from my questionnaire survey, I would like to show three groups of pictures that reveal the landscape changes in three villages. The first group was a comparison of photos from FCS village, which was entirely relocated from the mountaintop to the foot of the mountain after the earthquake. The second group of pictures used was from QSP village, which was also relocated from mountainside to valley area, but was designated as a "show case" reconstruction project by local government. The third comparison is from ZTB village, which did not quite capture the opportunity of reconstruction and had to stay on the mountaintop after the catastrophe. Though these three groups of pictures were not taken at the same point, they were taken from a similar angle in order to best show the overall landscape of these villages. This kind of "repeat photography" method could be a good way to understand disaster recovery (Burton *et al.*, 2011), especially the physical recovery issue.

Figure 7.1 Village FCS: Comparison of Housing Recovery 01/2009 VS 07/2012

Figure 7.2 Village QSP: Comparison of Housing Recovery 01/2009 VS 07/2012

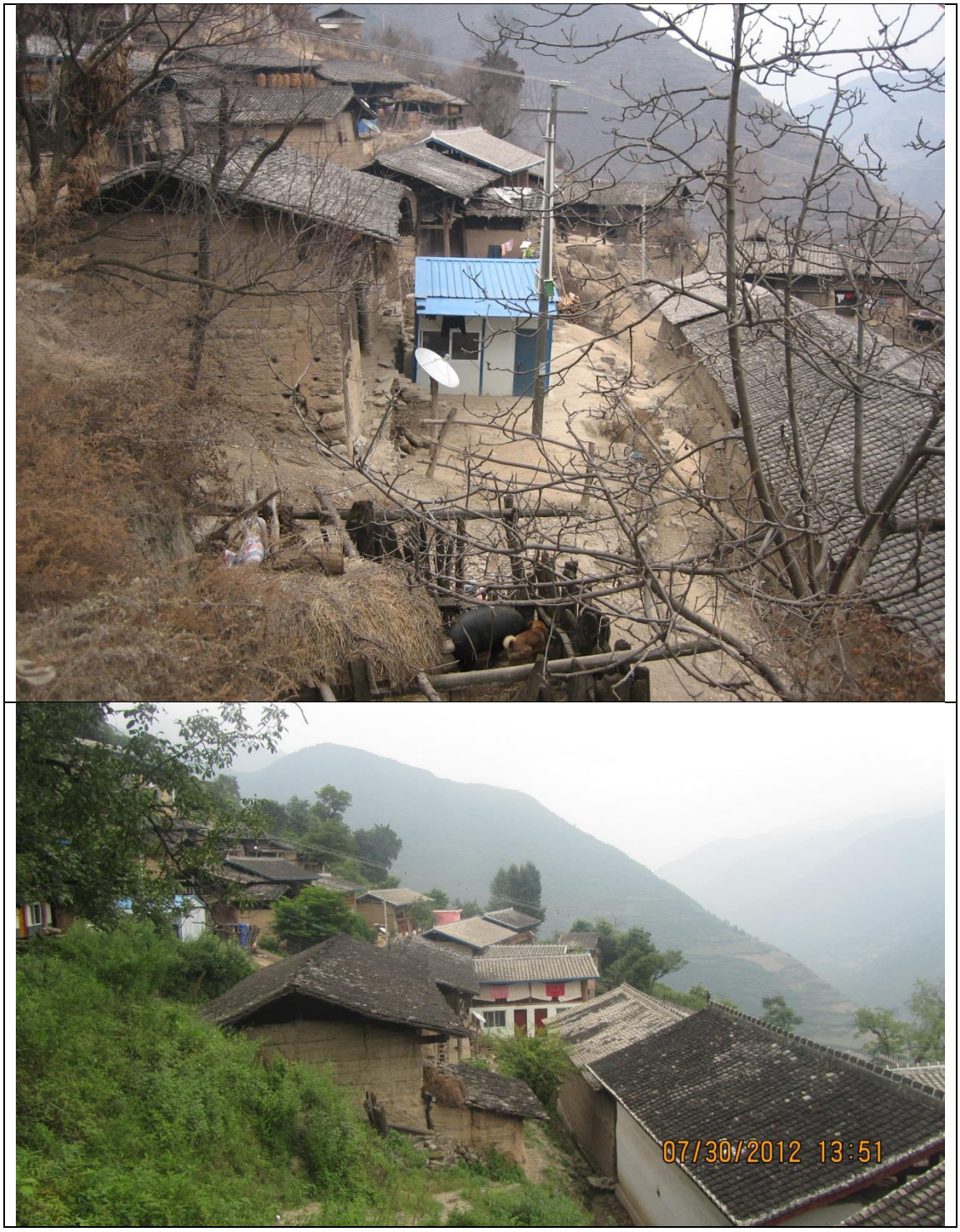

Figure 7.3 Village ZTB: Comparison of Housing Recovery 01/2009 VS 07/2012

From the pictures above we can suggest that the housing conditions have improved significantly since the earthquake. However, the improvement varied among the different communities. In the coming section, detailed information regarding housing recovery will be represented and discussed.

Table 7.1 Housing Recovery

	Mean(RMB)			Std. Dev.(RMB)		
Year	2007	2009	2012	2007	2009	2012
Physical capital (Estimated house value)	48,155.9	34,417.3	133,921.0	44,030.1	37,525.7	115,664
House space(m^2)	115.865	84.892	142.781	62.4912	64.313	85.861
Material type	Pre-EQ		2009		2012	
Grass & Mud	11.29%		11.47%		0.93%	
Wood & Mud	49.11%		46.84%		24.90%	
Wood & Brick	29.37%		30.17%		24.86%	
Concrete	10.23%		11.52%		49.31%	
Material types(Bedroom)						
Grass & Mud	0.30%		0.14%		0.04%	
Wood & Mud	54.52%		52.43%		25.09%	
Wood & Brick	33.45%		34.74%		24.46%	
Concrete	11.72%		12.69%		50.41%	
Total	100.00%		100.00%		100.00%	

The housing recovery was examined in three dimensions: estimated house values, estimated house space, and main construction structure and material types. It can be seen from Table 7.1 that the estimated house values in 2012 were almost twice as expensive as before the earthquake on average. Meanwhile, it was almost four times as expensive as the value after the earthquake in the beginning of 2009. Also, the living space in houses saw a big improvement after the disaster. Compared with the

housing space before the earthquake, each family's living space increased about 23% in 2012, from 115.865 m^2 to 142.781 m^2. With the increase in mean values, the standard deviations of estimated housing values and housing spaces also increased, indicating that the inequality of housing among different families had grown in the recovery process. From the building materials utilization perspective, there was a great shift from traditional wood & mud type housing to concrete. Before the earthquake, about half of the houses in our surveyed area were constructed by wood & mud, but this kind of building material only accounted for about a quarter of the total construction in 2012. In contrast, the concrete structure houses became the main type in 2012, with this kind of material sharing a percentage of 49.31 in all the constructions about four years after the earthquake. If only bedrooms and living rooms were taken into consideration instead of using all kinds of rooms (e.g., cottages), the shift from vulnerable materials (e.g., grass & mud) to relatively earthquake resilient materials (e.g., concrete) were even more significant.

Table 7.2 Reconstruction Methods and Housing Cost

Reconstruction or Repair?	Freq.	Percent
Severely damaged, reconstructed	283	68.19
Mild damaged, repaired	116	27.95
Minor damaged, neither reconstructed nor repaired	16	3.86
Total	415	100
If reconstruction, finished yet?	Freq.	Percent
Unfinished	76	26.86
Finished	207	73.14
Total	283	100
If finished, when?	Freq.	Percent
2009	67	32.37
2010	40	19.32

2011	78	37.68
2012	22	10.63
Total	207	100
If unfinished, expected when?	Freq.	Percent
Later in 2012	10	13.16
2013-2015	39	51.32
After 2015	27	35.53
Total	76	100
Reconstruction Methods	Freq.	Percent
Self-driven	212	74.91
One-to-One aid	28	9.89
One-to-One plus Self-driven	38	13.43
Others aid	5	1.77
Relocated or not?	Freq.	Percent
Reconstructed at the original place	155	54.77
Local Relocated	115	40.64
Relocated to another place	13	4.59
Total	283	100
Variable	Mean (RMB)	Std. Dev.(RMB)
Investment on housing	116,732.00	81,162.77
Construction Materials	73,217.50	70,581.30
Labor	26,803.46	23,249.57
Land	5,601.64	22,962.69
Where the reconstruction spending came from?	Mean	Std. Dev.
Savings	33,121.96	44,484.04
Cash Borrowed from friends/relatives	29,015.05	41,543.11
Loan from banks	18,627.24	18,222.77
Government aids	17,046.98	13,448.00
Others	306.86	2,176.05

Table 7.2 reports the overall housing reconstruction methods and cost related questions. Overall, 68.19% of our 415 respondents preferred to reconstruct their houses after the earthquake, 27.95% of them chose the repair program, and only 3.86% of them did not apply for any government assistance program due to minor damage in the earthquake. Of the 283 families in the reconstruction program, 73.14% of them had finished their housing reconstruction already at the time of data collection, and

26.86% of them had not finished the entire rebuilding project yet. Of the 207 households that had completely finished their rebuilding activities, 32.37% of them finished their housing reconstruction in 2009, 19.32% of them finished in 2010, 37.68% finished in 2011, and the remaining 10.63% finished their housing replacement in the first half of 2012. For the 76 families that had not finished their entire reconstruction project, 13.16% of them expected to finish their project in the year of 2012, 51.32% of them believed that they could finish in the next two years, and the other 35.53% had a relative pessimistic view and estimated their rebuilding deadline as 2015 or later.

In terms of reconstruction methods, 74.91% of the families that reconstructed their houses adopted a self-driven or owner-driven model; the family built the houses themselves, either through a contractor or their kin and friends, with a financial subsidy from government. 9.89% of them obtained their basic houses through the government coordinated one-to-one (counterpart) assistance program with very limited cost. For some families, they would upgrade the basic house obtained through the one-to-one assistance program if they had the capacity to do so. These families accounted for about 13.43% of all the housing reconstruction families. The last five families reconstructed their houses through other methods, with the help of other organizations or individuals. In terms of relocation, about 54.77% of the families demolished their old houses and rebuilt new houses at the original place. 40.64% of our respondents relocated to another place locally, mainly away from the high-risk mountaintop or mountainside area to lower places, with very few households moving to another place within the county.

On average, each family invested about 116,732 Yuan into their houses, which was a little bit less than the estimated mean value of their houses as 133,921.0 in 2012.

The cost of construction materials was 73,217.50 Yuan on average, and shared about 62.72% of the total housing investment. The labor cost accounted for about 22.96% of the total housing investment, and the land cost accounted for 4.37%. Meanwhile, the sources of the investment on housing were investigated. 33,121.96 came from prior savings, accounting for about 28.37%. The second major source was support from friends or relatives. This support was 29,015.05 Yuan on average, and accounted for about 24.85% of the total investment. The third source came from the government-endorsed loans from banks, and the fourth major source was the government subsidy, which had almost the same amount as the loans from banks.

7.3 The Role of Social Capital in Housing Recovery

From our field trip and participant observations, we found that social capital could play an important role in housing recovery in some villages. Meanwhile, the results in Table 7.2 also indicate that the informal personal social network was the second source of funding for housing recovery, excluding family savings. Consequently, the role of social capital on housing recovery was explored and discussed in this section using both interview and questionnaire survey data.

Social capital mainly facilitated housing recovery in two ways: as an informal financial resource and/or labor-service pool. As shown in the financial resources of housing investment question in Table 7.2, the informal social network, that included friends and relatives/extended family members, was the second largest financial resource for housing investment. However, we also noticed that though the informal social network could be an important financial pool for emergencies, such an effect may be weakened in a catastrophic event where most of the social network is locally embedded, causing almost all the “nodes” in this network to also be severely impacted

by the catastrophic event. As many interviewees indicated in the in-depth interviews "*Yes, our relatives could provide help during normal times, but they were also impacted by the earthquake, and they had to rebuild their houses as well. Thus, it could be inappropriate to ask them to lend money to us*.[13]"

Another role of social capital in housing recovery was that it could provide a "free" labor force for reconstruction work, but this phenomenon did not universally exist in all villages we visited. In some more traditional villages, the phenomenon of extended family members, friends, and neighbors coming together for housing reconstruction was more common. They would arrange a schedule among several families, and thus they could provide labor to help each other during housing rebuilding, especially on labor-intensive days (e.g., roofing). In some more market-oriented villages, people would prefer to contract their housing reconstruction work or hire laborers for rebuilding. Since there was a great labor need during the recovery process, especially during the peak time of the reconstruction, the labor cost increased significantly. The salary for the same kind of workers almost doubled compared with the situation before the earthquake. Similar to other rural places in China, one of the most important income resources for families were their salaries as temporary workers in cities, and the most common jobs for rural migrant workers, especially for males, were as construction workers. Therefore, many people, especially the ones who had been working as construction workers, had some kind of knowledge and skills of housing reconstruction. As one of our respondents said

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[13] Interview QSP_2009_villager2

"It's not difficult to organize a construction team in our village, most of young people know how to build a house, and we almost have all the necessary skilled workers. En…, maybe not all the skilled workers, we cannot deal with some high technology issues[14]"

The estimated house value was used as the indicator of housing recovery outcome, and the social capital index constructed in chapter six was used as the measurement of social capital in this analysis. The relationship between house value and social capital are represented in the graphs below. Overall, there was a positive correlation between house value and social capital, in both the data from 2009 and from 2012. My assumption here was that the social capital in 2009 may affect the housing recovery process, and thus it could also have an influence on the house value in 2012. Consequently, the relationship between house value in 2012 and social capital in 2009 was explored in Figure 7.6, and it indicated a positive but weak trend.

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[14] Interview JCC_2012_villager4

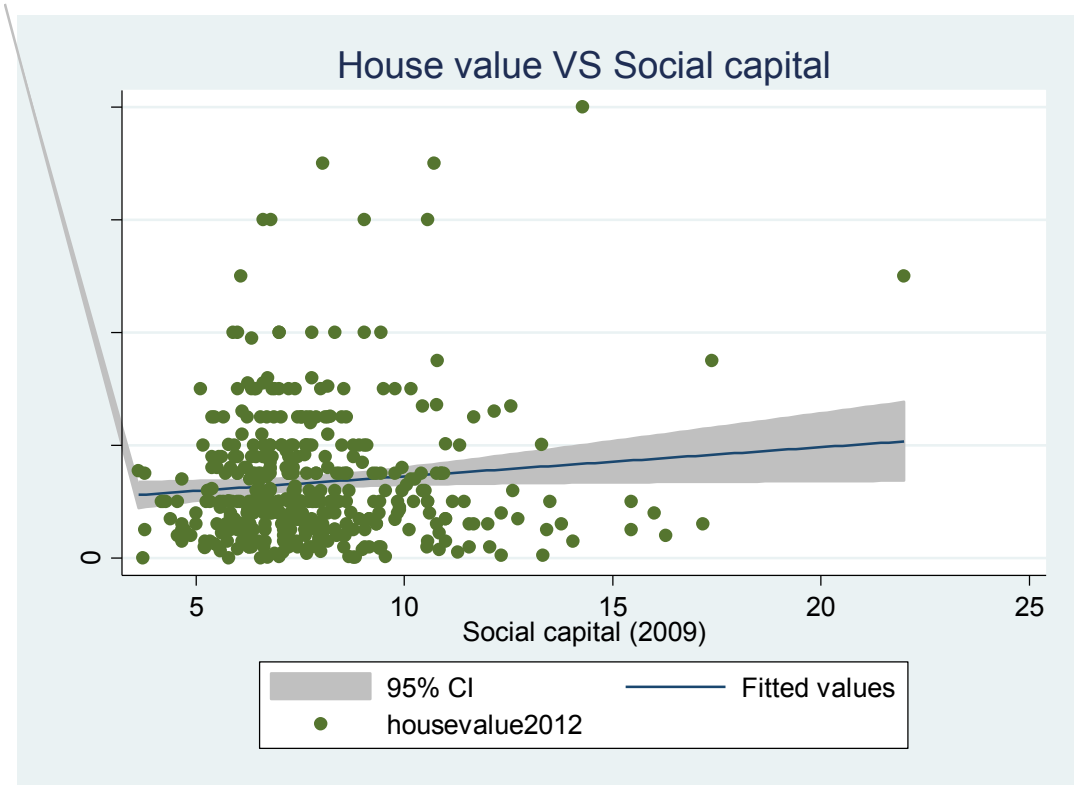

Figure 7.4 House Value (2012) and Social Capital (2009)

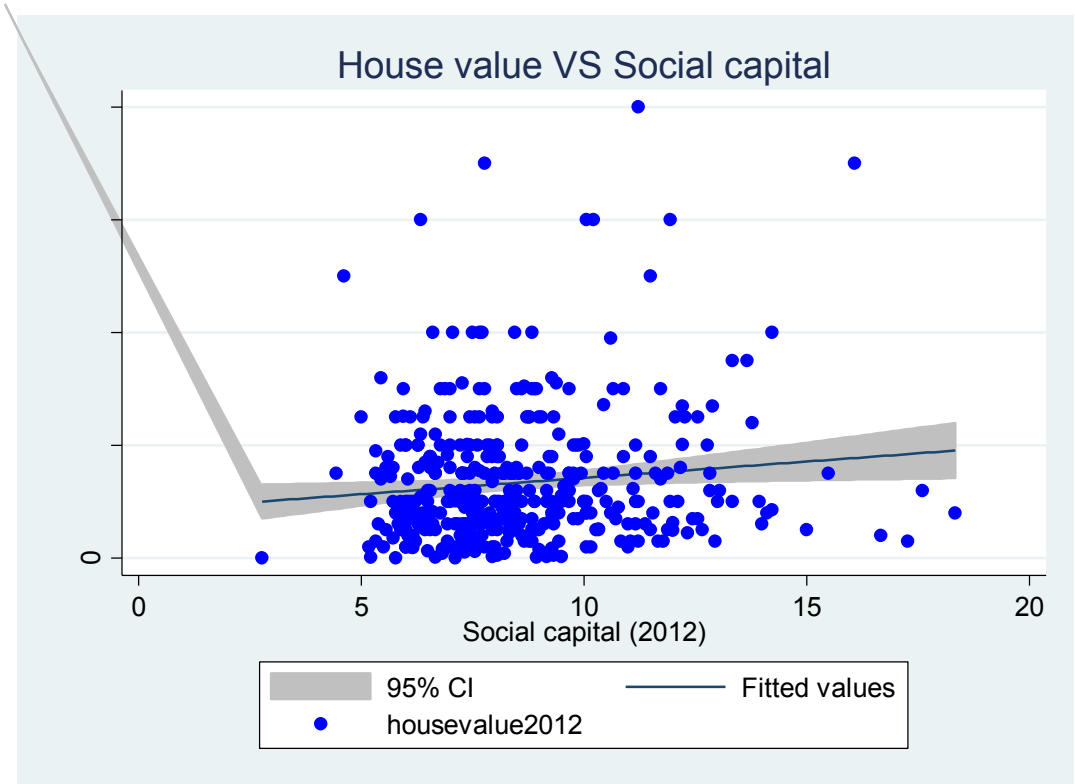

Figure 7.5 House Value (2012) and Social Capital (2012)

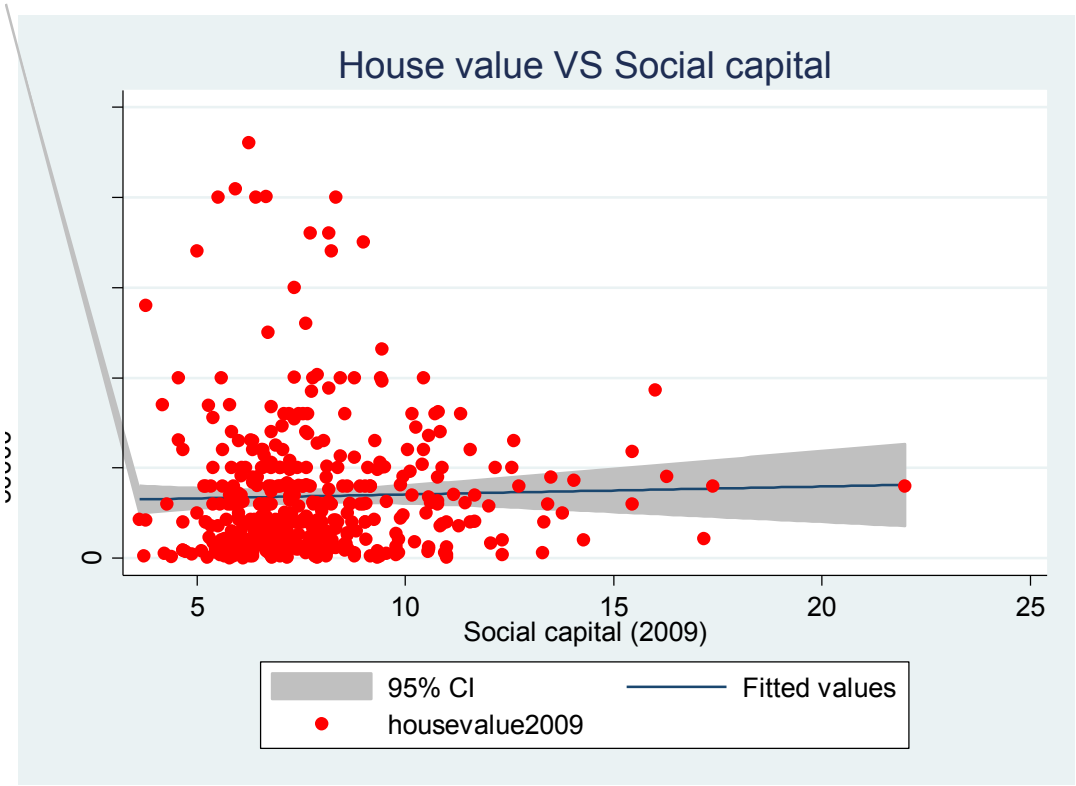

Figure 7.6 House Value (2009) and Social Capital (2009)

Several models were constructed to explore the effect of social capital on housing recovery. The assumption here was that all other four livelihood capitals (social capital, human capital, nature capital and financial capital) would also affect housing recovery. Hence, the estimated housing value was used as the dependent variable, the social capital index was used as the independent variable, and the control variables included the natural capital, human capital, financial capital (income), disaster damage degree, and community variable. Income was used instead of financial capital because financial capital a credit component, which represented the maximum amount of money people could borrow, and thus had a correlation with the

social capital variable. Whether a family participated in the housing reconstruction program, repair program, or neither, was used as the indicator of disaster damage degree in the analysis. Meanwhile, the village variable was used as the community indicator that controlled the community differences. The means and standard deviations of these influencing factors are reported in Table 7.3. The average income in 2009 was 18,914.51 Yuan and increased to 22,254.84 Yuan in 2012. The natural capital increased from 0.585 in 2009 to 0.940 in 2012. The human capital index also increased from 2.326 to 2.487. The standard deviation of income, natural capital, and human capital also increased, as seen with an increase in mean values among these variables. However, the social capital variable's standard deviation decreased. The three sub-indicators of social capital were also reported because they were used to explore the effects of social capital's dimensions in this study.

Table 7.3 Influencing Factors of Housing Recovery

Variable	Mean		Std. Dev.	
	2009	2012	2009	2012
Social capital	7.796	8.519	2.292	2.291
Organization membership	1.188	1.506	2.013	2.012
Social support	2.879	2.968	0.744	0.704
Community cohesion	3.729	4.044	0.528	0.465
Income (RMB)	18914.51	22254.84	13017.17	18059.99
Natural capital (Acre)	0.585	0.940	0.642	1.645
Human capital	2.326	2.487	0.978	1.111

As shown in Table 7.4, first, only the cross-sectional data from 2012 was used in the regression model (1), then the livelihood capitals in 2009 were also included in the model (2) because I assumed the housing recovery outcome would be affected not

only by the current livelihood assets, but also by prior livelihood capitals. In the model (3), the three sub-indicators of social capital were used instead of the social capital index. Though the social capital had a positive effect overall, this effect was not significant in all of the models. Even the three sub-indicators used were not statistically significant. In contrast, income and human capital had significant positive effects on the estimated housing values.

Table 7.4 The Effects of Social Capital on Estimated Housing Values

Models	Model(1)	Model(2)	Model(3)
Dependent variable: Estimated House value in 2012			
Social2012	1083.93	-183.27	
Org2012			741.07
Support2012			5301.84
Cohesion2012			-21913.89*
Nature2012	-3321.85	-3786.48	-3903.29
Human2012	10895.35**	7050.91	7156.46
Income2012	2.04***	1.99***	1.87***
Social2009		2532.65	
Org2009			1749.79
Support2009			7910.12
Cohesion2009			-297.91
Nature2009		4716.30	6121.48
Human2009		4131.85	3413.81
Income2009		0.64	0.67*
N	415	415	415
Prob>F	0.000	0.000	0.000
Overall R-sq	0.3723	0.3809	0.3888
legend: * p<.1; ** p<.05; *** p<.01			

Following the analysis above, the dependent variable was changed as the percent of labor cost sharing to the total housing investment. The independent and control variables were kept the same (Table 7.5). Thus, the sample used in the

regression only included the families who had reconstructed their houses. As expected, the more social capital one family had, the less labor investment sharing in housing recovery was reported. However, this effect was not found to be significant.

Table 7.5 The Effects of Social Capital on Labor Cost in Housing Recovery

Variable	laborsh1	laborsh2	laborsh3
Dependent variable: Labor cost/estimated housing value			
social2009	-0.003	-0.002	
nature2009	-0.006	0.004	-0.005
human2009	0.003	0.002	0.003
income2009	-0.000**	-0.000*	-0.000*
social2012		-0.003	
nature2012		-0.003	-0.004
human2012		0.010	0.011
income2012		-0.000**	-0.000*
org2009			-0.000
org2012			-0.004
support2009			-0.008
support2012			-0.001
trust2009			-0.006
trust2012			0.005
N	255	255	255
Prob>F	0.0275	0.0021	0.0010
Overall R-sq	0.0582	0.0702	0.0715
legend: * p<.1; ** p<.05; *** p<.01			

For families who chose housing reconstruction, there was a dummy variable representing the housing reconstruction status in 2012: finished rebuilding or not finished with rebuilding. This variable was adopted as the dependent variable for further analysis using logit models, and the odds ratios are presented in Table 7.6. The first logit model only used the livelihood capitals in 2009, the second logit model adopted the livelihood capitals in 2012 instead, and the third logit model included both.

Finally the three sub-indicators of social capital were used instead of the social capital index in the fourth model. Similar to the results from prior analysis in regression models, the effect of social capital was not significant and quite weak overall.

Table 7.6 The Effects of Social Capital on Reconstruction Result

Variables	Logit1	Logit2	Logit3	Logit4
Dependent variable: Finished reconstruction or not				
social2009	1.044		1.031	
human2009	1.163		1.168	1.112
income2009	1.000		1.000	1.000
nature2009	1.497		1.488	1.358
social2012		1.094	1.085	
human2012		0.875	0.801	0.790
income2012		1.000***	1.000***	1.000***
nature2012		1.032	1.012	1.006
org2009				1.026
org2012				1.126
support2009				1.228
support2012				0.784
trust2009				0.704
trust2012				1.507
N	283			
Prob > chi2	0.0019	0.0003	0.0006	0.0021
Pseudo R2	0.0952	0.1194	0.1300	0.1431
legend: * p<.1; ** p<.05; *** p<.01				

Instead of using the housing values in 2012 as the dependent variable, information from both 2009 and 2012 were used as panel data for analysis. The results of fixed and random models are presented in Table 7.7. The fixed2 and random2 models used the three sub-indicators as a replacement for the social capital index. The Hausman test indicated that the fixed models were preferred. Again we see that even

using both waves of data for longitudinal analysis, social capital's effect on housing recovery was not consistent or significant.

Table 7.7 The Effects of Social Capital on Housing Value

Models	Fixed1	Random1	Fixed2	Random2
Dependent variable: Estimated house value				
Social capital	-88.681	938.544		
Organization			2415.695	1568.066
Cohesion			-6473.814	-5641.670
Support			-7141.046	687.262
Natural	731.075	-720.894	638.390	-670.678
Human	5517.428	7130.484**	5736.838	6849.941**
Financial(Income)	1.154***	1.354***	1.158***	1.341***
N	830	830	830	830
Prob>F	0.000	0.000	0.000	0.000
Overall R-sq	0.3141	0.4147	0.3125	0.4160
Hausman test: Fixed1 VS Random1 Prob>chi2 =0.9429 Hausman text: Fixed2 VS Random2 Prob>chi2 =0.6682				
legend: * p<.1; ** p<.05; *** p<.01				

Overall, the effects of social capital on housing recovery were neither consistent nor statistically significant in this analysis, regardless of whether the comprehensive social capital index or the three social capital sub-indicators were used. In the models above, I used several indicators (estimated housing value in 2012, labor cost share in housing investment, finished with rebuilding or not, both estimated value in 2009 and 2012) of housing recovery, yet none of the models revealed that social capital had a positive significant effect on housing recovery. On the contrary, income was a consistent and significant facilitator of housing recovery. Human capital also exhibited a positive, significant effect in most of the models. Though we observed some free-labor support and mutual labor sharing activities during housing

reconstruction in some villages, the effect may not be generalized. Meanwhile, the role of informal social networks as a financial support resource was weakened after catastrophic events, because most of this network was locally embedded, resulting in most of the network being impacted by the earthquake.

7.4 The Role of Government Aid

There were mainly two kinds of initiative assistance programs from the central government after the earthquake. The first one was the Temporary Living Stipend (TLS) program, which lasted for three months and provided 300 Yuan and 0.5 kg of groceries each to disaster survivors in rural areas and unemployed disaster victims in cities. After the first three months, an additional three-month TLS program was launched that provided 200 Yuan per person to orphans, elderly without descendants, the disabled, families with deceased family members, or those severely injured in the earthquake. According to our field trip observations and interviews with disaster survivors, this comprehensive TLS program played an important role in helping disaster survivors maintain a life and fabricating a sense of confidence and cohesion after the tragedy. In January 2009, about eight months after the earthquake event, many families we visited were still depending on the temporary living stipend for everyday expenditure.

Another major assistance program from the government was the Housing Recovery (HR) program, which facilitated the housing reconstruction in rural areas. Each family could choose a reconstruction or repair program depending on the degree of damages to their houses and their willingness to rebuild. If they preferred to rebuild their houses, the old and damaged houses would be demolished and the government would provide 20,000 cash assistance (10,000 from central government and 10,000

from province government) and ten to thirty thousand in interest free loans that would last for three years to each family, based on the needs of the different applicants and evaluations from banks. As an alternative choice, the repair assistance method provided three thousand cash for housing maintenance for each family. In practice, the eligibility for either program was mainly based on the request of each applicant and not strictly distinguished, because local officials mainly determined evaluation of the disaster impact. Besides the damages from the earthquake, another major reason for people to choose different programs was their economic calculation; if they wanted to participate in the reconstruction program, they had to totally destroy and demolish their current houses and build a new building. Consequently, some poor families preferred the repair program due to the lack of ability to reconstruct a new building. However, most rich families preferred the reconstruction program because they perceived this as an opportunity for bettering their housing conditions.

Besides these two comprehensively covered assistance programs from the government, most of the temporary sheltering (e.g., tents) and mass care were also provided by the government in China after the earthquake, though nongovernmental organizations like the Red Cross and other international organizations also played an important role.

Since almost all utilities, like electricity and phone/internet services, are provided by state owned businesses, the restoration of these services were also mainly coordinated by the government. Meanwhile, infrastructure and public transportation systems were also repaired through the funding of government.

The restoration of public service facilities like hospitals, schools, and recreation facilities were mainly conducted by the One-to-One assistance program,

which was coordinated by the Chinese central government. This One-to-One assistance program had a long tradition in the PR China period, however it was mainly adopted in the development area during normal times, and only occasionally used after disasters. Generally speaking, this One-to-One assistance program works as follows: one entity in a relatively more developed area would have a counterpart in another less developed area. This entity could be a public university, a public hospital, city government or province government etc. Once an assistance bonding was established between the two entities, the developed one would help the less developed entity through the investment of finance, technic and/or human power. Thus, this program had three main characteristics: first, it was mainly adopted in the public sector or in public-owned organizations; second, this partnership was more about one-way aid rather than mutual aid; third, there were strong political motivations behind this program, except for the basic motivation of helping others. After this earthquake, the severely impact areas were divided by counties and designated to 20 of the more developed provinces/big cities from the east part of China. Thus, each province would help the recovery of one county, on average, that was severely impacted by the disaster. In most situations, the assistance provider would take care of the public facilities' reconstruction, like hospitals and schools. In addition, some rural villages were also picked up as political showcases, where the assistance providers would rebuild new houses and give them to local survivors through the local government. Based on the criteria of solely meeting people's basic needs, this housing program only had three rooms per house, thus many recipients preferred to expand the house after they received it if they could afford the cost. However, it should be noted that the majority of the disaster survivors had to rebuild their houses on their own with the

housing financial support from the HR program. In our survey, 74.91% of the respondents reconstructed their houses by themselves. 9.89% obtained their new houses through the One-to-One assistance program, with another 13.43% also receiving houses from the One-to-One program, but improving and expanding upon their house after receiving it. Finally, the remaining five families that participated in the study got their houses with assistance from other sources.

Since the Housing Recovery program was the major assistance from government at the household level during the recovery period, the awareness and evaluation of this policy from the disaster survivors' perspective was investigated and the results are reported in Table 7.8. Of the 283 respondents who reconstructed their houses, all of them knew of the reconstruction assistance program, but only 227 of them got the entire reconstruction subsidy. An additional nine participants received part of the assistance package. One person did not answer this question, and the remaining 46 respondents did not receive this assistance because they got their new houses through the One-to-One assistance program. Of the 279 respondents who answered the question "Do you know the reconstruction loan program?", 91.76% of them gave a positive response, and another 8.24% answered no. About 75.58% of the 258 respondents applied and got the government supported interest-free loan program. Another 9.3% applied, but were rejected by the banks. Finally, 15.12% of them did not apply for the loan program at all. We also inquired about the mortgage method for the people who had applied to the interest free loan program; 172 of our respondents answered this question, seven of them used their savings as a guarantee, 17 of them had stable full-time jobs and used their salary as assurance, and only two of them used their other real estate. Most of them got the loan with the help of their informal social

networks; 33.72% of the 172 respondents were endorsed by their neighbors, relatives, and/or friends for the loan. An additional 51.16% got the loan because their village bonded and applied for the loan together, with every family as both a benefiter and guarantor. For the people who chose to repair instead of replace their houses, almost all of them knew the repair aid program, but only 88.7% of them received all of the subsidies. An additional seven participants received part of the aid, and six of them did not receive any because they later changed their program into the reconstruction program.

Table 7.8 Awareness of Government Housing Assistance Policies

Knew the reconstruction aid from government?	Freq.	Percent
Yes	283	100
Total	283	100
Got the reconstruction aid	Freq.	Percent
Yes, all of them	227	80.5
Yes, part of them	9	3.19
No	46	16.31
Total	282	100
Knew the reconstruction loan program?	Freq.	Percent
Yes	256	91.76
No	23	8.24
Total	279	100
Applied the loan program?	Freq.	Percent
Yes, and approved	195	75.58
Yes, but not approved	24	9.3
Didn't apply	39	15.12
Total	258	100
Mortgage method	Percent	Cum.
Savings guaranteed	7	4.07
Salary guaranteed	17	9.88

Real estate guaranteed	2	1.16
Neighbors/Relatives guaranteed	58	33.72
Village bonded together	88	51.16
Total	172	100
Knew Repair subsidies?	Percent	Cum.
Yes	115	99.14
No	1	0.86
Total	116	100
Got the repair subsidies?	Freq.	Percent
Yes, all of them	102	88.7
Yes, but only part of them	7	6.09
No	6	5.22
Total	115	100

The results in Table 7.2 exhibit that government subsidies and government-endorsed loans from banks were one of the major financial resources for housing reconstruction. On average, each family got 18,627.24 Yuan from government subsidies and 17,046.98 Yuan from interest-free loans, with the two together accounting for the largest proportion of reconstruction financial resources (about 36.36%). Hence, the comprehensive coverage of this housing recovery program from the government played a positive and effective role for housing recovery after the earthquake.

Two of the nine villages in our sample were selected as the exemplary One-to-One recovery showcases by local government. The new communities and houses were designed and rebuilt by a One-to-One program provider from Shenzhen. Basically, each family could get an undecorated house that had three rooms and 60 m^2 in total for free. The only thing they had to pay for in order to receive the new house was the land cost. However, such building structures, based on the apartment standard in cities, could not match the needs of families in rural areas. Thus, most of the families redeveloped and expanded their houses after receiving them. Since the families in the

exemplary villages could save on the materials and labor costs, they had more money for improving and furbishing their houses. On average, each family in the showcase villages had 171.88 m^2 for living, compared to 134.38 m^2 for households from other villages. Furthermore, the average estimated house value in the showcase villages was 192,100 in 2012, and the same indicator for households in other villages was 117,118. Overall, the households in the special exemplary program had a much better living condition and recovery result compared with their counterparts in other villages.

7.5 Summary

Overall, most of the 2008 earthquake survivors had recovered from the impact of the earthquake, at least from a housing recovery perspective. The housing structure had a big improvement, and many families now have a comparably more earthquake resilient house post-disaster. However, some poor families were still experiencing the difficulty of rebuilding. Thus, the challenges for these families did not resolve yet. Meanwhile, the housing reconstruction put many families into indebtedness due to loans from banks or money borrowed from informal social networks, adding a burden on their future lives.

Prior studies indicated that social capital was the best predictor of recovery, rather than human capital or financial capital (Aldrich, 2012). However, this conclusion was not supported in this analysis, at least from the perspective of housing recovery. Though informal social networks could provide financial support and reduce labor cost through mutual aid in housing recovery, the quantitative survey data did not fully support such a statement. The social capital only had a weak, non-significant positive effect on housing recovery. On the contrary, financial capital and human capital did play important roles in housing reconstruction.

The comprehensive coverage of the Temporary Living Stipend program and Housing Recovery program from the government played an important role for assisting disaster survivors after the catastrophe. These two programs not only provided tangible physical assistance, but also delivered a sense of confidence to the disaster survivors. Families in the exemplary recovery villages were able to benefit more from the specially selected One-to-One assistance program, but for people in other villages, the housing reconstruction mainly followed the owner-driven model.

Chapter 8

RECOVERY PERCEPTION AND DETERMINANTS

In this chapter, the perceived recovery and determinants of recovery perception are explored and discussed. The research hypotheses include:

H1. The household livelihood assets, especially physical capital, social capital, and financial status, are the significant determinants of perceived recovery. Housing reconstruction is often used as an equivalent to disaster recovery in many studies, and this is also reflected in my interviews with the disaster survivors. For example, if a family had a better (more valuable) house, the respondent would perceive a higher degree of recovery. Similarly, if a family had a higher financial status during the time period in which our research was conducted, that family would have a higher degree of recovery perception. Social capital, like social support, community cohesion, and bonding, would provide a feeling of care and support, positively affecting the respondents' perceived recovery.

H2. The individual demographic characteristics, like gender, education, ethnicity, and age, would also influence perceived recovery. For example, a more educated person may have a higher expectation of recovery. Thus, when he/she had a similar degree of recovery (e.g., housing recovery), he/she would have a lower perceived recovery compared with his or her counterparts. Consequently, the individual variables should be controlled in the analysis in order to explore the effects of livelihood assets on recovery perception.

Therefore, this chapter starts with an exhibition of the dependent variable (i.e., perceived recovery), followed by a descriptive analysis of the possible influencing factors (i.e., livelihood assets, disaster damage, individual characteristics, government policy adaptation, and community variations), and concludes by exploring the determinants of recovery perception using several regression models.

8.1 Dependent Variable: Perceived Recovery

Three related questions were used to capture the perceived recovery in this study. First, a direct subjective judgment about the recovery was obtained from the question "Overall, have you recovered from the 2008 earthquake?" The answers were divided into five categories: not recovered at all, recovered some, recovered to almost the same as the pre-earthquake situation; recovered better than pre-earthquake situation; recovered and much better than before. If the respondents preferred the three "recovered" choices, another inquiry about when they had recovered was used for more information. If the respondents chose the two "not recovered" options, the expected recovery time was asked.

The results of the perceived recovery are presented in Figure 8.1. About 69.85% of the 415 households reported that they had recovered from the 2008 earthquake about four years later. Within the families that had recovered from the disaster, 194 of them had recovered to a situation about the same as before the earthquake, 85 of them had a better life, and 11 of them had a much better situation than before the earthquake. For the families that reported "not recovered," 26 of them were not recovered at all, with the remaining 99 households indicating that they had recovered some, but not entirely. Within the 290 recovered families, about 30.7% of them recovered in 2012, one third recovered in 2011, and the rest recovered in 2010 or earlier. Within the 125

families that had not recovered from the earthquake impact, about 42.4% of them expected to recover within the next three years (in/before 2015), 50% of them reported a more pessimistic prospect (i.e., more than three years), and about 7.2% of them believed they would never recover from the disaster impact.

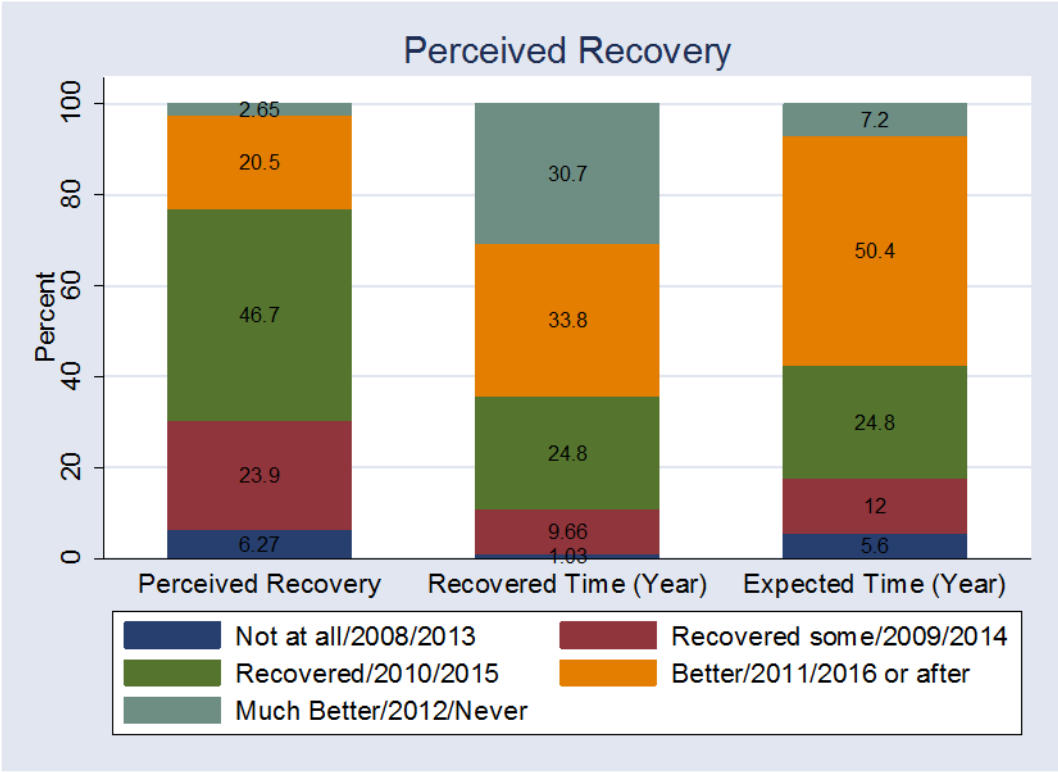

Figure 8.1 Perceived Recovery

8.2 Influence Factors: Livelihood Assets and Individual Characteristics

The five livelihood assets (social capital, financial capital[15], physical capital, human capital, and natural capital) were considered as the influencing factors of

[15] The household annual income was used as financial capital here.

perceived recovery at the household level. Additionally, individual demographic characteristics like gender, ethnicity, religion, marriage status, main job in last year, education level, and party membership were also included as potential influencing factors. Meanwhile, the disaster damage degree, which was measured by the difference in estimated housing values before and after the earthquake, was also used in the analysis. The reconstruction program variation (reconstructed, repair, or neither) was used as the indicator of government policy adaptation, and the village variable was also included as an indicator of community differences.

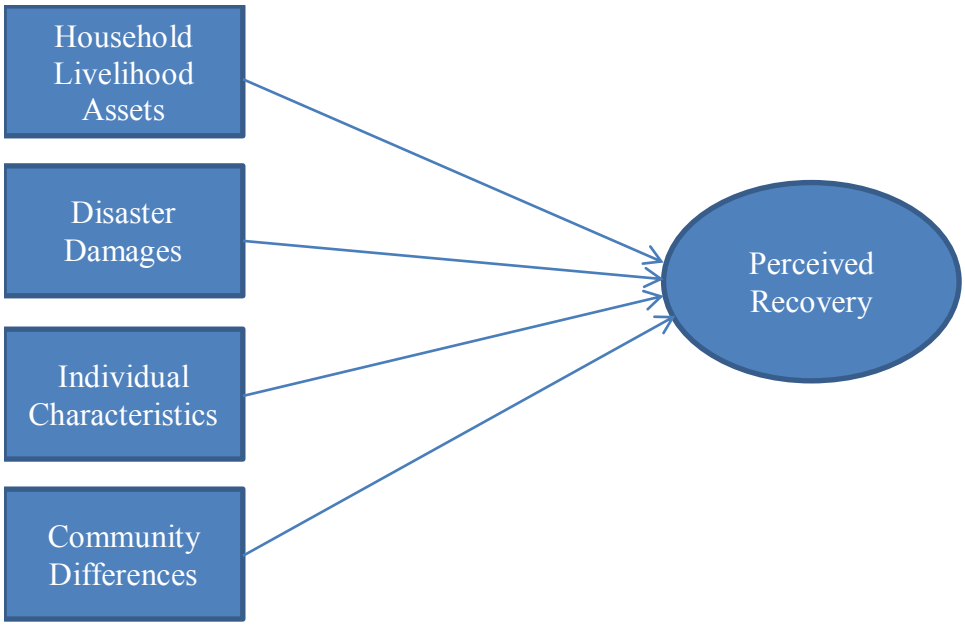

Figure 8.2 Possible Influencing Factors of Recovery Perception

Household Livelihood Capitals and Disaster Damages: The descriptive analysis of the livelihood capitals and their sub-indicators, including the mean and standard deviation, are reported in Table 8.1. Overall, all the livelihood capitals had

increased from 2009 to 2012. The social capital index increased from 7.80 to 8.52 and the financial capital indicator, which was measured by incomes, also increased from 20,449.62 RMB (adjusted by CPI) in 2009 to 22,254.84 RMB in 2012. The physical capital, measured by the sum of estimated house values and fixed assets, had increased more than three times from 39697.14 Yuan in 2009 to 139968.9 Yuan in 2012. Meanwhile, the natural capital, which was measured by the land (acres) owned by the family, and the human capital index had both also increased in the last four years.

Within the sub-indicators of the social capital, the respondents had better organization participation in 2012. Meanwhile, the social support they could receive had increased, though this increase was mainly from friends' or relatives' informal support. In contrast, formal support from formal organizations like local governments or banks had decreased from the beginning of the recovery period to 2012, about four years after the catastrophe. Another sub-indicator of social capital, the community cohesion and solidarity indicator, also had improved both from the labor-related cohesion perspective and money-related cohesion perspective. Meanwhile, the average housing damage due to the earthquake was about 15103.08 Yuan for each household with a standard deviation of 35094.85 Yuan.

With the increase of average values, the standard deviations of all the livelihood capitals had increased except for social capital. Furthermore, all the sub-indicators of social capital had a smaller standard deviation in 2012 than in 2009. This fact reveals that social capitals within these communities had not only become better, but also had become more equal, though the "physical"-related capitals' gap had widened.

Table 8.1 Independent Variables: Livelihood Capitals

Variable	Mean		Std. Dev.	
	2009	2012	2009	2012
Social capital	7.80	8.52	2.292	2.291
Organization membership	1.19	1.51	2.013	2.012
Social support	2.88	2.97	0.74	0.70
Inform support	3.54	3.86	0.99	1.06
Form support	2.33	2.26	0.86	0.82
Community cohesion	3.73	4.04	0.53	0.47
Labor related cohesion	3.77	4.12	0.54	0.51
Money related cohesion	3.54	3.65	0.78	0.75
Financial capital (Income)	20449.62	22254.84	14073.65	18059.99
Physical capital	39697.14	139968.9	38404.35	116210.5
Natural capital	0.59	0.94	0.64	1.65
Human capital	2.33	2.49	0.98	1.11
	Mean		Std. Dev.	
Disaster Damage	15103.08		35094.85	

<u>*Rebuilding Program and Individual Characteristics*</u>: The distributions of the individual characteristics that may influence perceived recovery are presented in Table 8.2. Of the 415 households, 283 of them were in the reconstruction program, which required them to demolish old buildings and construct new ones. 116 of them preferred the repair program due to mild housing damages from the earthquake, with the remaining 16 families choosing not to participate in either of the programs because they believed their houses had very minimal damages. Of the 415 respondents who answered the questionnaire, 40.72% of them were female, 17.83% of them were minorities, 10.36% of them had a religious affiliation, and 14.22% of them were members of political parties (mainly the Communist Party). In addition, 54.46% of our respondents were the head of the household and more than 90% of them were married.

Respondents with primary or middle school education levels represented the majority of our respondents, while the illiterate accounted for about 25% proportion. The remaining 10% of respondents had a high school or higher level of education. In terms of work status, 64.34% of the respondents were mainly involved in on-farm activities like crop or livestock cultivation within the last year, while the other 35.66% had spent more time doing business or occasional jobs.

Table 8.2 Control Variables: Individual Characteristics and Rebuilding Program

Variables	Contents	Freq.	Percent
Building Program	Reconstruction	283	68.19
	Repaired	116	27.95
	Minor damaged, neither repair or reconstruction	16	3.86
Gender	Female	169	40.72
	Male	246	59.28
House head	No	189	45.54
	Yes	226	54.46
Ethnicity	Minorities	74	17.83
	Han	341	82.17
Religion	No	372	89.64
	Yes	43	10.36
Marriage	Married	375	90.36
	Single	27	6.51
	Single2[16]	13	3.13
Party membership	No	356	85.78
	Yes	59	14.22
Main job last year	On-farm	267	64.34
	Off-farm	148	35.66
Education	Illiteracy	104	25.06
	Primary school	125	30.12

[16] Single due to the loss of partner (Divorce, pass away etc.)

	Middle school	142	34.22
	High school	35	8.43
	College or above	9	2.17
	Total	415	100

8.3 Livelihood Capitals by Perceived Recovery

In this section, the distribution relationship between the perceived recovery degree and the five livelihood capitals is presented.

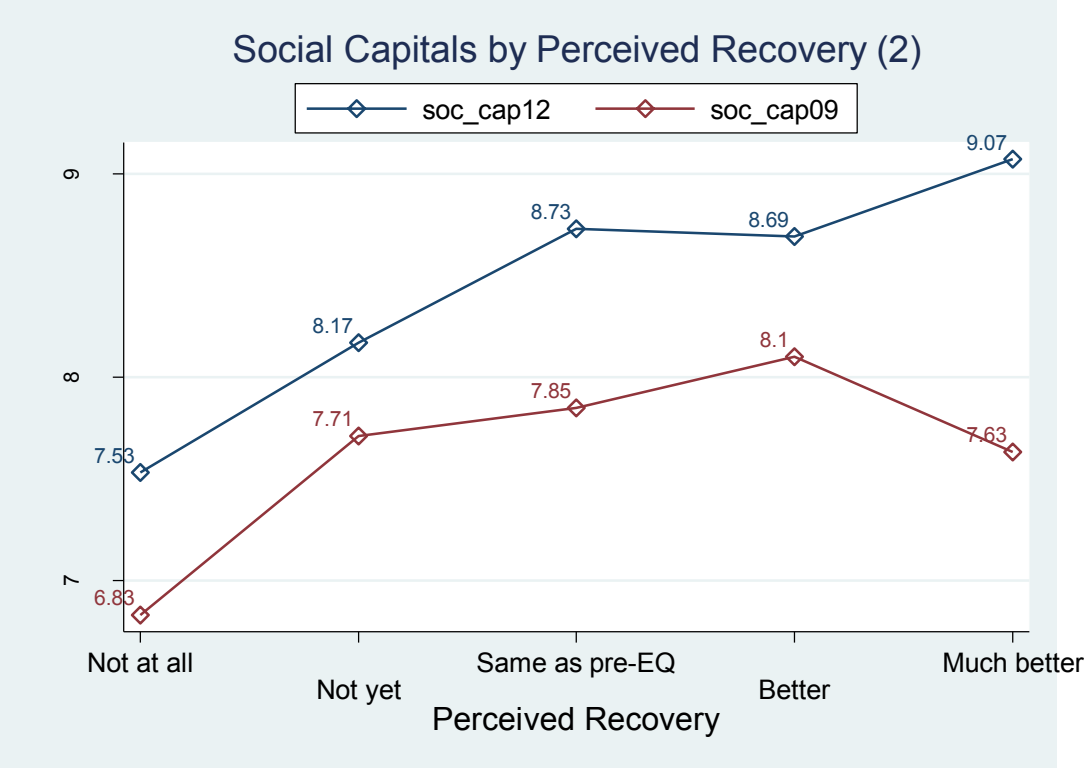

Figure 8.3 Social Capitals by Perceived Recovery

Figure 8.2 presents the relationship between social capital and perceived recovery. Overall, the families that had a higher social capital score in 2012 perceived

a higher degree of recovery, with the exception of the "a little better than pre-earthquake" group had a slightly lower social capital score than the "recovered as the same" group. However, this linear relationship pattern did not hold true between the social capital score in 2009 and the perceived recovery degree; the families that had the highest perceived recovery degree in 2012 had a relatively lower social capital score in 2009, even lower than the "not recovered" group. This pattern may indicate that recovery perception was mainly influenced by the respondent's current sense of social capital status.

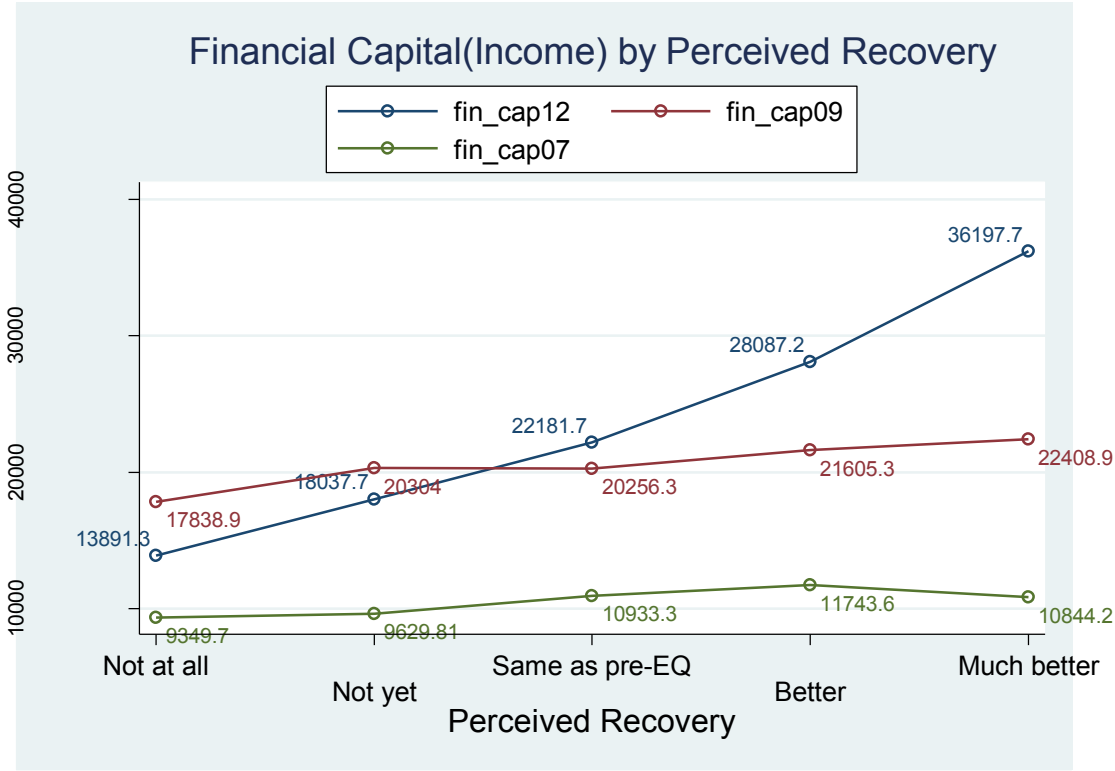

Figure 8.4 Financial Capitals by Perceived Recovery

Figure 8.3 presents the relationship between financial capital, which was measured as annual household income, and perceived recovery from the pre-earthquake data, post-earthquake data in January 2009, and the survey results from 2012. The current perceived recovery in 2012 was linearly related with the financial capital in 2012. The families that had higher incomes in 2012 perceived a higher degree of recovery, and such variation was very clear. However, this relationship had a fluctuation in both pre-earthquake 2007 and post-earthquake 2009 data. Also, the slopes of these three lines clearly indicate that the income gaps between the families that perceived "recovered better" and those that perceived "not recovered" had increased significantly.

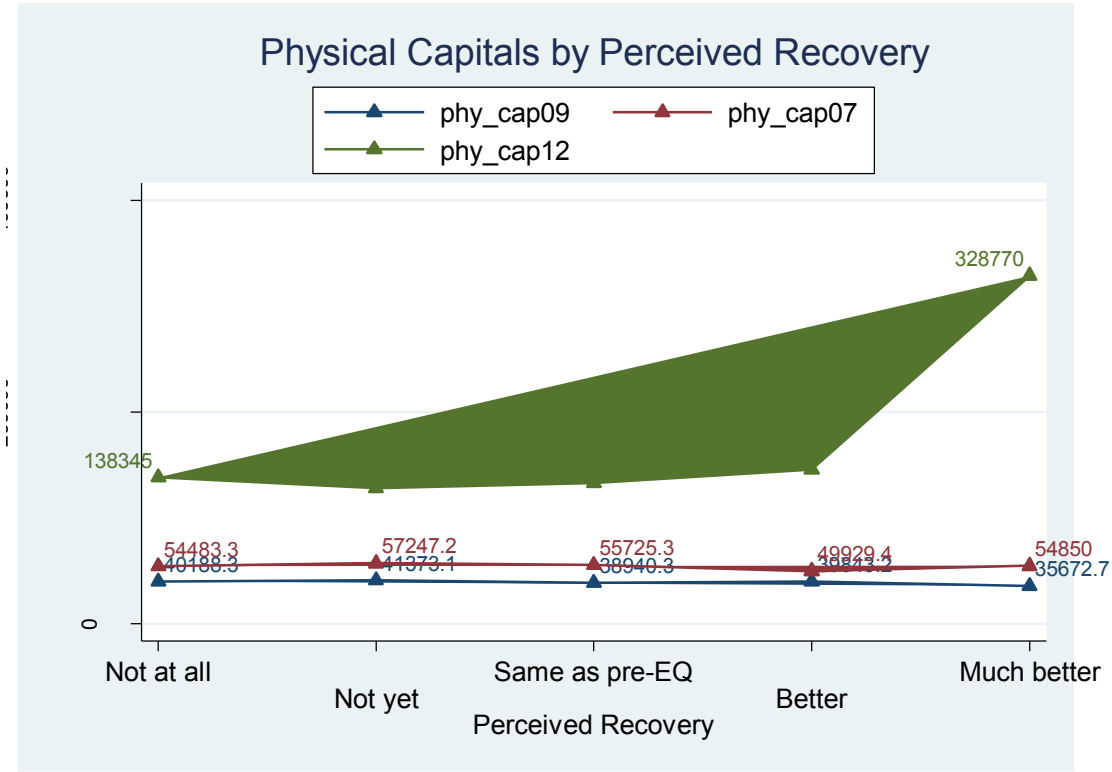

Figure 8.5 Physical Capitals by Perceived Recovery

There was no clear pattern between the physical capital and perceived recovery (Figure 8.4). For the data from 2012, the "much better" group had a significantly higher physical capital, but the differences in physical capital between the other four groups ("not recovered at all", "recovered some, not yet", "recovered, and same as pre-earthquake", "recovered, and better") were not significant. The families that perceived "recovered some, not yet" and "recovered as the same as pre-earthquake," actually had a slightly lower physical capital than the group that perceived "not recovered at all". Before the earthquake and in the early recovery period, there were little physical capital differences between the different family groups. Since the

physical capital mainly captured the estimated house values in this study, such data results indicate that there was no significant difference in sheltering conditions between the family groups. However, the families that had the highest perceived recovery degree (i.e. the richest families) invested a lot into their housing reconstruction, and thus had a much higher physical capital in 2012 compared with their counterparts.

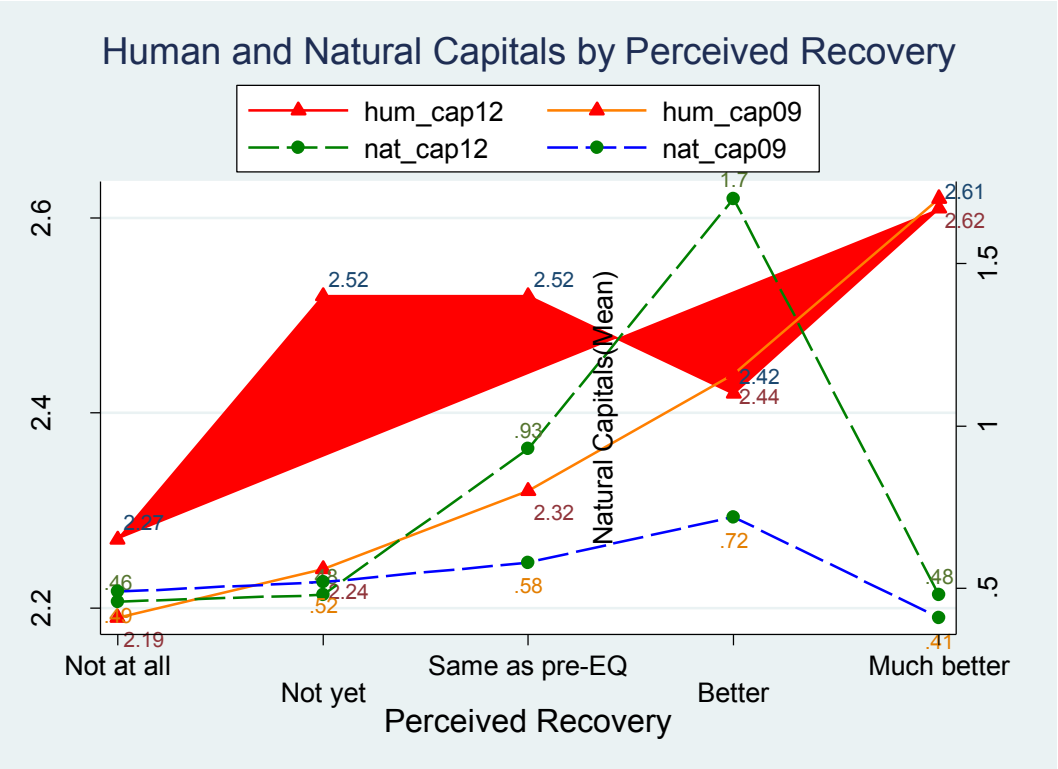

Figure 8.6 Natural and Human Capitals by Perceived Recovery

The relationship between natural capital and perceived recovery degree followed a similar pattern for both 2009 and 2012 data (Figure 8.5). The families that

had the lowest perceived recovery degree and highest perceived recovery degree actually had similar, low rates of natural capital. Among the other three middle groups, if a family had more natural capital, they would indicate a higher degree of perceived recovery. This result reveals that the families with the highest perceived recovery degree may depend predominately on off-farm livelihood strategies. For human capital (Figure 8.5), there was a positive linear relationship between the human capital scores in 2009 and the perceived recovery degree. However, there was no such pattern between the human capital scores in 2012 and the perceived recovery degree, though the families that had the highest human capital score in 2012 had the highest perceived recovery degree and the families had the lowest human capital score in 2012 had the lowest perceived recovery degree.

8.4 The Determinants of Perceived Recovery

Instead of using the five categories of recovery degrees, the perceived recovery was recoded into a dummy variable for further analysis, with one representing "recovered" and zero representing "not recovered". Since the dependent variable was a dummy variable, several logit models were constructed based on different assumptions. First, I assumed that the perceived recovery was mainly influenced by the changes in livelihood capitals (i.e., differences between capitals in 2012 and 2009), with the control of disaster damage, policy adaptation, and community differences. Consequently, the livelihood capital changes were used as the predictor variables in model one. Furthermore, it was assumed that the perceived recovery was mainly determined by current household livelihood assets. Thus, the livelihood assets in 2012 were used to predict the perceived recovery in 2012 in model two. The third model included both the livelihood assets in 2009 and 2012, because the hypothesis was that

both livelihood assets in the current year and previous year would have an impact on perceived recovery. In the fourth model, not only the livelihood assets, disaster damage, policy adaptation, and community variables were used, but individual demographic characteristics like gender, ethnicity, religion, marriage, party, main job last year, education, and age, were included. The last model used the change in livelihood assets rather than current livelihood assets, with the individual characteristics, disaster damage, policy adaptation, and community variables. The results of the five models are reported in Table 8.3.

Table 8.3 The Determinants of Perceived Recovery

Dependent Variable: Perceived Recovery (Recovered or Not)					
Variable	Logit1	Logit2	Logit3	Logit4	Logit5
Social capital change	1.083				1.057
Financial capital change	1.000+				1.000+
Human capital change	0.818				0.812
Physical capital change	1.000				1.000
Natural capital change	1.299*				1.343*
Social capital in 2012		1.124+	1.124+	1.074	
Financial capital in 2012		1.000*	1.000*	1.000*	
Human capital in 2012		0.878	0.826	0.905	
Natural capital in 2012		1.680*	1.672*	1.781*	
Physical capital in 2012		1.000	1.000	1.000	
Social capital in 2009			0.975		
Financial capital in 2009			1.000		
Human capital in 2009			1.203		
Natural capital in 2009			1.254		
Physical capital in 2009			1.000		
Disaster damage	1.000	1.000	1.000	1.000	1.000
Program Adopted *repaired*	0.609	0.585+	0.552+	0.596	0.582+
neither	9.804*	12.43*	14.00*	11.24+	10.04+
Household head				0.515+	0.480+

Education *Primary*				1.226	1.244
Middle				2.012+	2.021*
High				0.723	0.801
College				2.895	3.462
Age-group *Adults*				1.079	0.755
Olds				1.714	1.069
Marriage				1.015	0.889
Job				1.381	1.326
Religion				1.855	1.817
Party				1.326	1.611
Gender				1.086	1.100
Ethnicity				3.391	2.951
Statistics					
N	415	415	415	415	
Pseudo R^2	0.122	0.147	0.153	0.181	0.160
Count R^2	0.7157	0.7181	0.7229	0.7422	0.7542
P	0.0001	0.0000	0.0000	0.0000	0.0005

1. Odds Ratio (OR) were reported instead of coefficient in all models;
2. Count R^2=number of correct predictions/total number of observations; if the predicted probability was greater or equal to 0.5, it was classified as 1, if it was less than 0.5, it was classified as 0.
3. Community variable was used in all models, but not reported here.

legend: + p<.1; * p<.05

Overall, both the current livelihood assets and the livelihood assets changes affected recovery perception in a similar pattern. However, previous livelihood assets would not have a significant effect. Financial capital and natural capital were the most significant, positive predictors of perceived recovery in this analysis. If families had more financial capital, which was measured as annual income, the respondent would be more likely to perceive themselves as recovered from the disaster impact, regardless of whether the financial capital change or the current financial status was used. Natural capital had a similar effect as financial capital in all of the models. Social capital also had a positive effect on recovery perception, but the effect was not significant in most of the models. If the social capital change was used, it had a

positive effect, but was not significant in either model (Logit1 and Logit5). The current social capital had a stronger effect on the current recovery perception, and this effect was statistically significant at the 10% level if when only livelihood assets, disaster impact, policy adaptation, and community variance were included in the model. If personal demographic characteristics were included, the effect was no longer significant, though the effect was still positive. Although the physical capital was positively related with perceived recovery, the effect was not statistically significant. Similarly, neither the effect of human capital change nor the effect of current human capital was significant in the models.

The direct disaster loss, which was measured by the difference in estimated house values before and after the earthquake, was not significantly related with perceived recovery. The families that had adopted different housing recovery programs had varied recovery perceptions. Compared with the families who were in the government assisted reconstruction programs, the limited families that had minor damage and neither chose the reconstruction program nor the repair program, had a much higher chance of perceiving themselves as recovered. This difference was shown to be statistically significant at the 5% level. The participants in the repair group had a lower probability of perceiving themselves as recovered compared with the reconstruction group. This effect was significant in three of the five models presented at the 10% level. Since the housing recovery program variable reflected both the disaster damage and the utilization of government assistance, whether the disaster damage or the utilization of government assistance had a stronger effect on recovery perception was explored. As I illustrated earlier in the recovery process and housing reconstruction chapter, the decision-making process of which program to participate in

was determined by the disaster damage and the reconstruction capacity of a family together. If a family had well-built houses, and experienced little damage in the earthquake, they would have a much higher possibility of perceiving themselves as recovered four years later. If a family had housing damages, but they lacked reconstruction resources and were "forced" to choose the repair program, because the reconstruction program required them to demolish the old house first and then rebuild, they would have a lower probability of perceiving themselves as recovered. The results of community variations were not reported in the table because it was mainly used as a control variable, though there were some differences among different villages.

In terms of individual demographic characteristics, if the interviewee was the head of a household, he/she would have a lower degree of recovery perception, at the 10% significant level. Other personal characteristics, like being the racial majority, being male, being a party member, having religious faith, and predominately receiving income from off-farm in the last year, had positive effects on recovery perception. However, all of these effects were not statistically significant. Effects based on marriage status, age, and education, were neither consistent nor significant in the analyses.

Table 8.4 Determinants of Perceived Recovery (Sub-indicators of Social Capital)

Dependent Variable：Perceived Recovery (Logit6-Logit9, recovered or not; Ologit: five recovery scales)					
Variable	Logit6	Logit7	Logit8	Logit9	Ologit
Organization score change	1.019			0.974	
Support score change	1.238+			1.235+	
Cohesion score change	1.37			1.332	

Financial capital change	1.000+			1.000+	
Human capital change	0.811+			0.803+	
Physical capital change	1.000+			1.000	
Natural capital change	1.304*			1.341*	
Organization score in 2012		1.036	0.904		0.946
Support score in 2012		1.416+	1.509*		1.468*
Cohesion score in 2012		1.551	1.526		2.011*
Financial capital in 2012		1.000*	1.000+		1.000*
Human capital in 2012		0.902	0.966		0.868
Natural capital in 2012		1.658*	1.752*		1.213*
Physical capital in 2012		1.000	1.000		1.000*
Damage	1.000	1.000	1.000		
Program Adopted *Repaired*	0.629	0.585+	0.620	0.609	0.954
Neither	8.683+	14.27*	13.69*	9.760+	2.900*
Household head			0.476+	0.465*	0.557+
Education *primary*			1.233	1.240	1.091
middle			2.155*	1.997+	1.648+
high			0.604	0.760	0.584
college			2.620	3.140	2.963
Age-group *adult*			1.186	0.665	1.688
old			1.636	0.774	2.059
Marriage			1.034	0.897	1.176
Job			1.455	1.294	1.313
Religion			2.798+	1.978	1.487
Party			2.178	1.902	1.298
Gender			1.131	1.143	1.082
Ethnicity			3.237	2.772	1.715
cut1					7.261
cut2					58.74*
cut3					698.0*
cut4					9979.0*
N	415	415	415	415	415
Pseudo R^2	0.130	0.158	0.201	0.170	0.099
Count R^2	0.7157	0.7181	0.7422	0.7542	
P	0.0001	0.0000	0.0000	0.0002	0.0000

1. Odds Ratio (OR) were reported instead of coefficients in all models;
2. Count R^2=number of correct predictions/total number of observations; if the predicted probability was greater or equal to 0.5, it was classified as 1, if it was less than 0.5, it was classified as 0.

3. Community variable was used in all models, but not reported here. legend: + p<.1; * p<.05

Social capital was measured in three dimensions in this study: organization membership, social support, and community cohesion culture. Since the role of social capital in disaster recovery was one of my particular research interests, the three sub-indicators of social capital were used instead of the social capital index to explore their separate effects on perceived recovery. Similar to the models (model 1 to model 5) introduced before, the model 6 and model 9 used the "changes" between the two time points. Models seven and eight used the current sub-indicators, and the final Ordinal Logit model used the five-category recovery degree instead of a dummy variable. The results of all the models using the three social capital sub-indicators are presented in Table 8.4.

The social support indicator was the only one that had a significant and positive effect on perceived recovery. This effect was significant at the 5% level in the eighth Logit model and the Ologit model. Meanwhile, it was significant at the 10% level in the other three models. The community cohesion indicator also had a positive effect, but this effect was not significant in the logit models, although it was significant at the 5% level in the Ordinal logti model. The organization affiliation's effect was not stable in the models.

Other livelihood capitals had a similar pattern of effects as the models that used the social capital indicator. Financial capital and natural capital kept a constant positive, significant effect on recovery perception, regardless of whether or not the "changes" were used or the current status was used. Physical capital's effect was positive but not significant. Human capital's effect was negative and the significance was not stable in any of the models. Since the influence of personal demographic

characteristics and disaster damage also had similar patterns as the models I presented in Table 8.3, they do not warrant a discussion here.

The Odds Ratio was reported in all the logit and ordinal logit models. If the odds ratio was greater than one, the predicted result had a greater likelihood to be one (recovered here). The pseudo R^2 and Count R^2 were reported here as measures of goodness of fit instead of R^2, because the conventional R^2 measure was not meaningful in binary regression models (Gujarati, 2011). All the models reported in the two tables above were statistically significant, and the Count R^2 values indicated that the goodness of fits were not bad. In summary, all the logit models here captured about 70% of the observations.

8.5 Summary

In this chapter, perceived recovery from the 2008 earthquake and the determinants of recovery perception were explored. About 70% of our survey respondents reported that they had recovered from the disaster impact, while another 30% said that they had not recovered yet. A few of the respondents, including all of the elderly participants, had a pessimistic perspective, indicating that they believed they would never be recovered from the tragedy.

Not all the household livelihood assets were determinants of recovery perception. Financial capital, which was measured as annual income, and natural capital, that captured the land owned by a family, had a consistently significant positive effect on perceived recovery. If a family had more annual income and owned more land, the probability of choosing a perception of recovered from the earthquake was much higher. Though physical capital and social capital were also positively related with perceived recovery, the results were not significant. On the contrary, if

one family had more human capital, they were more likely to report not recovered from the disaster impact, though this effect was not significant in all of the models. For the three components of social capital, social support had a stable significant positive effect on recovery perception. The community cohesion indictor played a positive role as well, but it was only significant in the ordinal logit model. The role of organization affiliation was neither significant nor clear. For the livelihood assets, the effects kept constant regardless of whether the current livelihood assets (2012) or the changes between 2009 and 2012 were used in the analyses, especially for statistically significant assets including financial capital, natural capital and the social support component of the social capital. Nonetheless, the results also showed that the current livelihood assets were stronger predictors than the changes in this analysis, which may indicate that psychological-related recovery perception may be more determined by current well-being status rather than absolute changes.

The direct disaster impact indicator's effect was not significant, but variations among people who adopted different recovery programs did exist. Compared with the families that reconstructed their houses, the families that chose the repair program had a lower probability of perceiving themselves as recovered. The families that had minor housing damages and did not participate in either program were most likely to say they were recovered. Choosing the housing reconstruction or the repair program was not only influenced by the disaster damage, but also determined by the family's rebuilding capability. Some poor families had to join the repair program because they did not have enough resources for rebuilding, thus they would have a lower degree of recovery perception.

Most of the individual features' effects on recovery perception were not significant, except the household head variable. The household head was less likely to perceive their family as recovered compared with the non-head members in this study.

The most interesting finding from this analysis was the effect of social capital and the economic-related livelihood capitals including financial capital, physical capital, and natural capital. The positive effects of financial capital (i.e., income) and natural capital (i.e., land) on perceived recovery were very significant and consistent across all the models. Unlike some prior studies (Aldrich, 2012), these results reveal that the economic-related (i.e., livelihood-related) factors were more important than social capital in underdeveloped societies experiencing catastrophic events. The weak effect of social capital in this study may also be due to the measurement of social capital adopted. Of the three sub-indicators, social support's effect was significant and positive, the community cohesion indicator's effect was also positive, and the organization affiliation's role was weak. In a transforming society like China, the traditional lifestyle and bonding methods in rural areas were severely and negatively affected by the fast-growing market economy. Modern civil society expressions like nongovernmental organizations were still in their infancy during this time period, especially in rural areas. For example, all the respondents in this survey were only affiliated with two kinds of local organizations, one was local branch of the Communist Party, and the other was religious-related groups. Thus, the social capital's effect as a risk-sharing tool may be weakened in the marketization process (Lu, Sato, & Zhang, 2008). Meanwhile, most of the household's major social networks were disrupted and impacted by the mega-earthquake, and could be another reason for explaining the non-significant effect of social capital in this analysis.

Chapter 9

CONCLUSION AND DISCUSSION

9.1 Disaster Recovery Processes and Results

This dissertation examines household and community recovery in rural China after the 2008 Wenchuan earthquake through three connected data collection efforts: the first about one month after the earthquake, the second about eight months after the event, and the third in the summer of 2012, about four years later. A dataset including both quantitative longitudinal questionnaire surveys and qualitative in-depth interviews were obtained and used for analysis.

In general, there are six stages of post-disaster activities within these families. The first one is the self-protection period, which may last seconds to hours. During this initial period, survivors would avoid the danger and seek protection. The second stage is information seeking or rescue, which depends on the ground scenarios. Survivors would seek any available methods or communication channels to find the accurate information about the safety status of their families, friends, relatives, and neighbors. If severe injuries occurred in the immediate vicinity, the information-seeking activities would be postponed and rescue activities would be conducted. The third cluster of activities involves family reunion and temporary sheltering, with uncertainty. This period may last hours to days, depending on the physical distance of the separation between family members. Psychological problems including anxiety, desperation, and numbness would appear during this period, especially with the continuation of aftershocks and disrupted transportation and communication systems.

The fourth period is self-rescue and/or waiting in temporary shelters. Some families and communities would respond to the disaster impact more actively and start self-rescue soon after the earthquake, while others would respond to the tragedy more passively and wait for solutions. The pledge of help from political leaders would inflate the survivors with a sense of confidence regarding recovery, but it also increased expectations and their dependence (e.g., some families would postpone their self-initiated recovery activities entirely). The fifth period is the housing reconstruction and repair period, which is also the most burdensome period for most of families. The last one is the long-term livelihood recovery period, which would last for years. The present study emphasizes periods five and six. Disasters, especially catastrophes like the Wenchuan earthquake, change the society in the impact regions in terms of infrastructure and socioeconomic status etc. With the changes in macro atmosphere, people would adjust to these changes and adapt new livelihood strategy combinations in order to finally achieve their recovery goals.

The central government of China set a three-year reconstruction plan for this earthquake recovery. Similar schedules can also be found in other countries, like in Chile after the 2010 earthquake and tsunami (Siembieda, Johnson, & Franco, 2012). However, scholars suggest that there should be no recovery time table because different families and communities vary in terms of returning to their former lives (Alesch et al., 2009), and there should be no arbitrary timeframe in the process from moving from relief to long-term recovery (Mulligan & Nadarajah, 2012). The results from this study also suggest that there is no clear-cut point between the disaster response and disaster recovery period, and there is no specific end time to disaster recovery. While some families or communities start to invest early into recovery

efforts, some families and communities are still in sorrow. When most families had recovered from the disaster impact four years later, some families, especially the ones comprised of mainly elderly individuals, were still far away from their perceived recovery goals.

In terms of livelihoods assets, the households had a much better condition in the summer of 2012 compared with the situation in January 2009 (eight months after the earthquake). Physical capital, which mainly included the fixed assets and estimated house values, had the biggest improvement. Following physical capital was natural capital, measured by the size of land, and financial capital, including annual incomes, savings and available credits. The human capital index and social capital index, which are both composed of several variables, also exhibited a significant increase since 2009. With the increase of these livelihood capitals, most of the standard deviations also increased, with the exception of the social capital index. Although all the households showed an improvement in livelihood improvement since 2009, they did not follow a similar recovery speed. The inequality, especially in economic-related gaps among these households, widened during the recovery process. However, the increased economic gaps did not impair social capital. On the contrary, the variation within the social capital index was narrowed in 2012 compared with the situation in 2009.

Prior studies show that natural disasters tend to magnify the pre-disaster social trends, particularly those relating to levels of inequality in a society (Bolin & Stanfrod, 1991; Morrow & Peacock, 1997; Oliver-Smith, 1990). The results from this longitudinal research provide some evidence regarding the “physical” aspects. Nevertheless, from the early therapeutic/altruism community response view (Barton,

1969; Fritz & Mathewson, 1957), scholars have also noticed that disasters could produce a shift in social values and norms (Perry & Lindell, 2003). The results from this study indicate that the therapeutic/altruism (Barton 1969; Fritz and Rayner 1958) phenomena during the emergency response period could last to the recovery period, at least four years after the disaster, though researchers like Quarantelli and Dynes (1977) have doubted the enduring condition of the decrease of conflict and the increase of consensus following disasters. Our interview data also indicates that the mega-disaster changed people's values in some aspects; people become less materialistic and valued time with families and friends more than before. When there is no conflict regarding distribution of resources (Tierney, Lindell and Perry 2001), social capital could be generated through social participation (Miller 2007), even with some distrust of local government officials (Han, Hu, and Nigg 2011).

Housing recovery was the most burdensome effort for most families affected by the earthquake. On the whole, the habitable conditions of these survivors have witnessed a large improvement, regardless of whether viewing these improved conditions in terms of housing structure, available space, or from estimated house values. However, it should be noted that the improvement of housing conditions (physical capital) is a trade off with the increased indebtedness of many families. This pressure of indebtedness shapes the livelihood strategy combinations of many families. The income structure changes indicate that many families tend to adopt a more diversified livelihood strategy combination, and off-farm livelihood activities play a more important role in boosting income than on-farm activities.

For the families who reconstructed their houses, there were four models of reconstruction in this study. The first type is unified reconstruction with counterpart

assistance. The families who were selected in this model could receive an unfurnished house almost for "free". Each house included three rooms in total of 60 m^2, and another 30 m^2 space for further development. The reconstruction project was designed by local government and counterpart assistance providers, and necessary public service infrastructures were provided within the communities. The second type of housing reconstruction is unified reconstruction without counterpart help. In this scenario, the land acquisition and design of the community was coordinated by local government, but the residents had to rebuild the houses either by themselves or through contractors. The third type is combined reconstruction, which is similar to the second type, but with limited household members (several households combined together), whom have to acquire the land and rebuild the house themselves. The last one is the self-reconstruction model, which had the most freedom in terms of rebuilding, but the families also had to take on the responsibility of pursuing land and rebuilding by themselves. The unified-reconstruction-with-counterpart-assistance families were not eligible for the housing reconstruction subsidy from the central government, while all other families could apply for the housing reconstruction subsidies and loans.

9.2 Determinants of Disaster Recovery

The determinants of household recovery after disasters can be classified into three sets. The first set mainly includes the internal resources in terms of livelihoods assets: human capital, financial capital, natural capital, physical capital, and social capital. The second set includes resources available from communities. Both physical resources like infrastructures and public service facilities, and "soft" resources like cohesion and solidarity within communities, collective actions within communities,

leadership, and disaster knowledge within communities, could be classified into this set. The third set of determinants mainly comes from external support from higher level of governments, nonprofit organizations, and some business organizations, if possible. Social capital could be the key method to link all these resources together and to finally achieve the goals of households and communities in terms of recovery.

In order to examine the effects of livelihood assets on recovery, housing recovery and perceived recovery were used as the dependent variables. Economic factors like financial capital and natural capital were significantly and positively related with both housing recovery and perceived recovery degrees. The effect of human capital was neither consistent nor significant in most of the models. The role of social capital appears to be complicated; social capital's effect is stronger and more significant on recovery perception than in terms of real housing recovery. Moreover, the social support sub-indicator is the best representative of social capital in this study, rather than the institutional affiliation or community cohesion indicators. Overall, social capital's effect on recovery is not as significant as the claims of some prior studies (Aldrich, 2012).

Intuitively, social capital can be called upon, particularly in time of crisis, to leverage material gains. It can provide essential resources to accomplish critical tasks after disasters, because it is less affected compared with the devastated physical and human capital (Dynes, 2006). Social capital could play an important role in evacuation and returning (Fussell, 2006), utilization of formal aid (Beggs, Haines, & Hurlbert, 1996) and post-disaster community recovery (Aldrich, 2011b). However, it should be noted that the effect of social capital may be weakened when all the families within the community are impacted by the disaster (Chowdhury, 2011). Furthermore, social

capital may also have a down side. Strong social capital reinforced collective action from local organizations, speeding up their recovery and connecting them to external aid providers, but it also strengthened the obstacles to the people on the periphery of society at the same time (Aldrich, 2011b). The groups with strong social capital may push the unwanted "public bad" to other devastated communities (Aldrich & Crook, 2008). It may also block or delay urgent decision-making for quick response (Buckland & Rahman, 1999), and facilitate lobbying and rent-seeking for available government resources after disasters (Chamlee-Wright & Storr, 2011b). The lack of linking and bridging social capital may affect the socially disadvantaged group's access to outside resources and services (Hawkins & Maurer, 2010). The results from this study indicate that social capital has a positive effect on recovery, but this effect is quite weak, and more significant on perceived recovery than physical recovery (i.e., housing recovery).

I attribute such inconsistency and indistinctness to the measurement of social capital in different studies and societies. As Woolcock summarized recently, the term social capital has not only become a social scientific term, but also become a routinized discourse across diverse disciplines and countries around the world in the last twenty years (Woolcock, 2010). From Bourdieu's early social support function (2008) of social capital, to Coleman's rational choice approach (1980), to Putnam's civic view (1994; 2001), to Lin's resource perspective (2002), and finally to Burt's network approach (2000), social capital can take on so many different meanings in relation to social issues. In the World Bank's social capital assessment tool, which is also the original source for social capital measurement in this study, social capital has six modules: groups and networks; trust and solidarity; collective action and

cooperation; information and communication; social cohesion and inclusion; empowerment and political action (Grootaert, 2004). These social capital measurements can also be divided into three categories based on the nature of its sources: bonding social capital, linking social capital (vertical dimension), and bridging social capital (horizontal dimension) (Woolcock, 2001). Even in Aldrich's (2012) series of studies about social capital and disasters, social capital is measured differently. In the case of recovery after the Kobe earthquake, social capital was measured by the number of NPOs. In another study conducted in India, social capital was measured as the presence of local organizations bonding and linking to outside aid organizations. However, in the study after Hurricane Katrina and the 1923 Tokyo earthquake, voter turnout was used as the indicator of social capital. The varied measurements of social capital may be a factor affecting the consistency of results.

Another reason for the inconsistency may come from the different cultural, social, and institutional features in different countries. In a transforming society like China, the traditional lifestyle and bonding methods in rural areas are severely and negatively affected by the fast-growing market economy. Modern civil society expressions, like nongovernmental organizations, are still in their infancy, especially in rural areas. For example, all the respondents in this survey were only affiliated with two kinds of local organizations, local branches of the Communist Party and religious-related groups. Thus, social capital's effect as a risk-sharing tool may be weakened in the marketization process (Lu, Sato, & Zhang, 2008). Meanwhile, most of the household's major social network is disrupted and impacted by the mega-earthquake, thus the overall effect of social capital in this study was relatively weak. For the three sub-indicators, the social support's effect was significant and positive, the community

cohesion indicator's effect was also positive, and the organization affiliation's role was weak. In a similar study conducted after the 2008 Wenchuan earthquake in China, the trust in local officials was significant and positively related with perceived recovery, but the personal networks' effect was not significant (Chen & Meng, 2010). Thus, the measurements of social capital in different societies should be detailed, evaluated, and discussed in the future.

Mass care and other basic services after mega-disasters are mainly delivered by government agencies in China. This is quite unlike societies with highly developed nonprofits organizations (NPOs), where the NPOs could play an important role in mass care and deliver of other services (Bolin & Stanford, 1998), or in scenarios where the government agencies are absent and external resource providers (international NPOs) fulfill the service needs after disasters (Rodriguez, Wachtendorf, Kendra, & Trainor, 2006). The Wenchuan earthquake was the most disruptive and the second deadliest earthquake since the establishment of the People's Republic of China in 1949. It was also the most devastating disaster since China's reform in 1978. After such a catastrophe, solid financial support was possible and available due to the rapidly developing economy in China in the last thirty years. Political leaders pledged that the available resources would be mobilized nationally for disaster response and recovery. Hence, several ad-hoc disaster assistance programs from the central government were initiated after the earthquake. The Temporary Living Stipend (TLS), which covered almost every survivor in rural areas, played the role of safety net in helping the disaster victims. From our observations, interviews, and surveys, many families were still depending on this stipend for living at the end of the year 2008. The Individual Housing Assistance (IHA) program for families in rural areas also

facilitated the housing recovery of many families. However, some poor families failed to benefit from the housing reconstruction subsidy because they could not afford the housing reconstruction cost, even with the subsidy from government. Due to massive media coverage, almost everyone in our sample was aware of these programs, and the delivery effects were quite positive. The Counterpart Assistance program, which was coordinated by the central government, played a critical role in infrastructure and public service facilities recovery in the affected regions. Some limited communities were selected as reconstruction showcases. These exemplary villages were mainly planned and reconstructed through the Counterpart Assistance program, and survivors in these communities were able to benefit from government assistance programs more than others.

Unlike the observations after the 1994 Northbridge earthquake that showed that richer communities benefited more from federal government assistance (Loukaitou-Sideris & Kamel, 2004), the economic condition of a community was not a key determinant of using assistance from higher level government in this case. The collective action within a community (a kind of social capital if applied) played a significant role in leveraging the interaction between the community, local government, and upper level of government, affecting the use of varied external assistances and eventually determining the disaster recovery processes and results. Although community cohesion and solidarity was important to achieving collective action, crisis leadership within a community was another key determinant of collective action.

9.3 Contributions, Limitations and Future Research

This dissertation mainly has two contributions to disaster research. First, it provides experience in disaster recovery from another cultural perspective which could help the theorization efforts of disaster recovery. The determinants of recovery include the resources and capacities of households and communities, as well as the assistance from outside help providers like the higher level of governments. This is especially true in a society which has a strong-government and a relatively centralized government system. With the absence of non-government sectors in rural China, most of the services are provided by government, even the mass care services. In the recovery process, resources available from higher level of governments play an important positive role of facilitating the overall recovery. The political pledge from top political leaders could direct resources dramatically, but the 'ad-hoc' political pledge without detail operational guidelines could confuse individuals' decision making process and discourage individuals' efforts of recovery, especially in the early period. This case study after the 2008 Wenchuan earthquake in China highlighted the role of government assistance in disaster recovery when high level political leaders involved. Also, it demonstrated the interactions among individuals/households, communities, local governments, and central government, and such interactions' impact on individuals/households recovery decision-making process.

Second, this study tries to integrate development theory with disaster research. The Sustainable Livelihoods Analysis (SLA) framework, which is mainly used in the antipoverty and development area, has proved to be a useful analysis framework for disaster research. In particular, the five livelihoods assets can serve as important sources and checklists for identifying people's capacity for disaster response and recovery (Birkmann, 2006). With an increase of external threats like climate change,

many families and communities in developing countries are becoming more vulnerable to natural hazards. A sustainable strategy for disaster reduction must focus on building livelihood assets (Vatsa, 2004), and there is a need to integrate disaster risk reduction, adaptation, and sustainable livelihoods together to achieve this sustainable development target (Practical Action, 2010).

In practice, the research findings of this dissertation may contribute the future development of disaster recovery policies and programs in both China and the United States. Take the housing recovery program for example; this 'ad-hoc' housing assistance program from central government in China is evolving into a routine assistance program to individuals after disasters in recent years. However, the formal and official policy is not launched yet, and detail operational guidelines are still not clear. The research findings of individual housing recovery decision making process and the interactions among individuals/households, communities, local governments and central government could help the future development of such individual housing recovery assistance program in China. Meanwhile, the widely covered housing assistance program in China could provide some lessons for the Individual Assistance programs from FEMA. Also, the One-to-One assistance program in China could provide some experience to the Public Assistance program and mutual aid programs in the United States.

However, it should be noted that there were also some limitations in this study. First, it mainly examines disaster recovery and influencing factors in rural areas of China. The disaster recovery trajectories in rural areas and cities are quite different in the transitional society of China. The housing reconstruction models and government assistance patterns are quite different in the dual urban-rural system. Meanwhile,

although the five livelihoods assets can serve as an important checklist in general, the indicators used in this study are mainly based on the rural scenarios. Necessary modifications are needed for the generalization of this study.

This study mainly explores household and community disaster recovery and determinants based on the 2008 Wenchuan earthquake in China, focusing primarily on the academic aspect. Comparison studies about disaster recovery issues between the United States and China and discussions from the policy and practice perspectives would be very valuable because the two countries are in different development stages. Topics like the measurements of social capital and the different roles of social capital in disaster response and recovery would be very interesting. Comparisons of individual disaster assistance programs and policies, as well as their roles in facilitating household recovery, would be meaningful as well. In conclusion, a systematic comparison of disaster response and recovery from the economic, cultural, and institutional dimensions is suggested for future studies.

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Appendix A

HOUSEHOLD SURVEY QUESTIONNAIRE

Questionnaire no： □□□□□□
Interview time: _____
Address： ____**village** _____ **town**
Contact information:
Interviewer:
Supervisor:

The Follow-up Livelihood Recovery Survey in Wenxian

According to the People's Republic of China's Statistic Law Chapter III, item 14, this questionnaire is the individual and household survey material. The information will be kept confidentially, and nobody can access the information without the agreement of the respondent.
The information will be collected for a study. This study is designed to learn about people's livelihood recovery after the 2008 Wenchuan earthquake. If you choose to participate in this study, it is your right to ask me to clarify any question, to decline to answer any specific question, or to end the interview at any time. Thanks very much for your support and cooperation.

07/2012

Section I: Demographic Information

The householder will be designated as no.1, please specify the number of the interviewee (A0)_____

A1.	A2. Name	A3. Gender	A4. The relationship with the householder	A5. Ethnicity	A6. Hukou	A8 Religion	A8. Birthday	A9. Marriage Status	A10 Party	A10. Main job in last year	A11. Education	A12. Professional Certificate?	A13. Full-time Labor force?	A14. Why not full-time worker?	A15 Sick in last 6 month?
no	(These information will be obtained from the prior baseline study)	1Male 2Female	1householder 2spouse 3parents 4children 5brother/sister 6 brother/sister in law 7grandchildren 8 others	1Han 2 Tibetan 3Qiang 4.Ohter	1Rural local 2Local city 3Other place 4No registration	1Christian 2Islam 3Buddhism 4Taoism 5Others 6 No religion		1Married 2Divoced 3Widowed 4Single 5Other	1Communist 2League member 3Other party 4No party	1Cultivation 2Work for others(not local) 3Work for others(Local) 4Run small business 5 Others	1 Illiterate 2Primary school 3Middle school 4High school 5College 6Graduate	1No 2Driver license 3electric welder 4plumber 5Chef 6Account 7Barber 8CS 10Car maintenance 11Real estate 12Garden 13.Housekeeping 14Others	1Yes->A15 2No->A14	1Kids before school 2Kids at school age, but not at school 3At school 4In military 5Disabled/Sick 6Old 7Others	1 Yes 2 No
01															
02															
03															
04															
05															
06															
07															
08															

Section II Housing and Utilities

Type	B1 Purpose (1. For living 2.Livestock keeping 3. Tools keeping, 4. For rent or others)	B2Area （m^2）	B3 Estimated value(RMB)	B4Constrcuted time(mm/yy) if constructed after the eq→B6	B5If constructed before the eq, repaired due to the eq? 1. Yes 2. No
Cottage					
Mud and Wood Structure					
Brick and Wood					
Bricks					
Concrete					

B6 Did you rebuild or only repair your house?
1. Rebuilt 2.Repaired→B16 3. House damaged, but neither rebuilt nor repaired→B16 4. No damage →B16

B6a If you rebuilt your house, have finished it yet?
1.No 2.Completed the major work 3.Totally completed
B6b If you have completed your house rebuilding, when did you finished that?
1.2009 **2**.2010 **3**.2011 **4**.2012

B6c If your house rebuilding hasn't finished yet, when do you expect to finish that? **1**. Before the end of 2012 **2**.2013-2015 **3**. After 2015
B6d If you rebuilt your house, how did you rebuild it? 1. Rebuilt myself 2. Rebuilt by mutual aid partner (government) 3. Rebuilt by other organizations, please specify_____

B7 If you rebuilt your house, where did you rebuild it? 1. The same place->B9 2. Relocated in this area 3.Move out from communities
B8 If you are relocated, how did you get the land for your house? 1. Purchased or exchanged by myself 2. Purchased by myself, but coordinated through government 3. The whole community relocated through coordination of government
B9 Do you know the reconstruction aid (30,000) from the government? 1. Yes 2. No
B10 Have you got the reconstruction aid from government? 1. Yes, all the 30,000 2. Yes, but part of it 3. No
B11 If you didn't get the reconstruction aid from the government, what's the main reason for that? _____
B12 How much has you spent for reconstruction? _____
B12a Came from your savings? _____
B12b Borrowed from relatives and friends: _____
B12c Borrowed from banks _____
B12d Assistance from government:_____
B12e Others：_____

B13a If you have loan from bank, do you know you can apply the interest subsidy from government? 1 Yes, I know 2 No, I don't->C1
B13b If you know you can apply the interest subsidy, have you applied that? 1. Yes, and got that->B14 2. I applied, but was rejected ->B15a 3.No, I didn't apply->B15a
B14 If you have applied the loan without interest, how much have you been approved? _____
B15 How did your loan warranted? 1By my savings 2 By my salary 3 By my real estate 4 By friends and neighbors 5 By the whole community
B15a If you did get the loan without interest, the main reason was: _____
1.I don't need that 2. Too poor, the bank didn't approve 3. I don't have social support and connections, the bank didn't approve 4.Others, please specify:_____

B16 If you repaired your house, did you know that you can get 3000 subsidy from government? 1. Yes 2. No->C1
B17 Have you got the subsidy from the government? 1.Yes, all the 3000 2. Yes, part of that 3. No
B18 If you didn't get all the subsidy from the government for your repair, the main reasons was:_____

C. Utilities

C1 What do you used for light? 1Electricity 2 Oil 3Gas 4Others
C2 Do you have phone or cellphone? 1Yes 2No

Section III Production resources

D Land owned

	Farm		D3Orchard	D4Forest	D5Pond	D6ley	D7Poor quality wasteland	D8Others
	D1Paddy field	D2Dry land						
Areas								
Estimated value								
Rented to others? (1 Yes, 2 No)								
If rented, how many are rented?								

D9 Compared with the situation before the 2008 earthquake, the land you owned were 1. More than before 2 less than before 3 almost the same
D10 If you owned less land, the main reason of losing the land was: 1. Damaged by earthquake, 2. Taken for reconstruction, 3. Sold to others 4. Others, please specify___

E Assets and equipment

E01n	E02 items	E03 Quantity	E04 Purchased time(mm/yy)	E05 Purchased unite price	E06 Estimated value
01	Tractor over 12P				
02	Tractor below 12P				
03	Plow				
04	Pump				
05	Sprayer				
06	Thresher I (打谷机)				
07	Thresher II (脱粒机)				

08	Mill				
09	Feed processor				
10	Auto Tricycle				
11	Tricycle				
12	Carriage				
13	Horse				
14	Donkey				
15	Mule				
16	Farm cattle				
17	Rack truck				
18	Other equipment				

Section IV Annual Income in 2011

No	Items	Value($)	No	Items	Value ($)
F01	Crop I_____		F08	Living aid	
F02	Crop II_____		F09	Pension	
F03	Crop III_____		F10	Aid for disabled	
F04	Other Crops (Include tea etc)		F11	Other assistance	
F05	Animal Raising (cattle, poultry)		F12	Saving interest	
F06	Salary		F13	Aid from relatives or friends	
F07	Medical care reimburse		F14	Others (run business)	

F15 Compared with the situation before 2008, your income in last year 1 increased→F18 2 Decreased→F19 3 Almost the same
F18 How many increased? _____
F19 How many decreased? _____
According to the economic contribution to the family, who are the first three members? (Input the number here):
F201 _____ F202_____F203 _____

Loan: (Assumed that you need money for emergency, where you can get the money)

	Whether or not? (1 yes, 0 no)	The maximum can be borrowed
F21Bank		
F22Usury		
F23Micro-credit		
F24 Relatives and Friends		

Section V Social Capital

Organization affiliation: Have any member of your family been in the organizations list as below? 1 Yes 2 No

Organization type: [1]Communist Party [2]League member [3]Citizen corps [5]Women's association [6]Worker Union [7] Community Committee [8] Community voluntary organizations [9]Association for the aged [10]Other voluntary organizations [11]Faith-based organizations [12]Culture club [13] Crop cultivation association

G1No	G2a Organization name	G2b Organization name	G3b Organization type	G4b Have an official position? (1 yes, 0 no)	G5b Activity [1]Active [2] Non-active
01					
02					
03					
04					
05					
06					
07					
08					

What kinds of benefits can you obtained from these organizations? (If you can get one kind, please fill the blank with 1 there, if not, please put 0)

Benefit	Obtained or not
G101 Get information for production or sales	
G102 Get loan	
G103 Get training and technical support	
G104 Know someone useful	
G105Better family relationship	
C106 Improve mental health	
G107Others	

G11 Do you think these activities are important for you and your family? 1 Yes, very important 2 No, not important

What kinds of training have you or your family member get after the earthquake?

Type	Involved (1 Yes, 0 No)	Time participated(mm/yy)	Helpful? (1 Yes, 0 No)
Work/Service skills training			
Crop cultivation skills			
Animal raising skills			

H Social Support

H1 If you or your family need somebody's help, whether you or your family can get the help from the following resources?

	Quite sure can get help	Probably can get help	Hard to say	Probably not	Definitely not	Not suitable	
H1a.Friends	[1]	[2]	[3]	[4]	[5]	[6]	☐
H1b.Neighbors	[1]	[2]	[3]	[4]	[5]	[6]	☐
H1c.Children	[1]	[2]	[3]	[4]	[5]	[6]	☐
H1d.Other relatives	[1]	[2]	[3]	[4]	[5]	[6]	☐
H1e.Village committee	[1]	[2]	[3]	[4]	[5]	[6]	☐
H1f.Town government	[1]	[2]	[3]	[4]	[5]	[6]	☐
H1g. Bank	[1]	[2]	[3]	[4]	[5]	[6]	☐
H1h. Local bank	[1]	[2]	[3]	[4]	[5]	[6]	☐
H1i. Others	[1]	[2]	[3]	[4]	[5]	[6]	☐

H2. Do you agree the statements as following? Please choose one degree of your agreement

Statement	Totally disagree	Partly disagree	No opinion	Agree	Totally agree	
H2a.If you need help, most of people in this village will help you	[1]	[2]	[3]	[4]	[5]	☐
H2b.If you sacrificed for the public goods, the villagers will support you	[1]	[2]	[3]	[4]	[5]	☐
H2c.Most of the people in this village can be trusted	[1]	[2]	[3]	[4]	[5]	☐
H2d.If someone had a hard time and need money, most of people would lend to him/her	[1]	[2]	[3]	[4]	[5]	☐
H2e.If you had children, and you would be out temporarily, you will ask the neighbors to take care of your children	[1]	[2]	[3]	[4]	[5]	☐
H2f.If your family had a wedding or funeral, most of the villagers would come to help	[1]	[2]	[3]	[4]	[5]	☐

H4 Have you known some helpful outsiders after the earthquake? 1 Yes→H5 2 No→Section VI

H5 If you knew some, who are they? 1.Volunteers 2.Mutual aid partners 3. Officials from county government or city government 4. Officials used to be your village

H51What kinds of help did they offer to you?

Section VI Livelihood Strategies (Activities)

I Animal raising:

I1 no	Kinds	2011 (Year)				
		I107 Purpose(1 Self use 2 For sale)	I207 Amount	I307 Amount for sale	I407 Cost	I507 Gross income
01	Pig					
02	Sheep					
03	Chicken					
04	Duck					
05	Goose					
06	Rabbit					
07	Silkworm					
08	Bees					
09	Fish					
10	Others					

Crop Cultivation:

J1no	Kinds	2011 (Year)			
		J2a Area	J3a Product	J4a Gross income	J5a Cost
01	Wheat				
02	Rice				
03	Corn				
04	Beans				
05	Vegetable				
06	Potato				
07	Broccoli				
08	Herb				
09	Tea				
10	Pepper				
11	Fruit				
12	Nuts				
13	Olive				
14	Lute				
15	Garlic				
16	Rape				
17	Chinese sorghum				
18	Peanut				
29	Sunflower				
20	Others				

Migrant work (age above 15)

M

Family member no(Same as the table A)		**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**
M1Is any family member work outside (migrant worker) now?	1 Yes 2 No->M16								
M2 Where is he/she working?	1Local county 2Local region 3This province 4 Cities not in our province, please specify_____ 5Others								
M2a Why does she/he work there?	1 Worked there before 2. Friends introduced 3. Local government organized 4. Others_____								
M3 What does he/she do?	1Construction 2 Manufacturing 3 Service 4 Run small business 5House keeping 6Part-time 7Others								
M4 Salary for work outside? (RMB)									
M5 Type of work	1 Stable, full-time work 2 Temporary, part-time work								

M15 The main reason why this family member work outside?	1 Earn more 2 More opportunities 3 Learn new things and knowledge 4It will be comfortable in cities 5 Used to be outside 6 Others	
M15a Have you ever thought moved to the place they worked?	1. Yes 2.No	
M115b If you have, the reason why not moved?	1. Don't have enough money to maintain my life there 2. Don't have Hukou there, and cannot benefit the social welfare there 3. Friends and relatives are at hometown, we are used to the life here 4.Others	
M16 If nobody was migrant worker, why?	1 Farm work need labor force 2 not in good health 3 Not used to the life outside 4 Reconstruction needs after the earthquake 5Others 6 It's not necessary earn more outside	

Run small businesses

Family member no (same as the table A)		**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**
M1Any family member are running business?	1 Yes 2 No								
M2 If yes, what kinds of business?	1. Vegetables dealer 2. Butcher or sell cattle 3. Herb dealer 4. Shop 5. Technical business like carpenter 6. Clinics or pharmacy 7.Transportation 8.Others								
M2a How long does he/she invest in this business each year?									
M3 How much can he/she earn from this business each year?									

Section VII P Perception Part

P1. Overall, do you think you and your family have recovered from the impact of the 2008 earthquake?

1 Not yet, and far away 2 Recovered some, but still worse than before 3 Almost as the same as the situation before the earthquake 4 Totally recovered, and a little better than before 5 Totally recovered, and much better than before

P2. Overall, how long do you think you and your family can recovery from the impact of the 2008 earthquake?

1. Less than 3 years 2. 3 to 5 years 3.5 to 8 years 4.8 to 10 years 5.more than 10 years

P3. Which is the main reason that impeded your recovery?

1.Don't have enough money 2. Not enough human resource 3. Don't have enough social capital 4. Don't have enough land 5.Pyschology impact

P4. What's the probability do you think a damaged earthquake can hit this area in future?

1. Quite impossible 2. Impossible 3. Hard to say 4. Possible 5. Very possible

P5. If a damaged earthquake hit this area again, when do you think it would happen?

1. In next 5 years 2. In next 10 years 3. In next 30 years 4. In next 50 years 5. More than 50 years or never

P6. If an earthquake happen again, what's the possible impact on you and your family?

1.No impact 2.Minor impact 3. Medium impact 4. Some impact 5. Highly negative impact

P7. Have you and your family prepared something for next possible earthquake?

1. Totally nothing 2.Almost nothing 3. Hard to say 4. Prepared something 5. Prepared a lot

P8. If you have done some preparedness for next earthquake, please list the activities you have done:

_____

Appendix B

IRB APPROVE LETTER

UNIVERSITY OF DELAWARE

RESEARCH OFFICE

210 Hullihen Hall
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DATE:	July 18, 2012
TO:	Ziqiang Han
FROM:	University of Delaware IRB
STUDY TITLE:	[359008-1] Long-term livelihood recovery from catastrophe in rural areas-experience from 2008 Wenchuan earthquake in China
SUBMISSION TYPE:	New Project
ACTION:	DETERMINATION OF EXEMPT STATUS
DECISION DATE:	July 18, 2012
REVIEW CATEGORY:	Exemption category # 2

Thank you for your submission of New Project materials for this research study. The University of Delaware IRB has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

We will put a copy of this correspondence on file in our office. Please remember to notify us if you make any substantial changes to the project.

If you have any questions, please contact Jody-Lynn Berg at (302) 831-1119 or jlberg@udel.edu. Please include your study title and reference number in all correspondence with this office.