Community Disaster Coping Capacity of Historical Villages in the Disaster-Prone Mountainous Area of Southwest China

Doctoral Course in Global Environmental Studies

Laboratory of Global Environmental Architecture

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中国南西部の災害常襲山間地域における歴史的集落のコミュニティ防災力に関する研究

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ABSTRACT

Numerous historical villages in the remote mountainous areas of Southwest China have a particularly high risk from multiple hazards. As public emergency services cannot always provide a timely emergency response to these historical villages, it is remarkably important for the historical villages to develop their disaster coping capacity and to be able to provide a better emergency response at the community level. Therefore, this dissertation attempted to analyze and clarify the features of the current status of the community disaster coping capacity (CDCC) in two case historical villages in mountainous Southwest China, Shangli and Dali. The objectives of the research are:

(1). To identify the factors which affected the local people's disaster-resistant building improvement activities in the two case historical villages.
(2). To clarify the features of community disaster coping capacity (CDCC) in the two case historical villages in terms of individual disaster coping capacity (IDCC), actual community disaster coping capacity (ACDCC), and potential community disaster coping capacity (PCDCC).
(3). To examine the common features and differences of community disaster coping capacity (CDCC) between the two case historical villages.
(4). To recommend specific measures to enhance community disaster coping capacity (CDCC) in the historical villages in the remote mountainous areas of Southwest China.

The research found that the people's disaster-resistant building improvement activities in both the two case historical villages are limited. The common factor that hampered the people's effective activities in both the two villages could be attributed to limited access to building technology. In addition, the strict administrative licensing process for construction works of historical buildings and the impediments on decision-making due to property right subdivision are two particular factors in Shangli Village. In Dali Village, the insufficient financial capacity, the lack of flat land resource, and the restrictions on unauthorized modifications to heritages are three special factors that hampered people's activities.

The IDCC was examined based on three factors: risk awareness, disaster preparedness, and potential disaster coping ability. The IDCC of both Shangli Village and Dali Village represent a predicament between high disaster awareness and limited disaster preparedness, and limited potential responding ability. Both of them lack disaster education and training. The ACDCC was examined based on three factors: disaster risk reduction planning, community disaster mitigation organization, and disaster mitigation measures. The ACDCC of these two villages represents six features. Lack of systematic and integrated plan caused insufficient disaster mitigation measures. Nevertheless, the ACDCC of both Shangli Village and Dali Village have preliminarily progressed due to the volunteer firefighting troop establishment and their primary-step disaster mitigation measures. The dominant role of local government or local administrative office and the lack of community involvement are represented. Fire risk only is targeted, while other risks are ignored such

as the earthquake in Shangli Village. Disaster mitigation measures lay particular stress on disaster response during emergencies far more than on pre-disaster mitigation. Cultural heritage conservation programs lack technical support for better disaster-resistance of historical villages. The PCDCC was examined based on three factors: community asset, community connection, and community participation in disaster-related activities. The PCDCC of Shangli Village is characterized by weak community connection. Oppositely, the PCDCC of Dali Village is characterized by both strong community connection. Benefiting from various community groups and active group activities in Dali Village, their people have a larger network, frequent collective action, and cooperation, various sources of information and active communication within the community, and high sociability. Consequently, they also have an active motivation to develop their own community by themselves. The PCDCC in Dali Village is higher than in Shangli Village. On the whole, the CDCC of Shangli Village is hampered by the lack of integrated planning, disaster training, community activities, and community involvement. Comparatively, the CDCC of Dali Village is hampered by the lack of integrated planning, disaster training, and community involvement.

Based on the research findings, this study proposes the following specific recommendations for CDCC enhancement of historical villages in Southwest China in the context of cultural heritage. **First**, in order to promote the disaster-resistant building improvement in historical villages, this study strongly advocates a multi-hazard risk targeted policy, detailed regulation at the local level, development of new materials and technology targeting historical buildings and villages, multiple channels of financial support, and a technical support platform for historical villages. For local communities, it is necessary to create a historical building database and to continually update in order to grasp the safety and conservation condition. **Second**, to enhance the IDCC in historical villages, this study strongly suggests a local community-based education and training system and a leading role of school in the disaster education and training events within communities. Local governments are expected to support local communities to develop a school-leading disaster education and training system for improving people's inactive participation in disaster education and training activities. On the other hand, it is necessary for the local communities to adjust the emphasis of education and training activities according to their specific shortcomings. **Third**, to enhance the ACDCC, this study strongly recommends a systematic and integrated plan for each historical village adapting to their own conditions. On the other hand, local communities need to improve infrastructures and facilities' availability and to develop the professionality and community involvement of volunteer firefighting troops. **Fourth**, to enhance the PCDCC, this study strongly suggests various community groups and activities' organization in historical villages. Local governments are expected to provide institutional and financial support to encourage the local communities' groups and activities. On the other hand, local communities need to revive various community groups and to develop active group activities.

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LIST OF ABBREVIATIONS AND ACRONYMS

ACDCC	Actual community disaster coping capacity
ADRC	Asian Disaster Reduction Center
CDCC	Community disaster coping capacity
CEA	China Earthquake Administration
CNY	Chinese Yuan
CNR	China National Radio
COSHA	China Occupational Safety and Health Association
CPGPRC	Central People's Government of the People's Republic of China
CTVs	Chinese Traditional Villages
CTVsPDST	Chinese Traditional Villages Preservation and Development Study Center
DIG	Disaster imagination game
EMs	Ethnic Minorities
ERH	Earthquake Relief Headquarters of the State Council
EST	Evacuation simulation training
FDMA	Fire and Disaster Management Agency.
GOSC	General Office of the State Council of the People's Republic of China
ICDTBs	Important Conservation District of Traditional Buildings (Japan)
ICOMOS	International Council on Monuments and Sites
IDCC	Individual disaster coping capacity
IDNDR	International Decade for Natural Disaster Reduction
JSDF	Japan Self-Defense Force
LAOSCPRC	Legislative affairs office of the state council
MOCA	Ministry of Civil Affairs of the People's Republic of China
MOHURD	Ministry of Housing and Urban-Rural Development of the People's Republic of China
MWR	Ministry of Water Resources of the People's Republic of China
NBOS	National Bureau of Statistics of the People's Republic of China
NDRC	National Disaster Reduction Committee of the People's Republic of China
NGO	Non-governmental organization
PAP	People's Armed Police
PCDCC	Potential community disaster coping capacity
PHTsVs	Provincial Historical Towns and Villages
PLA	People's Liberation Army
PRC	People's Republic of China

SAOWS	State Administration of Work Safety
UNISDR	United Nations International Strategy for Disaster Reduction
USD	US Dollar
WH	World Heritage

CHAPTER 1. INTRODUCTION

This chapter presents an overview of the entire dissertation. It includes the background information, the purpose, objectives, methodology, and scope of this research. Based on the literature review, the positioning, originality, and significance of this research were declared. Additionally, this chapter also provides a brief description of the two case historical villages and a brief introduction of each chapter of the dissertation.

1.1 Research background

1.1.1 Cultural heritage and natural disasters

Cultural heritage, which encompasses archaeological and historical built environment and movable heritage (Taboroff, J., 2000), is at risk from multiple hazards, especially in low-income areas. Fires, earthquakes, floods, tsunami, land and mud slides, etc. are among the major causes of not only the loss of human lives but also the loss of irreplaceable cultural heritage properties.

Several natural catastrophes have left a lasting mark on cultural history. The Vesuvius' eruption in Pompeii in 79 A. D. comes to mind in this context, as do the earthquakes in Shaanxi in 1556, Lisbon in 1755, Tokyo in 1649, 1703, and 1923, and San Francisco in 1906; the floods of the Yellow River in 1887 and the Yangtze River in 1911, 1931, and 1998; and the inundation of Florence in 1966 (ICOMOS, 2008). During the last decades, we have witnessed a series of costly disasters that have struck cultural heritages; the capital of Merina Kingdom of Madagascar in the 19th century at the Rova of Antananarivo, which had originally been slated to become the nation's first cultural World Heritage Site but was destroyed by a fire just before the inscription was finalized (Suresh, N. 2015); the 1996 earthquake in Yunnan Province in China, which severely affected the World Heritage city of Lijiang (He, H., et al.,2001); the Wenchuan Earthquake of May 2008, which affected more than half of China, with strong aftershocks continuing to hit the area up to several months, causing huge numbers of casualties and damage to heritage sites across areas of West China, such as Dujiangyan irrigation system and numerous historical settlements; and the Gorkha Earthquake in April 2015 caused extensive damage across areas of Nepal, extending from the mountain villages in Gorkha, through the Kathmandu Valley, the World Heritage sites, to the base camp of Everest.

Although there is a long tradition of devastating disasters that have destroyed irreplaceable cultural assets, awareness of disaster risk reduction is low and memory is short. In developing countries, evidence points to a pattern of higher vulnerability to disasters, but a weak implementation of countermeasures for disaster mitigation. Consequently, negative impacts are exacerbated. Moreover, the harm to cultural heritage further increases because of the absence of sufficient risk estimation, assessment, and reduction measures (Taboroff, J., 2000). Therefore, in order to protect treasured cultural heritages, close attention needs to be paid to the cultural heritage at risk from multiple hazards, especially in low-income countries.

1.1.2 Particular multi-hazard risk in historical villages in Southwest China

The World Heritage Convention offers a definition of cultural heritage which includes monuments, groups of buildings, and sites. The groups of buildings refer to the buildings, which because of their architecture, their homogeneity, or their place in the landscape, are of outstanding universal value from the point of view of history, art, or science (UNESCO, 1972). According to the above definition, groups of buildings may exist in tangible forms of historical cities, towns, and villages.

The safeguard of historical cities and towns against disasters are gradually being emphasized in recent decades. The Washington Charter advocates that historical cities and towns should be protected against disasters and nuisances in order to safeguard the heritage and to protect the security and well-being of the residents. Certainly, whatever a disaster affecting a historic city or town, preventative and repair measures must be adapted to the specific character of the properties concerned (ICOMOS, 1987). However, the historical villages' safety, which is usually threatened by a particularly high multi-hazard risk, are not treated as a concern. Hazard interactions are considered as that a primary hazard triggers or increases the probability of secondary hazards occurring (Gill, J. C., et al., 2014)). For instance, Southwest China, in where various ethnic minorities population have preserved colorful cultural landscape of traditional human settlement, almost all existing Chinese historical villages are located in remote mountainous areas that have no well-developed infrastructure and sufficient traffic capacity. However, Southwest area is also one of the most disaster-prone mountainous areas in China. Thus, historical villages have not only high natural disaster risks such as an earthquake and flood but also a particularly high fire risk that is man-made or triggered by an earthquake and landslides may trigger by an earthquake or heavy rain. In addition, they also face isolation risk due to the traffic disruption during an emergency after a disaster happens. Actually, the isolation situation had occurred during the Wenchuan earthquake which happened in 2008 that a collapsed mountain cut off the roads, resulting in villages located in the deep mountainous area to be isolated and caught in helplessness within "golden hour". Besides, historical villages attract tourists who will be unfamiliar with local conditions and vulnerable in an emergency. Thus, multi-hazard risk should be emphasized since these various risks may separately or jointly affect villages by triggering and intensifying the disaster damages.

Therefore, the conservation approach of historical villages needs to be very concerned not only about heritages' authenticity and integrity but also about heritages' safety that might be threatened by multi-hazard risk. In other words, it can be seen that disaster risk management is also a crucial topic for historical villages' safety and conservation. Public agencies usually take the responsibility of disaster risk management and providing emergency services in cities and towns. However, it is impossible for public emergency services to always be able to provide a timely emergency response to historical villages, which are usually located in remote mountainous areas. Thus, it is remarkably important for these historical villages to develop their disaster coping capacity and to be resilient and able to provide an effective emergency response at the community level.

1.1.3 Significance of the Community Disaster Coping Capacity (CDCC)

As early as 1989, disaster mitigation has been emphasized as a community-based approach. Maskrey A. (1989) pointed out that if the local people could master the process from pre-disaster preparedness, disaster emergency response, to post-disaster recovery phase by themselves and their groups, disaster risk reduction will come into the core of the problem and the approach to solving the problem. The community-based disaster mitigation approach could be understood as "community disaster coping capacity" (CDCC). It represents the comprehensive capacity of a community to cope with disaster around the disaster risk management cycle of pre-disaster preparedness, emergency response, and post-disaster recovery through the cooperation of all community members. However, for a long time, public agencies are relied on and supposed to take full responsibility for disaster risk management, particularly in developing countries. Nevertheless, the limitation of public agencies was clearly realized during the 1995 Great Hanshin-Awaji Earthquake in Japan. Before that, no major earthquake directly struck a large city in Japan after the Great Kanto Earthquake of 1923. Along with the advances in construction technology and so on, it was widely believed that major destruction would not occur in the event of an earthquake. The Great Hanshin-Awaji Earthquake, however, caused the collapse of expressway overpasses and other damages that had been unanticipated and not thought possible (Suganuma, K., 2006). Moreover, the public agencies failed to respond immediately due to staffs' injuries, deaths, and transportation gridlock in the early morning when the earthquake happened. As a result, about two-tenth of the people who were trapped or injured was rescued by firefighters, policemen, or JSDF personnel, while the rest were all saved by themselves and neighbors (Suzuki, T., 2013). The limitation of the public agencies and the importance of the disaster coping capacity within the community were represented. Furthermore, community capacity has been increasingly realized and emphasized not only during the emergency response phase but also in the disaster preparedness, mitigation, and post-disaster recovery phases. The World Conference on Disaster Reduction in Kobe in 2005 promoted the significance of community-based disaster management. One of the eight statements in the Hyogo Declaration on Disaster Reduction declared: "We concur that strengthening community level capacities to reduce disaster risk at the local level is especially needed, considering that appropriate disaster reduction measures at that level enable the communities and individuals to reduce significantly their vulnerability to hazards (Hyogo Declaration on Disaster Reduction, 2005)."

On the whole, it is generally acknowledged that a community's disaster resilience depends not only on the capacity of public agencies but also on the disaster coping capacity of communities themselves. In addition, as stated before, historical villages are usually located in remote mountainous areas and have a particular multi-hazard risk. Thus, community disaster coping capacity (CDCC) can be seen particularly significant to these historical villages not only for the safety of people's lives and property but also for cultural heritages conservation. Therefore, this study focuses on the community disaster coping capacity (CDCC) of historical villages in the mountainous area in Southwest China.

1.2 Research purpose and objectives

1.2.1 Research purpose

From the above-mentioned perspective, the purpose of this study, therefore, is to analyze and clarify the features of the current status of community disaster coping capacity (CDCC) in historical villages in the mountainous areas of Southwest China, in order to contribute to developing specific measures for historical villages' community disaster coping capacity (CDCC) enhancement.

1.2.2 Research objectives

Accordingly, this study concentrates on the following objectives through case study in two historical villages:
(1). To identify the factors which affected the local people's disaster-resistant building improvement activities in the two case historical villages.
(2). To clarify the features of community disaster coping capacity (CDCC) in the two case historical villages in terms of individual disaster coping capacity (IDCC), actual community disaster coping capacity (ACDCC), and potential community disaster coping capacity (PCDCC).
(3). To examine the common features and differences of community disaster coping capacity (CDCC) between the two case historical villages.
(4). To recommend specific measures to enhance community disaster coping capacity (CDCC) in the historical villages in the remote mountainous areas of Southwest China.

1.2.3 Outline of two case historical villages

Southwest China, which has a particularly high multi-hazard risk as stated above, dwells Han ethnic and various ethnic minority groups that have different community conditions. Therefore, this study is carried out in two case historical villages of different ethnic groups. One is a Han ethnic village named Shangli, the other is a typical Dong ethnic village named Dali. Both of these two villages are located in the typical geological circumstance in Southwest China while having similar multi-hazard risk in this area (Figure 1.1).

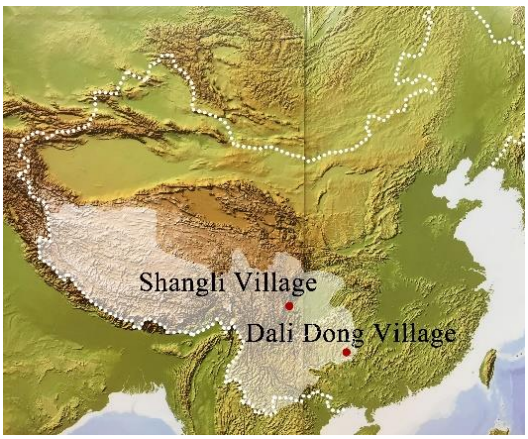


Figure 1. 1 Location of the two case historical villages

(Source: Author, based on the map Atlas of PRC, 2009)

Shangli Village in Sichuan Province, which is a Han ethnic village, is the closest existing historical village to the epicenters of the 2008 and 2013 earthquakes. Located 168 km away from Chengdu, Sichuan's provincial capital, Shangli was an ancient post town along the South Silk Road and has a history of more than 300 years. Since the Tea-Horse trade along the South Silk Road declined when modern transportation was developed, the village has mainly subsisted on farming for generations. Afterward, with the rise of tourism and migrant labor from about two decades ago, Shangli Village restarted doing business. Shangli Village is composed of 280 households and a total population of 1099 in 2013. 70% of the economic income of the village comes from tourism, 20% comes from migrant labor, and only 10% comes from agriculture. On the other hand, Shangli Village has a multi-hazard risk of earthquake, flood, and fire. The detailed information of disasters and resultant damages is presented in chapter 3.

Dali Village, which is a Dong ethnic minority village, located in the southeast autonomous prefecture of Miao and Dong Minority in Southeast Guizhou. Dali Village was established during the 1730s and is one of the 20 Dong villages in China's World Heritage Tentative List. At present, Dali Village has 309 households and 1,308 Dong ethnic minority residents in 2016. Most of the local people's livelihoods are relying on traditional terrace agriculture, some of them go out of the village to work as migrant workers in recent years. Based on traditional consanguineous and geographical relation, community affairs used to be organized by a group of respected elder men (this is called "Zhailao system"), according to the conventional regulation of "Dong Kuan," which governs the villagers' behaviors in all aspects of daily life and productive activities. The village committee started to manage community affairs from 1949. Dali Village has a multi-hazard risk of fire, landslide, and flood. In particular, Dali Village is severely threatened by fire risk due to the high density of traditional wooden buildings. The detailed information of disasters and resultant damages is presented in chapter 4.

1.3 Research methodology

1.3.1 Community Disaster Coping Capacity (CDCC) assessment framework

This research proposes an integrated framework of CDCC (Table 1.1). In this framework, CDCC can be explained by individual disaster coping capacity (IDCC), actual community disaster coping capacity (ACDCC), and potential community disaster coping capacity (PCDCC). The detailed definition and explanation of the factors, components, and sub-components are elaborated in Chapter 5.

1.3.2 Research methods

In order to deal with the objectives and research content, the following research methods are used:

(1) Method of field survey: This is the key method of the study in which the data are collected by means of interviews, structured interviews, questionnaire, observations, and measurement surveys. Whereby, the disaster history, people's response, as well as the factors of IDCC, ACDCC, and PCDCC in each case village

Table 1. 1 Proposed framework of CDCC

	Components		Sub-components
Individual Disaster Coping Capacity (IDCC)	Individual risk awareness		Understanding of disaster risk
			Disaster damage estimation
	Individual disaster preparedness		Individuals' building improvement
			Other preparedness measures
	Individual potential responding ability		Knowledge of emergency action
			Awareness of facilities location and usage
Actual Community Disaster Coping Capacity (ACDCC)	Disaster risk reduction planning		
	Community disaster mitigation organization		
	Disaster mitigation measures	Pre-disaster risk reduction measures	Government's building improvement
			Disaster risk inspection
			Organization of disaster education
		Initial stage response measures	Disaster alarm and information transmission
			Facilities inspection and maintenance
			Organization of disaster response training
		Damage control measures	Village improvement for damage control
			Sufficient facilities and other resources
		Evacuation measures	Evacuation route and evacuation site
			Evacuation training
Potential Community Disaster Coping Capacity (PCDCC)	Community asset		Community organizations and management
			Community events and collaboration work
	Community connection (Social capital)		Groups and networks
			Trust and solidarity
			Collective action and cooperation
			Information and communication
			Social cohesion and inclusion
			Empowerment and political action
	Community participation in disaster-related activities		People's participation in disaster education and training
			Participation willingness for disaster-related activities

are recognized. These data are the main source of materials for this thesis, which were collected through four field surveys from 2014 to 2016 (Table 1.2).

In the first field survey, which was implemented in June 2014, Shangli Village's basic information was observed, measured and drawn to have an overview of the characteristic of Shangli Village. In addition, disaster history, as well as community asset of Shangli Village, were overviewed through interviews with village leaders and villagers. The second field survey was conducted from September to October 2014, during which, building damage caused by recent disasters and disaster mitigation measures taken by local agencies were investigated through structured interviews with village leaders. In addition, IDCC components were investigated through a questionnaire survey. During the third field survey, which was implemented from July to August 2015, Shangli Village's ACDCC and PCDCC components were investigated through questionnaire surveys. A supplementary survey on IDCC was also conducted. In addition, Dali Village's basic information, as well as IDCC, ACDCC, PCDCC components were all investigated by observing, measuring, and conducting structured interviews with village leaders and villagers. The fourth field survey was implemented in February 2016. A supplementary survey on part of Shangli Village's ACDCC and PCDCC components was completed. In Dali Village, disaster damage and people's response, community disaster-related organization, disaster mitigation measures, and community connection were investigated through structured interviews with village leaders and villagers (Table 1.2).

Table 1. 2 Outline of field surveys

Factors	(Basic data)			IDCC			ACDCC				PCDCC		
Components	Spatial feature	Building types	Disaster history	Risk awareness	Disaster preparedness	Potential responding ability	Disaster risk reduction planning	Community disaster-related organization	Disaster mitigation measures		Community asset	Community connection	Community participation in disaster-related activities
Shangli													
Dali													
Methods	Structured interviews, questionnaires, observations, and measurement surveys												

1st field survey (June 2014) 2nd field survey (Sep.-Oct. 2014)
3rd field survey (July-Aug. 2015) 4th field survey (Feb. 2016)

Since in this study data collection was collected four times in two case villages targeting complicated issues, the detailed information about sample size and sampling strategy of each investigation activities are separately explained in later chapters.

(2) Method of using available secondary data: In addition to the primary data collected by means of field surveys, this study also used data from the damage report, which was made by the administration of Shangli Town, as well as from previous research on the disaster risk in Southwest China, on Dong ethnic minority and on the fire risk of Dong villages.

(3) Method of information process: The data collected from field surveys and available secondary data were synthesized according to the proposed CDCC assessment framework by a quantitative or a qualitative approach. The essential data and information are showed in the form of graphs, tables, and maps. In addition, the analyses of each CDCC component in both villages are compared in a quantitative or a qualitative way.

1.4 Research scope

The community disaster coping capacity (CDCC) enhancement relies on disaster risk reduction measures during the pre-disaster period and disaster-resistance improvement measures during the post-disaster recovery period. In other words, CDCC enhancement is based on preparing for better response and building back better. Therefore, this study recognizes the CDCC of two case villages through their disaster-resistance improvement measures in the pre-disaster phase and post-disaster recovery phase.

1.5 Literature review and research originality

1.5.1 Cultural heritage and disasters

The realization that multi-hazard risk is threatening cultural heritages is still not widespread. Some studies put much effort into clarifying the impact of disasters on cultural heritages and disaster preparedness. Taboroff, J. (2000) summarized the disasters' impacts on cultural heritages, including particularly disasters'

impacts on historical settlements (Table 1.3). Cultural heritage is highly vulnerable to natural disasters, and current risk management mechanisms can not meet the growing and overlooked needs of mitigation. This study recommended that a support program will result in significant cost savings not only to governments but also to the insurance industry, to individuals, etc. In addition, priority actions are listed, such as creating national inventories of historical heritages, identifying higher risk sites for priority action, drawing up emergency preparedness plan, and allocating resources for planning and implementation of management systems. Taboroff, J. (2003) also pointed out that many countries are not convinced that disaster preparedness is a priority. Few countries have developed comprehensive disaster management plans and institutional system. Although many cultural institutions in developing countries have their own emergency plans, they usually focus on fire, not other types of disasters.

Stovel, H. (1998) stated the importance and principles of risk-preparedness for cultural heritage. The study described a planning framework for risk-preparedness (Table 1.4) and gave detailed measures for responding fire, earthquakes and related disasters, flooding, armed conflict, and other hazards. Regarding a historical cities, towns or villages, this study emphasized on that the community development without guidance can easily exacerbate hazards. Therefore, the best way to avoid possible conflicts and damage is to try to anticipate the dilemmas that might accompany a disaster and to establish and implement clear recovery or risk-preparedness guidelines before a coming disaster. Kreimer, A., et al. (2003) pointed out that cultural heritage is often an afterthought to the emergency response in developing countries, while some countries have few resources to devote to preserving cultural heritage. In the wake of increased awareness is slowly spreading, governments and communities may begin to see the value of preserving cultural heritage for present and future generations.

Table 1. 3 Disasters' impacts on historical settlements

	Damage to historical settlements	Causes
Fire	Burning of buildings and their contents	Fire
	Structures, interior finishes, and objects	Heat smoke and combustion byproducts
	Water damage	Firefighting
Flood	Collapse or movement of buildings and their contents	Force of water flow, soil erosion, detachment of connected elements, inundation, humidity
	Damage to municipal infrastructure	
Earthquake	Structural collapse and damage	Lateral forces transmitted to buildings
	Component structures and objectives	Land and mud slides and avalanches (mountainous or hilly regions)
	Infrastructure and transport systems	

Source: Author, based on Taboroff, J., 2000

Table 1. 4 Disaster preparedness planning for cultural heritage

Phases	Planning for disaster-preparedness
Preparedness phase	Reducing risk at source Reinforcing the ability of a property to resist or contain the consequences of the disaster Providing adequate warning of impending disaster Developing emergency response plans.
Response phase	Ensuring availability of the response plan Mobilizing the conservation team
Recovery phase	Mitigating the negative consequences of the disaster Rebuilding the physical components and the social structure of those using the property and its community Reinstating and enhancing preparedness measures

Source: Author, based on Stovel, H., 1998

1.5.2 Historical settlement and disasters

So far, although the fire protection of historical buildings is an established research topic, it is a relatively new concern to extend the scope to multi-disaster risk management in historical settlements.

Some studies focused on the indigenous wisdom of disaster mitigation in historical settlements in Japan and China (Okubo, T., 2012; Kaneko, Y., et al., 2013; Chen, Z., 2004; Ruan, Y.S., 2013; Qi, J., 2013; Tang, Y., 2015; Liao, J.X., 2012; Liao, J.X., 2013; Zhou, B., et al., 2012; Nakamura, K. & Yamada, M., 1998; He, Y., & Kuroda, N., 2014). However, only fire risk is targetted. For instance, they analyzed fire prevention and mitigation measures in historical settlements, including traditional firefighting organization, regional firefighting cooperation, and firefighting water system.

Some studies concentrated on disaster damages, risk identification, risk assessment, and countermeasures in historical settlements in China, Turkey, Thailand, Korea, and Japan (Zhang, H., 2014; Liu, H.T., 2012; Selen, D., 2011; Maruchi, H. & Hata, S. 1996; Akinciturk, N., & Kilic, M., 2004; Lee, J., 2011; Wang, D. & Liu, K., 2015; Huang, Y., 2013; Hong, C., 2015; Xing, Y., 2007; Yin, S., 2009; Wang, H. & Fang, D., 2010; Li, H. 2011; Aburano, M. et al., 2004). However, most of these studies still focused on fire only and a few targeted geological disasters. For instance, several studies identified the fire safety hazards in Chinese ancient dwellings or villages and proposed countermeasures. In addition, Zhang, H. (2014) conducted a research on safety and prevention system of geological disaster in traditional mountainous villages in China and proposed a disaster prevention and mitigation planning system.

Some studies targeted technical development for disaster mitigation of historical buildings including building technology, civil engineering technology, and information communications technology (Zhang, Z. J., 2007; Zhang, Z.J., & Mei, X., 2010; Yamazaki, M., 2013; Suzuki. Y., 2013; Itsuno, K., et al., 2013; Kawai, M., 2013). These studies introduced various technical measures for historical building protection against fire risk, earthquake, landslide, and flood. In addition, Kawai, M. (2013) introduced information communications technology for culture heritage disaster mitigation.

Some studies focused on community involvement for disaster risk reduction in historical settlements (Okubo, T., 2013; Ochiai, C., 2012; Otsuki, C., et al., 2008; Ogawa, K., et al., 2013). These studies focused on community mutual-help disaster risk management in Japanese historical villages and on developing community-based disaster risk reduction activities in Japan, such as disaster imagination game (DIG) and evacuation simulation training (EST). In addition, the community-involved disaster mitigation measures targeting tourists were also concerned.

Based on the literature review stated above, the current status of the research on disaster risk management in historical villages still has the following three shortcomings.

(1) Most of the previous studies focused on historical cities, not much study paid attention to these historical

villages. However, as a kind of irreplaceable heritage, the historical villages in the remote mountainous areas tend to have a higher risk of suffering serious damage from disasters.

(2) The previous studies of disaster mitigation in historical settlements are mainly focusing on fire. There is a need to address a range of disasters since that remote historical village is threatened by a multi-hazard risk due to their geological condition and inherent vulnerability.

(3) No study has comprehensively evaluated pre-disaster preparedness for emergency response in historical villages. The current status of their disaster preparedness and possible emergency response ability should be evaluated in order to grasp the shortcomings and provide references to community disaster coping capacity enhancement.

1.5.3 Positioning, originality, and significance of this research

This research can contribute to the following three aspects.

(1) Focusing on historical villages' disaster risk reduction.
(2) Targeting multi-hazard risk that historical villages are facing.
(3) Evaluating the current status of community disaster coping capacity (CDCC) in historical villages.

On the whole, this study focuses on analyzing and clarifying the features of the current status of community disaster coping capacity (CDCC) in historical villages in the mountainous areas of Southwest China in order to contribute to developing specific measures for CDCC enhancement in the context of cultural heritage.

1.6 Research framework and dissertation structure

The dissertation is divided into four parts and nine chapters as presented in Figure 1.2. The main content of each part and chapter is described as follows:

PART 1: INTRODUCTION

Part 1 contains chapters 1 and 2. It provides an overview of the dissertation and draws a multi-hazard risk and institutional background of disaster risk management in Southwest China.

Chapter 1: Introduction

This chapter presents an overview of the entire dissertation. It includes the background information, the purpose, objectives, methodology, and scope of this research. Based on literature review, the positioning, originality, and significance of this research are declared. Additionally, this chapter also provides a brief description of the two case historical villages and a brief introduction of each chapter of the dissertation.

Chapter 2: Multi-hazard risk and institutional background of disaster risk management in Southwest China

This chapter presents an overview of the multi-hazard risk in Southwest China, in particular, high risk and vulnerability in rural areas. Additionally, this chapter draws an overview of the institutional background, including organizational, legal, planning, strategy system of disaster risk management in China. Moreover, the institutional gap between disaster risk management between urban and rural areas and primary practice of community-based disaster risk management in China are also presented.

PART 2: PEOPLE'S BUILDING IMPROVEMENT RESPONSE TO MULTI−HAZARD RISK

Part 2 includes chapters 3 and 4. The residential buildings, which are the main components of the cultural property in a historical village, are also the major risk-bearing body. Therefore, the disaster-resistance of these historical buildings can be considered as the core of the disaster mitigation strategy. This part analyzes and discusses the people's building improvement response to multi-hazard risk in two case historical villages and identifies the factors that affected people's building improvement response.

Chapter 3: People's building improvement response to multi-hazard risk in Shangli Village

This chapter focuses on the people's post-disaster building improvement response to various hazard risk in historical Shangli Village. It analyzes residents' building repair and retrofit activities and identifies the factors that affected people on their repairing and retrofitting after an earthquake and floods. Additionally, recommendations for better disaster-resistant building improvement are considered based on the research findings.

Chapter 4: People's building improvement response to multi-hazard risk in Dali Village

This chapter focuses on the local people's pre-disaster building improvement response to multi-hazard risk in historical Dali Village. It analyzes local government's and residents' disaster-resistant building improvement activities responding to the multi-hazard risk of fire, landslides, and floods. Additionally, it identifies the factors that affected people on their response. Based on the research findings, recommendations are provided for better disaster-resistant building improvement.

PART 3: CURRENT STATUS OF COMMUNITY DISASTER COPING CAPACITY (CDCC) IN HISTORICAL VILLAGES

Part 3 involves chapter 5, 6, 7, and 8. This part focuses on the current status of community disaster coping capacity (CDCC) in two case historical villages. It gives a definition of CDCC based on reviewing the previous studies. Hereafter, it separately analyzes the individual disaster coping capacity (IDCC), actual community disaster coping capacity (ACDCC), and potential community disaster coping capacity (PCDCC).

Chapter 5: Definition of community disaster coping capacity (CDCC)

This chapter gives a definition of community disaster coping capacity (CDCC) and proposes a CDCC assessment framework for the case villages, using individual disaster coping capacity (IDCC), actual community disaster coping capacity (ACDCC), and potential community disaster coping capacity (PCDCC).

Chapter 6: Individual disaster coping capacity (IDCC)

This chapter presents a detailed analysis of IDCC in the two case historical villages through three components: individuals' risk awareness, disaster preparedness, and potential responding ability. Based on the results, a comparative discussion on the features of IDCC between the two case villages is presented.

Chapter 7: Actual community disaster coping capacity (ACDCC)

This chapter presents a detailed analysis of ACDCC in the two case historical villages through three components: disaster risk reduction planning, community disaster mitigation organization, and disaster mitigation measures. Then, a comparative discussion on the features of ACDCC between the two case historical villages is presented.

Chapter 8: Potential community disaster coping capacity (PCDCC)

This chapter presents a detailed analysis of PCDCC in the two case historical villages through three components: community asset, community connection, and community participation in disaster-related activities. Then, a comparative discussion on the features of PCDCC between the two case historical villages is presented.

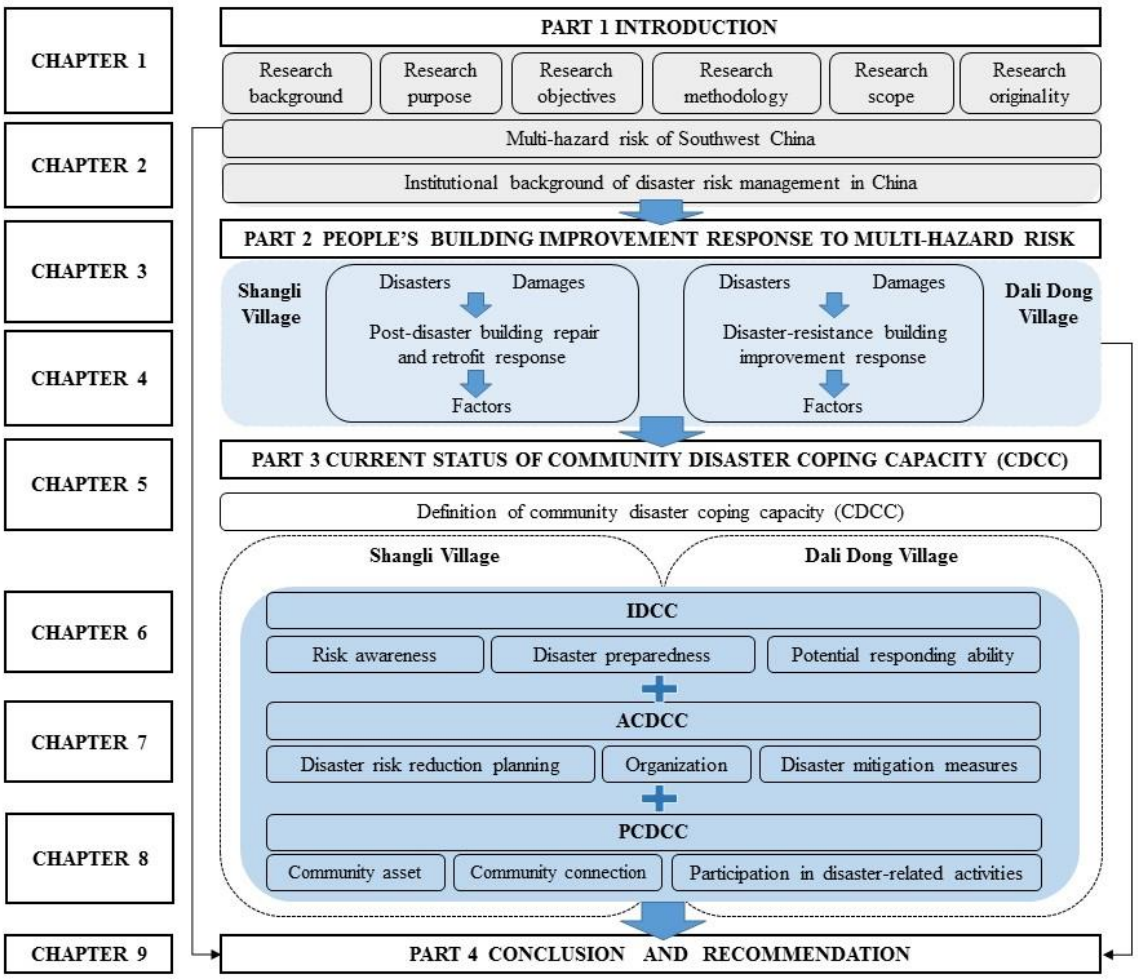


Figure 1. 2 Research framework of dissertation

PART 4: CONCLUSIONS AND RECOMMENDATIONS

Part 4 contains chapter 9. It summarizes the findings of the entire dissertation and provides recommendations for the community disaster coping capacity (CDCC) enhancement in historical villages of different ethnic groups.

Chapter 9: Conclusions and recommendations

This chapter summarizes each chapter, highlighting the common features and differences of community disaster coping capacity (CDCC) in the two case villages and provides recommendations for enhancement of CDCC in the historical villages in the remote mountainous areas of Southwest China.

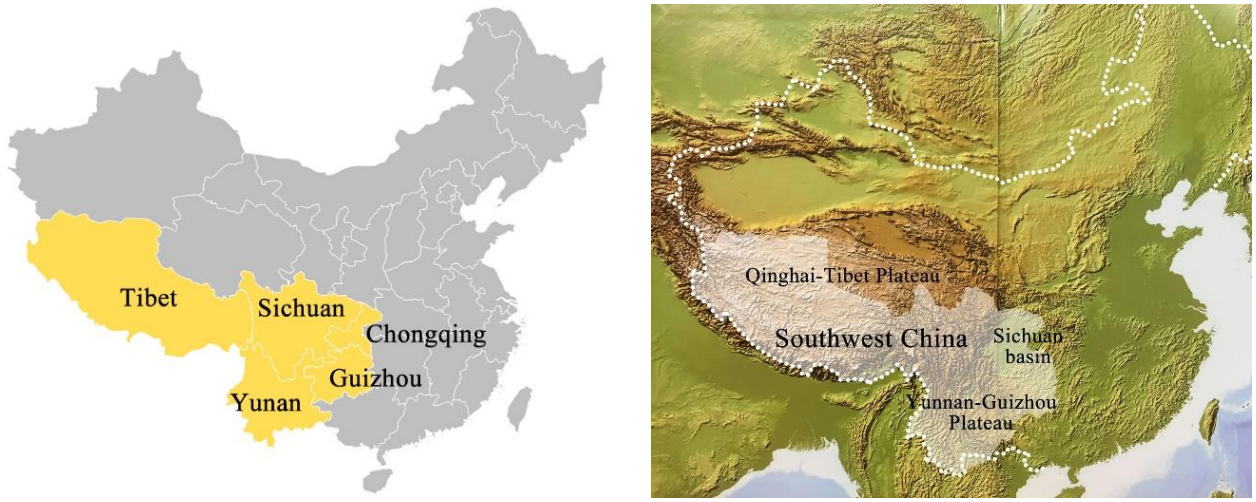
CHAPTER 2. MULTI-HAZARD RISK AND INSTITUTIONAL BACKGROUND OF DISASTER RISK MANAGEMENT IN SOUTHWEST CHINA

This chapter presents an overview of the multi-hazard risk in Southwest China, in particular, high risk and vulnerability in rural areas. Additionally, this chapter draws an overview of the institutional background, including organizational, legal, planning, strategy system of disaster risk management in China. Moreover, the institutional gap between disaster risk management between urban and rural areas and primary practice of community-based disaster risk management in China are also presented.

2.1 Historical villages in Southwest China

Southwest China[1] refers to the five Provinces of Yunan, Guizhou, Sichuan, Chongqing and Tibet (Figure 2.1(a)). It generally includes the Sichuan basin, Yunnan-Guizhou Plateau, and the south region of Qinghai-Tibet Plateau in terms of the geographical district (Figure 2.1(b)).

Han, which is an ethnic group native to East Asia (Li, X.B., et al. 2015), accounts for approximately 92% of the population of Mainland China. The others are 55 ethnic minorities. As the table 2.1 shows, Southwest China, dwells 34.22% of the nation's ethnic minorities population, constitute 18.67% of the local population. In particular, Tibet, Guizhou, and Yunnan, the ethnic minorities population account for 93.94%, 37.84%, and 33.42% of the local population.



(a) Administrative area of Southwest China (b) Geographical feature of Southwest China

Figure 2. 1 Southwest China

(Source: Author, based on the map Atlas of PRC, 2009)

[1] According to *The People's Government Committee Organization of Administrative Areas*, which was issued on Dec. 16, 1949, the mainland of China was divided into six administrative areas: North China, Northeast China, East China, South Central China, Southwest China, and Northwest China. Southwest China includes five Provinces:Yunan, Guizhou, Sichuan, Chongqing and Tibet (Zhang, J.P., et, al. 1992). Though the administrative offices were abolished on Nov. 1954, the six divisions are still in use.

Table 2. 1 Ethnic minorities (EMs) population in Southwest China

Area	Total Population	Population of EMs	Proportion of EMs (%)
East China	358,849,244	2,499,256	0.70
South Central China	350,658,477	29,563,571	8.43
Southwest China	**193,085,172**	**36,044,788**	**18.67**
Yunnan	42,360,089	14,158,815	33.42
Guizhou	35,247,695	13,336,008	37.84
Sichuan	82,348,296	4,118,599	5.00
Chongqing	30,512,763	1,973,607	6.47
Tibet	2,616,329	2,457,759	93.94
North China	145,896,933	8,716,190	5.97
Northeast China	104,864,179	10,944,334	10.44
Northwest China	89,258,221	17,457,975	19.56
China	1,245,110,826	105,337,818	8.46

(Source: Author, based on the basic data referenced to NBOS, 2000)

Southwest China, whose modern development was relatively limited by low transportation capacity due to the geographical conditions, lives various ethnic minorities population and preserved colorful cultural landscape of traditional human settlement. The Chinese Traditional Villages (CTVs) are the historical villages registered by the Ministry of Housing and Urban-Rural Development of PRC (MOHURD) from 2012, because of their well-preserved eco-environments, clans and branches, village landscapes, cultural characteristics, etc. These CTVs are the representative of the cultural landscape of Chinese historical villages and are distinct from other villages' cultural landscape or agricultural landscape domestically and abroad. In the context of local cultural traditions, local people have created various architectural systems with distinct vernacular characteristics, which represent a perfect integration of humanity and nature and reflect the local peoples' principle of adapting themselves to nature for survival and development. On the other hand, these historical villages are living examples of cultural anthropology, which preserved a wealth of cultural information thanks to its large number of tangible and intangible cultural heritages. The CTVs in Southwest China accounts for 43% of all CTVs in the whole country (Table 2.2).

Table 2. 2 Chinese Traditional Villages (CTVs) in Southwest China

	1st batch (2012)	2nd batch (2013)	3rd batch (2015)	Total amount
Yunnan	62	232	208	502
Guizhou	90	202	134	426
Sichuan	20	42	22	84
Chongqing	14	2	47	63
Tibet	5	1	5	11
CTVs in Southwest China	191	479	416	1086
CTVs	646	915	994	2555
Proporation	30%	52%	42%	43%

(Source: Author, based on the historical village albums (CTVsPDST, 2015) published in 2012, 2013, and 2015)

Table 2. 3 Geographical features of five provinces of Southwest China

Area	Mountainous area	Plateau	Hilly area	Intermountain area or basin	Plain
Yunnan	84.0%	10.0%		6.0%	0%
Guizhou	61.7%		30.8%	7.5%	0%
Sichuan	77.1%	4.7%	12.9%	5.3%	0%
Chongqing	75.8%	0%	18.2%	6.0%	0%
Tibet	0%	100%	0%	0%	0%
China	26%	33%	10%	19%	12%

(Source: Author, based on the basic data referenced to Atlas of China geography, 2011)

2.2 Multi-hazard risk in the mountainous Southwest China

Located between the most powerful tectonic belts of Pacific and Tethys Himalaya, China is a mountainous country. 33% of the mainland is plateau areas, 36% is mountainous and hilly areas, 19% is intermountain area or basin, and plain area accounts for only 12% (Editorial committee of Atlas of China geography, 2011). In particular, Southwest China is a geologically uplifted area between Qinghai-Tibetan Plateau in the west and the basins, plains, and hills in the mid-east region (Figure 2.1(b)). More than 90% of Southwest China is covered by plateau, mountainous or hilly area. The rests are intermountain area or basin (Table 2.3).

China is a populous agricultural country, who has low capacity to withstand disasters, is one of the few countries that are most prone to natural disasters in the world (Gao, Q.H., 2003; Shi, P.J., 1995). The geological disasters in China mainly happen to the transitional area between the first and the second geographical ladders and between the second and the third geographical ladders (Figure 2.2). Yunnan, Sichuan, Guizhou, Chongqing in Southwest China, and Hubei, Shaanxi, Beijing are most prone to serious geological disaster risk, such as earthquakes, collapses, landslides, mudslides, heavy rains, flash floods frequently occur to the mountainous area (Gao, Q.H., 2003). In particular, Southwest China and Northwest China, which sited on seismic zones such as Himalayas, Xianshui River, Hong River, and the Longmenshan, are most prone to earthquakes (Wang, Z., et al., 1995; Gao, Q.H., 2003). According to the earthquake database recorded by China Earthquake Data Center, during 50 BC to 1989, the earthquakes (≥M 7.0) frequently happened to Southwest China and Northwest China (Table 2.4). During the recent 24 years, the frequency of earthquake which happened to Southwest China accounts for almost half of the earthquakes in the whole country; the death in this area takes up 96%, the injured population takes up 91% in the whole country (Table 2.5). Thus, it can be seen that Southwest China has a high risk and severe vulnerability to geological disasters.

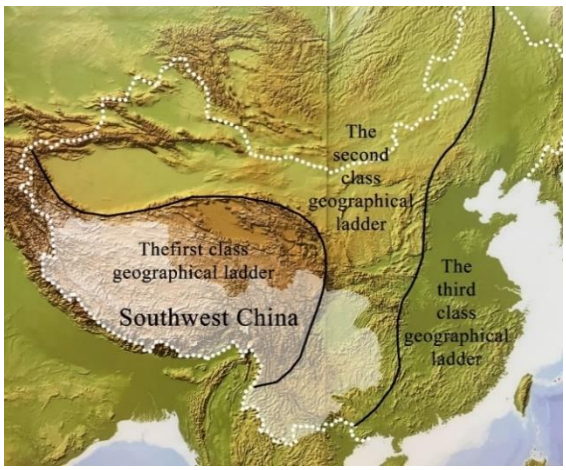


Figure 2. 2 Three geographical ladders in China

(Source: Author, based on the map Atlas of PRC, 2009)

Table 2. 4 Recorded earthquakes (≥M 7.0) from 50 BC to 1989

Frequency	17 times	12 times	11 times	10 times	5-9times	1-4times
Epicenters	Xinjiang	**Sichuan Yunnan**	Gansu	**Tibet**	Shangdong, Hebei Shanxi Ningxia	Jilin, Qinghai, Inner Mongolia Guangdong, Heilongjiang, Shannxi, Liaoning, Henan, Hainan, Fujian

(Source: Author, based on China Earthquake Data Center)

Table 2. 5 Earthquake damages from 1990 to 2014

	Frequency	Death	Injured	Economic loss (100 million)
Sichuan	39(13%)*	69,488(94%)	391,146(82%)	9,242.23(87%)
Yunnan	75(25%)	1,186(2%)	44,618(9%)	546.51(5%)
Tibet	18(6%)	14(<1%)	181(<1%)	33.79(<1%)
Chongqing	5(2%)	0(0%)	81(<1%)	1.83(<1%)
Guizhou	2(1%)	6(<1%)	10(<1%)	—
China	301	74,099	474,968	10,605.81

* The number inside the brackets refer to the proportion in China

(Source: Author, based on the following references)

1990-1995: (Monitoring & Forecasting of CEA, 1996)
1996-2000: (Monitoring & Forecasting of CEA, 2000)
2001-2005: (Monitoring & Forecasting of CEA, 2010)
2006: (Chinese Earthquake Administration, 2007)
2007: (Chinese Earthquake Administration, 2008)
2008: (Chinese Earthquake Administration, 2012)
2009: (Zheng, T.Y. et al., 2010)
2010: (Zheng, T.Y. et al., 2011)
2011: (Zheng, T.Y., & Zheng, Y., 2012)
2012: (Zheng, T.Y., & Zheng, Y., 2014)
2013: (Zheng, T.Y., & Zheng, Y., 2015)
2014: (Zheng, T.Y. et al., 2015)

2.3 Particularly high risk and vulnerability in rural areas of Southwest China

Of the loss caused by earthquakes which happened to an urban area, consequential loss and social loss become increasingly major rather than housing damage loss. According to the RMS' s (Risk Management Solution Inc.) simulation, if the 1923 earthquake strikes Tokyo again (in 1995), more than half of the total loss would be caused by business interruption and infrastructure damage, exceeds the building loss, which would be less than 50% (Bendimerad, F., 1995). Therefore, considering the concentration of population, wealth, infrastructure, and buildings in urban area, the disaster risk reduction management studies prefer to focus on cities rather than rural area. However, rural areas in China are higher seismic frequency region. In particular, based on Wang's statistical analysis, most of the counties in the western provinces such as Sichuan, Yunnan, Xinjiang, and Tibet, etc. experienced destructive earthquakes. The probability of earthquake occurred in counties is larger than that in cities of China. Of the 16 earthquakes above magnitude 8.0 which happened in the Mainland China in history (before 2005), only the Tangshan earthquake happened to the urban area, the other 15 earthquakes happened in rural areas (Wang, Y., et al., 2005). In 2008, the Sichuan earthquake of magnitude 8.0 happened to the mountainous rural area again.

Moreover, of the total loss caused by 109 earthquakes which happened during 1990 to 2000 in Mainland China, the building loss accounts for 70% to 90%, and even 100% (Wang, Y., et al., 2005). In particular, different from urban areas, residential buildings in rural areas are the major risk-bearing bodies of the earthquakes. Different from in the urban area, the seismic resistance of residential buildings in the undeveloped rural area is very poor due to the problematic design and construction, according to the investigation on the residential buildings in about 200 villages around seven provinces (Gao, Y.X., 1995). Gao (1995) found that most residential buildings in rural areas at present are adobe or brick house, after experiencing an upsurge of transformation, but almost of them neglected to guard against disaster risks (Gao,

Y.X., 1995). On the whole, the disaster risks and vulnerability extremely threatening the safety of rural area in Southwest China.

The historical villages in Southwest China have a particularly high fire risk. Traditional buildings were almost built by wooden material since time immemorial, adapting to the limited flat land and local resources in the mountainous environment, the historical villages in Southwest China are tending to present compact layouts. In addition, native people in the rural areas in Southwest China has a custom of using open fire for cooking and heating during the daily lives. Some areas still follow the traditional way even nowadays.

Table 2. 6 Major accidental fires which happened in historical villages in China from 1999

Year	Date	Name (Province)	Ethnic group	Burnt houses	Destroyed houses	Affected households	Casualty	Note	Resources
1999	0227	Xiaohuang(Guizhou)	Dong	172	-	142	0	CTVs	(Liao, J.X., 2013)
	0308	Diping(Hunan)	Dong	120	-	120	3	-	
2003	0306	Luanli(Guizhou)	Dong	56	-	89	0	-	
2005	0719	Dudongtun(Guangxi)	Dong	249	19	268	0	-	
	0910	Judong(Guizhou)	Dong	79	-	79	3	CTVs	
2006	0403	Guloutun(Guangxi)	Dong	294	-	147	0	-	
	0414	Dimen(Guizhou)	Dong	39	29	68	1	CTVs	
2007	0213	Wanzhai(Guizhou)	Dong	140	-	140	0	-	
	0918	Dayuntun(Guangxi)	Dong	89	23	112	0	-	
	1102	Ganchongtun(Guangxi)	Dong	209	-	209	0	-	
	1201	Tangan(Guizhou)	Dong	21	-	21	0	CTVs	
	1220	Jiaya(Guangxi)	Dong	40	4	44	2	-	
2008	1205	Gaochuan(Guizhou)	Dong	29	-	29	0	-	
2009	0319	Chaoli(Guizhou)	Dong	5	-	5	1	CTVs	
	0408	Xiaohuang(Guizhou)	Dong	8	6	14	0	CTVs	
	0510	Zhiliaotun(Guangxi)	Dong	68	69	137	0	-	
	0721	Maoping(Hunan)	Miao	24	7	31	0	-	Hunan*1
		Xijiang(Guizhou)	Miao	1	0	1	0	CTVs	Xinhua*2
	1007	Gaozeng(Guizhou)	Dong	36	14	50	0	-	(Liao, J.X., 2013)
	1106	Linluetun(Guangxi)	Dong	196	-	196	5	-	
2011	1023	Zaibie(Guizhou)	Miao	75	0	75	0	-	CNR*3
	1210	Yachan(Guizhou)	Dong	37	-	37	0	-	(Liao, J.X., 2013)
2012	0110	Longji(Hunan)	Dong	16	-	16	0	-	
	0213	Luotuan(Hunan)	Dong	71	22	500	0	-	
	0309	Shangxiang(Hunan)	Dong	41	-	41	0	-	
	0707	Gengtou(Hunan)	Dong	13	-	13	0	-	
2013	0311	Lijiang(Yunnan)	Naxi	13	-	13	0	WH	Renmin*4
	0715	Wusuo(Guizhou)	Miao	200	-	200	0	CTVs	Gov*5
2014	0125	Baojing(Guizhou)	Dong	148	-	290	0	CTVs	Gov*6
	0111	Dukezong(Yunnan)	Tibetan	343	-	246	0	PHTsVs	Renmin*7
	0406	Lijiang(Yunnan)	Naxi	10	-	10	0	WH	Renmin*8
	1212	Jiuji(Guizhou)	Miao	60	-	176	0	CTVs	News China*9
2015	0103	Wengnong(Guizhou)	Dong	14	6	20	0	-	Xinhua*10
2016	0220	Wenquan(Guizhou)	Miao	60	-	120	0	PHTsVs	Renmin*11

(Source: Author, based on Liao, J.X., 2013, and the following references:)
*1 http://www.hnt.gov.cn/ztzl/mlxc/fpc/201509/t20150923_1967360.html (accessed on April 22, 2016)
*2 http://www.gz.xinhuanet.com/2008htm/xwzx/2009-07/21/content_17162540.htm (accessed on April 22, 2016)
*3 http://china.cnr.cn/ygxw/201110/t20111029_508700101.shtml (accessed on April 22, 2016)
*4 http://politics.people.com.cn/n/2014/0407/c70731-24838619.html(accessed on April 22, 2016)
*5 http://www.gov.cn/jrzg/2013-07/17/content_2449374.htm(accessed on April 22, 2016)
*6 http://www.gov.cn/jrzg/2014-01/27/content_2576837.htm(accessed on April 22, 2016)
*7 http://travel.people.com.cn/GB/139035/373547/(accessed on April 22, 2016)
*8 http://politics.people.com.cn/n/2014/0409/c70731-24857598.html(accessed on April 22, 2016)
*9 http://news.china.com.cn/2014-12/13/content_34309870.htm(accessed on April 22, 2016)
*10 http://news.xinhuanet.com/2015-01/04/c_1113870073.htm(accessed on April 22, 2016)
*11 http://culture.people.com.cn/n1/2016/0224/c22219-28144669.html (accessed on July 20, 2016)

Moreover, the original electrical networks, which was assembled during the 1980s in the rural areas of Southwest China, gradually running out of capacity, in a wake of modern electrical facilities and appliance became universal during the recent 50 years (Xie, Y., 2014). Accidental fire increasingly happens due to low-capacity electrical network and local people's electrical misoperation on the aged wiring system. On the other hands, located on the hillsides, historical villages usually lack sufficient water resources and firefighting facilities for local people to rescue themselves at the prime time. Thus, these historical villages are extraordinarily threatened by fire risk. Table 2.6 shows the 33 major accidental fires which happened in historical settlements in China from 1999. The affected historical villages include ten Chinese Traditional Villages (CTVs), two Provincial Historical Towns and Villages (PHTsVs), one village on the World Heritage Tentative List, and one World Heritage city which experienced two accidental fires. Of these accidental fires, 61% happened in Southwest China. The fires caused not only the loss of cherished historical buildings and landscapes but also considerably disrupted the communities' socio-cultural environment. From this, it can be seen that the historical villages in Southwest China have a particularly high fire risk.

2.4 The institutional background of disaster risk management in China

This section introduces an overview of the institutional background of disaster risk management in China in terms of three aspects: organizational system, legal system, and planning and strategy system. Additionally, the institutional gap of disaster risk management between urban and rural areas and primary practice of community-based disaster risk management in China are also presented.

2.4.1 Organizational system of disaster risk management in China

China has adopted a disaster reduction and relief system featuring central leadership, departmental responsibility and disaster administration at different levels with major responsibility on local authorities. Under the leadership of the State Council, the central organs coordinating and organizing disaster reduction and relief work are the National Disaster Reduction Committee (NDRC), State Flood and Drought Control Headquarters, State Earthquake Control and Rescue Headquarters, State Forest Fire Control Headquarters and National Disaster Control and Relief Coordination Office. Correspondingly, local governments also set up coordination offices to handle emergency response and relief work when a disaster happens. During emergency response and relief work, the PLA, the PAP, militiamen, and reservists, as well as policemen play the major role. Social groups, non-governmental organizations, and volunteers will also join the effort (CPGPRC, 2009).

China does not have a specific disaster risk management ministry at the national level, which in charge of comprehensive issues of disaster risk management and directly led by the State Council. Instead of that, Chinese government has formalized the NDRC as the top inter-agency mechanism in charge of disaster risk management. The Ministry of Civil Affairs (MOCA) takes on routine jobs of the NDRC and plays a pivotal role in coordinating work done by various ministries and sectors (Chen, G., 2013). This organizational role

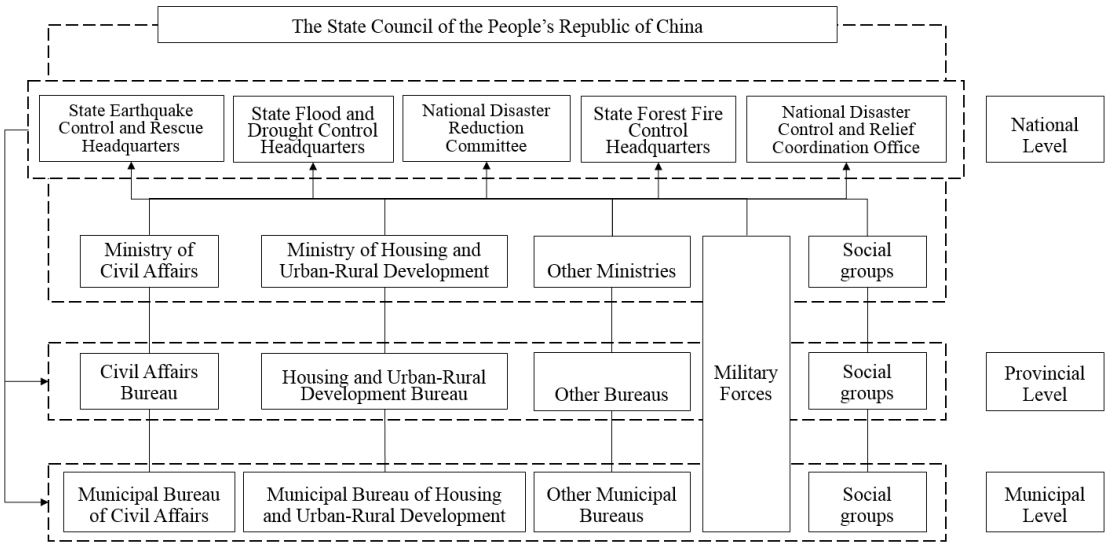


Figure 2. 3 Organizational system of disaster risk management in China

(Source: Author, based on CPGPRC, 2009)

in coordinating various ministries and sectors (Chen, G., 2013). This organizational system (Figure 2.3) was basically shaped in the early 2000s, while China's disaster risk management has been undergoing dramatic changes as pluralization, decentralization, and fragmentation. In February 1950, a central committee on disaster relief was established to coordinate disaster risk management work among the Ministry of Internal Affairs, the Ministry of Finance, Agriculture, Water Resources, Health, and other related ministries and governmental departments. Following the central government's instruction, local governments subsequently set up their disaster relief committees at the provincial, county, and township level. Shortly afterwards, the central committee on disaster relief and many of its local branches were abolished due to political activities. After the deadly quakes struck Xingtai in 1966, China set up the National Earthquake Administration to take charge of earthquake monitoring, research, and emergency responses in 1971. In 1978, two years after the Cultural Revolution was over, the Ministry of Civil Affairs (MOCA) was established to resume part of disaster risk management functions. Until 1998, the MOCA took over to organize and coordinate disaster relief work (State Council General Office, 1998), which since then institutionalized its pivotal role in managing natural disasters in China (Chen, G., 2016). In 1989, in response to the IDNDR, the Chinese government founded the National Commission for the International Decade on Natural Disaster Reduction, which was composed of 34 ministries and departments, including relevant military agencies and social groups. It soon became the top-level decision-making panel that commanded and coordinated the disaster relief work scattered in different ministries and departments. In 2005, it was renamed the China National Committee for Disaster Reduction and in charge of studying and formulating principles, policies and plans for disaster reduction, coordinating major disaster activities, giving guidance to local governments in their disaster reduction work, and promoting international exchanges and cooperation (ADRC, 2008). In 2002, the National Disaster Reduction Center (NDRC) was set up under the Ministry of Civil Affairs to serve as an information sharing platform on various natural disasters. In addition, it also in charge of not only

providing policy consultancy services and technical support for ministries and sectors which involved in disaster management, but also collecting and analyzing disaster information, and training professionals in the disaster reduction area (MOCA, 2015).

Although the MOCA has been playing a pivotal role in managing natural disasters, it does not have sufficient authority, resources, and tools to prevail over other state-level agencies and stakeholders. Evidently, China's disaster risk management does not fit in the rational decision-making model where parochial interests often give way to overall national interest. The concept of "fragmented authoritarianism" (Lieberthal, K. G., 1992) in China's decision-making provides a useful lens for viewing the processes of formulating and implementing disaster-related policies (Chen, G., 2016). In addition, the military forces have been institutionalized as the country's most important rescue team in major disaster relief campaigns.

In China, after major emergencies, the State Council, as a chief leading organization of national emergency management, usually coordinates various departments of the State Council by establishing or initiating permanent or temporary agency headquarters (Zhang, L.L., 2016). Take earthquake response as an example, China's disaster risk management system in normal times and disaster relief system at emergency, which was established in 1999, involve all of the administrative organizations (Figure 2.4). In normal times, the State Council has established the Joint Meeting of Earthquake Disaster Reduction, with the China Earthquake Administration taking on routine jobs of the executive office. Following the national

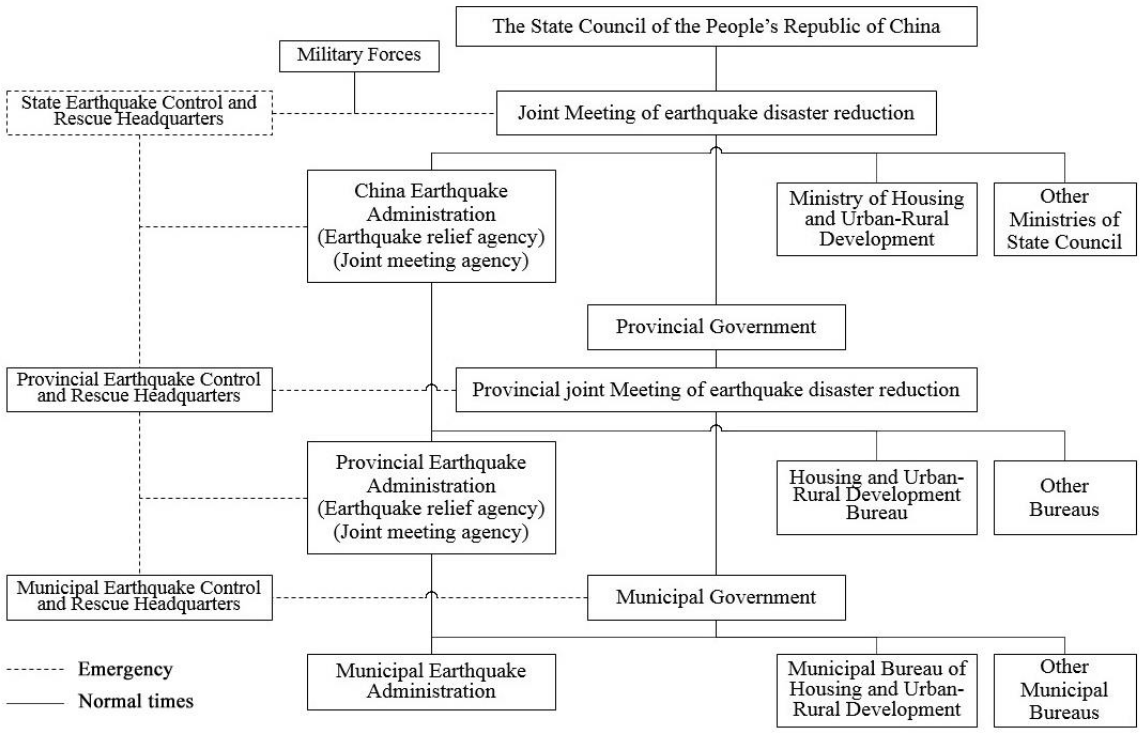


Figure 2. 4 Earthquake disaster management and disaster relief system in China

(Source: Author, translated from Kato, T. & Teng, W. X., 2002)

level, provincial and municipal level governments subsequently set up their Joint Meeting of Earthquake Disaster Reduction, with the Earthquake Administration at each level taking on routine jobs (Kato, T. & Teng, W. X., 2002). As a coordinating body for procedures, the State Earthquake Control and Rescue Headquarter does not establish substantive offices (Figure 2.4). At emergency, the temporary Earthquake Control and Rescue Headquarters are established at national, provincial, and municipal levels, with the Earthquake Administration in charge of the executive office.

This system, which based on multiple-level joint meeting and emergency headquarters, involves all of the administrative organizations that remarkably independent from each other. Each of them in charge of the related disaster risk reduction work in normal times and post-disaster recovery under a vertical hierarchy of "State Ministry-Provincial Bureau-Municipal Bureau". Personnel exchange at a horizontal level between the administrative organizations scarcely happens. However, disaster relief activities at emergency are mainly following a horizontal system of "National Government-Provincial Government-Municipal Government" (Figure 2.3 and 2.4). The mixed system of disaster risk management in normal times under a vertical hierarchy and disaster relief at emergency under a horizontal hierarchy is the feature of China's organizational system of disaster risk management (Kato, T. & Teng, W. X., 2002).

2.4.2 Legal system of disaster risk management in China

More than 30 laws and regulations have been promulgated and implemented on disaster reduction in China since the political situation was getting stable after the Cultural Revolution and the reform and opening up. At present, Emergency Response Law of the PRC is the first comprehensive law on emergency response (22■ in Table 2.7), which takes natural disaster as a kind of emergencies, is supposed to be apply to such emergency response activities as prevention and preparedness, surveillance and warning, response operations and rescue, and post-emergency response rehabilitation and reconstruction. Nevertheless, the focus of China's legislation on disaster risk management is specifically and separately targeting each type of disaster. There are 22 laws and 23 regulations separately focus on earthquake, meteorological disasters, geological disaster, biological disasters, forest and grassland fires, and even nuclear accidents, etc. (Table 2.7). In addition, there are regulations in order to ensure human resources and supplies for emergency response (18△ and 20△ in Table 2.7). China's laws and regulations related to disasters at the national level are as above. Since the legislation in China follows a central government-oriented system (Onishi, K., 2002), the regulations at local government level are developed following the regulations at the national level (Figure 2.5).

Except for the Emergency Response Law of the PRC, all the laws and regulations are separately targeting a single disaster. A basic act, which can provide an integrated standard of disaster risk management, is missing at the national level. Disaster risk management in China urgently needs professional and specialized law to standardize the activities covers the whole circle of disaster preparedness, disaster response, disaster

Table 2. 7 China's laws and regulations related to disasters at the national level

Year	Earthquake	Meteorological disasters	Other geological disasters	Biological disasters	Forest and grassland fires	Others
1982		1■				
1983				1△		
1984		2■	3■			
1985			4■		4■	
1986		5■		2△		
1987		6■				
1988		7■ 8■ 4△			3△	
1989		9■		5△		10■
1991		11■ 6△ 7△		12■		
1992			13■			
1993		14■			8△	9△
1994	10△					
1995	11△					15■
1996		2+■		12+■		16■
1997	18■	17■		12△		
1998	13△			3+■	19■	
1999		20■ 1+■				
2000				2+△		
2001	14△	21■		12+△		
2002		15△ 8+■				
2003			16△			17△ 18△
2004	10+△					10+■ 15+■
2005		6+△		19△		20△
2006						
2007		21△				22△
	22■					
2008	18+■	2+■			3+△ 8+△ 19+■	
2009		23△ 8+■ 20+■				
2010		11+■				
2011	10+△11+△	4+△ 6+△ 7+△	23■	2+△		
2014		20+■				
2016		8+■				

■Law △Regulation +■Law Revision +△Regulation Revision

(Source: Author, based on CPGPRC, 2009; Onishi, K., 2002; Li, Y. J., 2013)

1■ The Marine Environment Protection Law of the People's Republic of China
2■ Water Pollution Prevention and Control Law of the People's Republic of China
3■ The Forest Law of the People's Republic of China
4■ The Grassland Law of the People's Republic of China
5■ The Land Administration Law of the People's Republic of China
6■ The Air Pollution Prevention and Control Law of the People's Republic of China
7■ The Flood Control Law of the People's Republic of China
8■ Water Law of the People's Republic of China
9■ Environmental Protection Law of the People's Republic of China
10■ Law of the People's Republic of China on Prevention and Treatment of Infectious Diseases
11■ Water and Soil Conservation Law of the People's Republic of China
12■ Regulations for the Implementation of the Law of the People's Republic of China on the Entry and Exit Animal and Plant Quarantine
13■ Law of the People's Republic of China on Safety in Mines
14■ Agriculture Law of the People's Republic of China
15■ Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste
16■ Law of the People's Republic of China on Prevention and Control of Pollution From Environmental Noise
17■ The Flood Control Law of the People's Republic of China
18■ Law of the People's Republic of China on Protecting Against and Mitigating Earthquake Disasters
19■ Fire Prevention Law of the People's Republic of China
20■ Meteorology Law of the People's Republic of China
21■ Law of the People's Republic of China on Desert Prevention and Transformation
22■ Emergency Response Law of the People's Republic of China
23■ Water and Soil Conservation Law of the People's Republic of China
1△ Regulation of the People's Republic of China on Plant Quarantine
2△ Regulation on the Implementation of the Forestry Law of the People's Republic of China
3△Regulation of the People's Republic of China on Forest Fire Prevention
4△ Regulation of the People's Republic of China on the Administration of River Courses
5△ Regulation of the People's Republic of China on Forest Pest and Disease Management
6△ Regulation of the People's Republic of China on Flood Control
7△ Regulation of the People's Republic of China on the Safety Management of Dam

8△ Regulation of the People's Republic of China on Grassland Fire Prevention
9△ Regulation of the People's Republic of China on Emergency Management of Nuclear Accidents at Nuclear Power Plants
10△ Regulation of the People's Republic of China on the Administration of Earthquake Monitoring
11△ Regulation of the People's Republic of China on Emergency Responses to Destructive Earthquakes
12△ Regulation of the People's Republic of China on Pesticide Administration
13△ Regulation of the People's Republic of China on Administration of Earthquake Predictions
14△ Regulation of the People's Republic of China on Administration of Seismic Safety Evaluation
15△ Regulation of the People's Republic of China on Administration of Weather Modification
16△ Regulation of the People's Republic of China on the Prevention and Control of Geologic Disasters
17△ Regulation of the People's Republic of China on the Urgent Handling of Public Health Emergencies
18△ Regulation of the People's Republic of China on the Administration of Central Grain Reserves
19△ Regulation of the People's Republic of China on Handling Major Animal Epidemic Emergencies
20△ Regulation of the People's Republic of China on the Army's Participation in Emergency Rescue and Disaster Relief
21△ Hydrology Regulation of the People's Republic of China
22△ Regulation of the People's Republic of China on the Supervision and Management of Civil Nuclear Safety Equipment
23△ Drought Control Regulation of the People's Republic of China

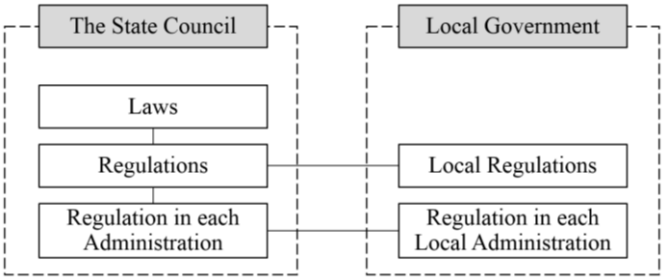


Figure 2. 5 Central government-oriented laws and regulations system in China

(Source: Author, translated from Onishi, K., 2002)

mitigation, and recovery. The Emergency Response Law cannot serve as a substitute since it focuses on controlling, mitigating and eliminating the serious social damage caused by all kinds of emergency incidents and on standardizing the emergency response activities at an emergency.

The distribution of responsibility tends to be unbalanced in the existing laws and regulations. The central government is now overloaded with excessive responsibilities in disaster management. This increases the difficulty in coordinating work among various sectors and in implanting detailed instructions and policies, and thus on many occasions causes inefficiency and even corruption (Chen, G., 2012). On the other hand, responsibility and right in disaster risk management remain unclear (Li, Y.J., 2013). Moreover, the existing laws and regulations concentrate on disaster response and relief at emergency, disaster preparedness, especially disaster mitigation during recovery, and disaster risk management system are not highly concerned.

2.4.3 Planning and strategy system of disaster risk management in China

2.4.3.1 Disaster response and mitigation plans at the national level

As for emergency related plans, Chinese government has established a system of disaster emergency plans covering national and local governments (Yang, S.Q., 2007) (Table 2.8). In 1998, the Chinese Government promulgated the National Natural Disaster Reduction Plan of the PRC (1998 -2010), the first national disaster reduction plan formulated in accordance with the Ninth Five-Year National Economic and Social Development Plan and the 2010 Long-term Objective. The Disaster Reduction Plan identified includes:

Table 2. 8 China's disaster risk management plans at the national level

Year	National disaster management plans
1991	Emergency response plans on destructive earthquake
1998	National Natural Disaster Reduction Plan of PRC (1998 -2010)
2005	National Emergency Relief Plan on Natural Disasters
2006	11th Five-year Plan for the Development of Science and Technology
2007	12th Five-year Plan on Comprehensive Disaster Reduction
2011	National Comprehensive Disaster Prevention and Mitigation Plan (2011-2015)
	National Emergency Relief Plan on Natural Disasters (Revision)
2012	Emergency response plan on destructive earthquake (Revision)
2016	National Emergency Relief Plan on Natural Disasters (Revision)

disaster reduction should be deeply considered in national economic and social development; prevention should be taken as the priority in combination with resistance and relief; The role of science, technology, and education should be incorporated in disaster reduction; the central and local governments, as well as all social sectors, should cooperate to reduce disaster risks; and international exchange and cooperation should be strengthened (ADRC, 2008).

In 2005, the Chinese government promulgated the National Emergency Relief Plan on Natural Disasters, the State's overall emergency response planning for an outbreak of public incidents and the state emergency response planning for natural disasters. Under the overall emergency response plan, special plans about disaster relief, forest fire, earthquake, geological disasters, and flood have been established. Then, until the end of 2004, all provinces, autonomous regions, and municipalities directly under the central government have drafted the provincial emergency plans. Based on these plans, a well-regulated disaster emergency response system has been established (Yang, S.Q., 2007). There is general agreement that China's crisis management system worked much better during the Sichuan earthquake emergency than in prior emergencies. The response to the Sichuan earthquake was guided by the General Plan for Natural Disasters and by the National Emergency Plan for Earthquakes (Richard, P. S., 2012). In the 11th Five-year Plan for the Development of Science and Technology, the Chinese government declared the technological development of a public security emergency response system and the enhancement of the nation's capabilities in handling disasters and unexpected public incidents as major tasks. The 12th Five-year Plan on Comprehensive Disaster Reduction requires local governments to include disaster reduction in their social and economic development plans (CPGPRC, 2009).

The current disaster management plans tend to focus mainly on the preparedness for emergency response, insufficient attention is paid to long-term disaster risk management and detailed disaster mitigation instruction. The future disaster risk management needs integrated plans for comprehensive disaster coping capacity enhancement and disaster risk management improvement.

2.4.3.2 Disaster mitigation strategies

China's disaster mitigation strategy has a clear mid-term and long-term goals: to build a relatively complete working system and operational mechanisms regarding disaster reduction; to greatly enhance the

capabilities related to disaster monitoring and early warning, prevention and preparation, emergency handling, disaster relief, rehabilitation and reconstruction; to notably raise public awareness of disaster reduction and emergency rescue skills; and to significantly reduce human casualties and direct economic losses caused by natural disasters. The Chinese government attaches great importance to the enhancement of disaster reduction capability. It has made great efforts in undertaking disaster reduction projects, in improving disaster early warning and emergency response, in enhancing scientific and technical support, and in strengthening personnel training and disaster reduction work in communities (CPGPRC, 2009).

In recent years, first, China has engaged in a series of important disaster reduction projects, including flood control on major rivers; housing renovation for impoverished rural residents; decrepit school building renovation; seepage prevention and reinforcement for unsafe reservoir; drinking water safety in rural areas; water and soil erosion control; farmland irrigation and drainage; ecological construction and environmental improvement; construction of earthquake-proof buildings and facilities; highway disaster prevention (CPGPRC, 2009). Second, as for the emergency preparedness technology, China has set up a disaster early warning and prediction network for different disasters, such as those for meteorological forecasting, earthquake warning observation, hydrographic surveys, forest fire prevention, plant disease, and insect pests prediction. This system involves several ministries and commissions of China and has played a key part in responding to devastating disasters. It has proven to be effective and efficient for disaster emergency response management (Yang, S.Q., 2007). Third, China has established an emergency rescue and disaster relief response system, which composed of an emergency rescue team system, emergency rescue response mechanism, and a disaster relief emergency fund appropriation mechanism. Fourth, China is establishing a science and technology support system and personnel training system for enhancing the scientific and technological level of disaster reduction and improving the quality of disaster relief personnel. Fifth, China is carrying out primary disaster reduction work in order to improve disaster risk reduction capability in communities (MOCA, 2011).

Despite the remarkable progress made by China in natural disaster risk management, problems still exist. First, disaster mitigation strategies are usually divided as a structural solution and non-structural solution. China's disaster mitigation strategies are currently running at the structural solution-dominated stage. The non-structural solution, such as legislation and social participation, etc., are lagging behind but increasingly being emphasized, while the structural solutions and techniques are far from developed. Second, the government is still playing an overwhelming role in disaster risk management, with nongovernmental organizations unable to provide sufficient assistance. Although indigenous NGOs, a symbol of the emerging civil society, have become increasingly visible players in China's disaster relief work, their roles and functions are still quite restraint under China's current state-centric political systems (Chen, G., 2016). Third, imperfect natural disaster insurance and state financial subsidy system lead to local governments' financial pressure for disaster risk management. As in other policy realms, China's disaster risk management process, to a large extent, is still vertically organized. Since local governments in China had no power to raise revenue

and most of their expenditures were disbursed by the central government in a strict top-down system. The central government had to be responsible for allocating the relief fund to any place that had encountered natural disaster prior to 1980. Local governments at all levels also started to disburse more funds for disaster risk management in 1994, after China introduced the Tax Sharing System in which local government was allowed to share tax revenues with the central government. Local governments today shoulder about 30% of China's total fiscal expenditure on disaster risk management. Yet they are still being pressured to pay more for disaster relief so as to ease the fiscal burden upon the central government (Sun, S.C., 2004). The state pays special attention to policy studies and pilot work concerning the insurance industry's role in disaster prevention and reduction. Efforts are made continuously, to sum up the experience of and to improve the risk prevention and relief mechanism for agriculture and forestry, combining natural disaster insurance and state financial subsidies. Efforts are also being made to set up an overall mechanism to disperse disaster risks in the agriculture and forestry areas and to gradually enhance the ability of insurance industries to effectively cover the economic loss and damage inflicted by natural disasters (CPGPRC, 2009).

2.4.4 Institutional gap of disaster risk management between urban and rural areas in China

Existing disaster-related laws and regulations in China mainly focus attention on urban areas. There are few special provisions made targeting rural areas. For instance, the Law of the People's Republic of China on Protecting Against and Mitigating Earthquake Disasters tried to push seismic risk reduction measures. however, there are no clear regulations for rural areas and some articles are even not suitable for rural areas (Yan, J.Q. & Hao, Y.Q., 2003). There is also no standard and supervision for earthquake-resistant building design and construction during the housing construction licensing procedures in rural areas. Consequently, rural areas' buildings without sufficient earthquake resistance are caught in a vicious circle of "severe damage - reconstruction without seismic performance enhancement - severe damage by earthquake again" (Wang, Y. et al., 2005).

The revised code for anti-seismic building design, which was promulgated in 2010, is based on the experience in 2008 Wenchuan Earthquake. It requires local governments at and above the county level to strengthen the management of the dwelling houses' seismic fortification and public facilities in rural areas. In addition, it suggests local governments to train local technical staffs and to encourage the practical seismic technologies development that not only meet the seismic fortification requirements but also be affordable. Moreover, it also declares that the State shall provide necessary support for the dwelling houses and public facilities in rural areas that need seismic fortification (GB 50011 - 2010). However, due to the lack of strict supervision and management institution and system targeting dwelling housing construction in most rural areas, in fact, the building code could not be fully implemented in rural areas. Except for earthquake disaster, China's rural areas have a various multi-hazard risk. In the absence of specific laws and regulations on disaster mitigation in urban and rural planning, there is no complete and in-depth planning system with the theme of disaster mitigation in urban and rural planning.

Based on the Urban and Rural Planning Law, Law on Protecting Against and Mitigating Earthquake Disasters, The Flood Control Law, and Fire Prevention Law, the current urban planning develops comprehensive disaster mitigation plan and special disaster mitigation plan. The comprehensive disaster mitigation plan includes a master plan and detailed plan. The master plan makes a clear guide for disaster risk assessment, loss forecasting, disaster mitigation spatial planning, evacuation system planning, disaster mitigation planning on public facilities and infrastructure, and hazard installations layout. The detailed plan makes guidelines for evacuation routes, shelter, evacuation park, and disaster-resistant community planning. In addition, related national ministries made several disaster mitigation standards on building and infrastructure design and construction in urban areas such as the building code of seismic design, flood control standards of infrastructures, etc.

Comparatively, rural areas without developed infrastructure and public facilities lack disaster mitigation planning and practicable construction standards on disaster mitigation. Though the " Technique code for village rehabilitation" has made basic specifications on environmental rehabilitation in order to reduce the risk of fire, flood, earthquake, storm, and geological disasters in rural areas (GB 50445-2008, Technique code for village rehabilitation). However, the scattered guidelines are far from a comprehensive disaster mitigation planning. The current approach is to apply urban disaster mitigation planning in rural areas, but the gap between urban and rural areas cannot in itself lead to complete implementation (Zhang, H., 2014). Though the Central government declared that it is necessary to strengthen disaster mitigation capacity of rural areas, since they are prone to natural disasters (Central Committee of the Communist Party of China, 2008), the actual situation is that all these urban-rural gaps stated above lead to difficulties of policies' implementation and consequently disasters-unprotected condition in rural areas. Moreover, more than three years passed after Sichuan earthquake, the Chinese government still focused on big cities' reconstruction and relocation programs and has yet to begin the disaster mitigation planning on historic districts in rural areas (Liu, H.T., 2012). In the absence of laws and regulations to follow and no advance planning in rural areas, the government has to preferentially distribute limited resources to urban areas during disaster emergency response and post-disaster reconstruction, while ignoring the disaster mitigation capacity enhancement in rural areas. So does the international organizations. For instance, the World Bank has directly financed several projects with components targeting disaster preparedness and reconstruction, including the China Yunnan Earthquake Reconstruction Project. Under this project, improved seismic resistance was incorporated into historic buildings in Lijiang, a World Heritage city. However, many sites remain unprotected and systems are not yet in place to effectively reduce risk to heritage from natural disasters (Taboroff, J., 2003). The investment also needs to be controlled and balanced by the institutional improvement.

2.4.5 Primary practice of community-based disaster risk management in China

Community-based disaster mitigation was started to be increasingly emphasized on in China from the 11th and 12th Five-year Plan on Comprehensive Disaster Reduction (CPGPRC, 2011). Three programs were initiated in the different scope with various related criterion (Table 2.9). National Comprehensive Community Building Demonstration, which established a goal of developing 5,000 model communities of disaster mitigation nationwide. MOCA is in charge of this program and has promulgated and implemented the criterion of national comprehensive disaster-reduction demonstration community to standardize the disaster mitigation issues at the local community level.

Community in China refers to different scope in urban and rural areas. In urban areas, a community is usually composed of one or several residential districts, while the Residents' Committee is found as a self-governance in each community in charge of routine matters. In rural areas, each village has a Villagers' Committee, which is also a self-governance organization of the community. Therefore, the specific issues of disaster mitigation are coordinated by the Residents' Committees in urban areas and Villagers' Committees in rural areas. However, scholars or practitioners found that there are still many problems in the practical process. First, the institutional, social, financial gaps between urban and rural communities, between eastern region and west region, and between traditional districts and new districts lead to tremendous differences of community-based disaster mitigation issues. It needs various specific guidelines in order to promote communities' sustainable development while taking the opportunity of community-based disaster mitigation. Second, disaster warning and emergency response system are still in control of the government, while communities' participation in disaster management is quite limited (Ye, H., 2010). Consequently, common people have insufficient disaster mitigation awareness and motivation. Third, Residents' Committee in the urban communities and Villagers' Committee in the rural communities at present are struggling to organize and coordinate community's disaster mitigation issues due to the heavy burden of more than 100 daily affairs appointed by local government (Lv, F., 2010). In addition, disaster mitigation activities at the community level are simultaneously hampered by the lack of specific and fixed financial support and consequent lack of human resources. In addition, disaster reserves for emergency response are still far from adequate. Fourth, the actual practice at the community level lacks operation guidelines. For instance, the criterion of national comprehensive disaster-reduction demonstration

Table 2. 9 Programs of disaster mitigation community in China

Name	Safe Community	National Comprehensive Community Building Demonstration	Seismic Safety Demonstration Community in Beijing
Time	2006	2010	2008
Scope	Nationwide	Nationwide	Beijing
Ministry in charge	SAOWS, COSHA	MOCA	Beijing Seismological Bureau
Aim	Community safety condition improvement	5000 model communities of disaster mitigation	Community earthquake-resistance enhancement
Target	All safety issues	Natural disasters	Earthquake
Related criterion	Basic Criteria of Safe Community	The criterion of national comprehensive disaster-reduction demonstration community	Old buildings' seismic safety performance evaluation guide of capital seismic safety demonstration area

(Source: Author, translated from Zhao, Y. T. & Mao, Q. Z., 2013)

community requires the candidate communities to conduct a risk assessment, to establish emergency response plan of disaster relief, to coordinate education and training activities, to establish community emergency shelter and necessary emergency supplies reserves, to motive the community members' participation, etc. (MZ/T 026—2011). However, no detailed guidelines were described, in particular, the remarkable different situation in rural communities are not mentioned. Finally, the education and training activities are hampered by the lack of professional experts and trainers, education materials, and training guidelines. The current activities are mostly temporarily organized coping with the governments' inspection. Long-term and systematic education and training system are needed.

2.5 Conclusion of the chapter

Approximately a third of China's ethnic minorities live in the southwest area and have preserved colorful cultural landscape of traditional human settlement. Moreover, nearly half of the Chinese Traditional Villages (CTVs) are located in Southwest China. However, Southwest China is one of the areas that are most prone to serious geological disaster risk, since more than 90% of the area is covered by plateau, mountainous or hilly area. Earthquakes, landslides, and flash floods caused by heavy rains frequently strike these mountainous areas. Moreover, the safety of rural areas in Southwest China is extremely threatened by multi-hazard risk and particular vulnerability. The disaster-resistance of the residential buildings in these undeveloped rural areas are poor due to the problematic design and construction. In addition, historical villages in Southwest China also have a particularly high risk of fire. Therefore, comprehensive conservation approach, which could take into account the multi-hazard risk of these historical villages in the rural mountainous area in Southwest China, is urgently needed.

The institutional system of disaster risk management in China has been basically shaped in the early 2000s and presents the characteristics of central leadership, departmental responsibility and disaster administration at different levels with major responsibility on local authorities. However, China does not have a specific disaster risk management ministry at the national level, which in charge of overall issues of comprehensive disaster risk management. Chinese government has formalized the National Disaster Reduction Committee (NDRC) as the top inter-agency mechanism in charge of disaster risk management, with the Ministry of Civil Affairs of PRC (MOCA) taking on routine jobs of the NDRC and playing a pivotal role in coordinating work done by various ministries and sectors. Nevertheless, the mixed system of disaster risk management in normal times under a vertical hierarchy and disaster relief at emergency under a horizontal hierarchy is the feature of China's organizational system of disaster risk management. MOCA does not have sufficient authority, resources, and tools to prevail over other state-level agencies and stakeholders.

A basic act and an integrated standard guidelines of disaster risk management, which can standardize the activities covering the whole cycle of disaster mitigation, disaster preparedness, disaster response, and disaster recovery, is missing at the national level. Consequently, the disaster management plans at present

tend to focus on emergency response, paying insufficient attention to long-term disaster risk management. In addition, China's disaster mitigation strategies are running at the structural solution-dominated stage, with the structural solutions and techniques are far from developed. The non-structural solution is lagging behind but increasingly being emphasized. Moreover, since the government is still playing an overwhelming role in disaster risk management, with nongovernmental organizations unable to provide sufficient assistance. Although indigenous NGOs have become increasingly visible players in China's disaster relief work, their roles and functions are still quite restrained under China's current state-centric political systems.

The institutional gap of disaster risk management between urban and rural areas is also presented. Existing disaster-related laws and regulations in China mainly focus attention on urban areas. Few special provisions made targeting rural areas. Moreover, in the absence of specific laws and regulations on disaster mitigation in urban and rural planning, there is no complete and in-depth planning system with the theme of disaster mitigation in urban and rural planning. Rural areas that without developed infrastructure and public facilities, also lack disaster mitigation planning and practicable construction standards on disaster mitigation. Therefore, facing particularly high risk, the rural areas not only have structural vulnerability such as undeveloped infrastructure and buildings with insufficient disaster-resistance but also non-structural vulnerability such as institutional ignorance.

The primary practice of community-based disaster mitigation is started to be increasingly emphasized in China. The disaster mitigation issues at the community level are coordinated by the Residents' Committees in urban areas and Villagers' Committees in rural areas. However, the practice still has the following problems. Communities' participation in disaster management is quite limited since most of the disaster-related issues are still in control of the government. On the other hand, residents' committee in the urban community and villagers' committee in the rural community at present have insufficient capacity to coordinate community's disaster mitigation issues due to the heavy work appointed by the local government. In addition, the institutional, social, financial gaps among communities lead to tremendous differences of community-based disaster mitigation issues. At the community level, particularly the rural areas lack various and specific operation guidelines, specific and fixed financial support system, personnel system including professional experts and trainers' involvement, long-term and systematic education and training system, sufficient disaster reserves.

On the whole, numerous historical villages in the remote mountainous areas of Southwest China, have a particularly high multi-hazard risk. They are also under an unbalanced and undeveloped institutional disaster risk management. For most of them, community-based disaster mitigation may be just a new term that they had never heard. As stated in the first chapter, it is necessary for local communities of these villages to protect not only their people but also their cultural heritage by themselves. Therefore, to analyze and clarify the current status of CDCC in these historical villages at the local community level is essential and significant for developing specifically targeted measures for these historical villages' CDCC enhancement.

CHAPTER 3. PEOPLE'S BUILDING IMPROVEMENT RESPONSE TO MULTI-HAZARD RISK IN SHANGLI VILLAGE

This chapter focuses on the people's post-disaster building improvement response to various hazard risk in Shangli Village. It analyzes residents' building repair and retrofit activities and identifies the factors that affected people on their repairing and retrofitting after an earthquake and floods. Additionally, recommendations for better disaster-resistant building improvement are considered.

3.1 Outline of the chapter

This chapter focuses on people's post-disaster building repair and retrofit activities[2] in Shangli Village. Its purpose is to identify the factors that affect the people's effective repair and retrofit after disasters. Hence, this study conducted research activities as follows. First, the author surveyed the natural and social situations and classified the building types of Shangli Village. Second, all the disasters and damages that had affected this village within the last decade were investigated. Third, the author investigated the people's actual condition of repair activities and cross-analyzed the differences of repair activities between different ages of buildings, different building types, and different damage situations. Fourth, people's earthquake-resistant and flood-resistant retrofit activities were investigated, and then cross-analysis is also conducted between different buildings. Fifth, the author analyzed the factors that limited people's repair and retrofit activities. The above research activities were based on three field surveys, which were conducted in June 2014, October 2014, and August 2015 (Table 3.1). A measurement survey on six building-groups helped to identify the building types and damage features. The structured interviews with Shangli administrative official staffs and village committee leaders focused on the damage and the repair procedures. The semi-structured interviews with the villagers focused on the disaster experience, the emergency response, the damage, the living environment, and the repair and retrofit activities as well as the reasons for their limited response. In addition, three questionnaire surveys focused on the living environment, housing conditions after disasters, the damage caused by earthquakes and floods, repair and retrofit activities, and the factors that affected people's building improvement response after disasters.

Table 3. 1 Outline of field surveys for people's building improvement activities in Shangli Village

Approaches	Measurement	Five houses			
	Structured interview	Two Shangli administrative official staffs, two village committee leaders, and one villager			
	Questionnaire	No.	1st (test)	2nd	3rd
		Delivered	20	280	280
		Collected	20	216	209
		Valid	20	174	150
		Content	Living environment, Housing condition, Damaged situation, Repair and retrofit activities, Factors of limitation, Access to support		

[2] "Repair" refers to the activities aimed at recovering the buildings to their former condition from the damage caused by the disaster; "Retrofit" refers to activities aimed at better earthquake-resistant and flood-resistant performances of the buildings.

3.2 Previous studies on post-disaster housing recovery and reconstruction

A lot of research focused on the post-disaster housing recovery and reconstruction all over the world. Some studies discussed the housing reconstruction as the fundamental of recovery. As Peacock, W.G. cited and stated that fundamental to an overall assessment of household recovery is reestablishing permanent housing, or in the vernacular, home, because without establishing home, the ability of a household to carry out normal activities and reestablish a routine is limited and hampered (Peacock, W. G.; Killian, C.D.; Bates, F. L., 1987; Bolin, R. C. & Trainer, P., 1978; Quarantelli, E. L., 1982). In short, delays in reestablishing housing all too often delay all other dimensions of recovery (Bolin, R. C., 1986).

Some studies focused on the disaster damage and reconstruction planning. Report of building damage analyzes and reconstruction includes 75 papers focused on six topics about damage analyzes and reconstruction after Wenchuan earthquake happened in 2008: Investigation on building damages; Analysis on typical damages; Anti-seismic assessment and reinforcement; Reconstruction; Earthquake-resistant code and design; Enhancement of earthquake-resistance (The Architectural Society of China., 2008). For instance, Ye and his investigation team analyzed the building damages in centrally affected areas in Sichuan, claimed the importance of earthquake-resistant code, and strategies for earthquake-resistance of each building structure. In addition, there is one paper by Zhao targeted on a historical mountainous village of Tai'an in Dujiangyan, Sichuan, analyzed the building damages by different building ages and structural types.

Some studies paid attention to the reconstruction plans for small settlement or historical villages. Alexander (Alexander, D. E., 1989) discussed the preservation of the identity of small settlement during post-disaster reconstruction in Italy. Wang (Wang, M., 2008) emphasized the significance of considering the inheritance and needs of the local ethnic culture. Ouyang (Ouyang, G. & Wang, D., 2006) focused on how planners and architects could balance the inheritance of ethnic characteristics with the actual needs of the local people in a changing environment. Wei (Wei, B.; Wang Y.; Cui, Y., 2014) discussed a new approach to balancing the development and conservation of historical villages through reconstruction after disasters. Zhao (Zhao, K., 2009) noted that the needs of local people for reconstruction are comparatively much more complicated, and this is the most important and difficult part of the post-disaster restoration.

Some studies introduced the application of Geological Information Systems (GIS) to reconstruction. Yang (Yang, S.; Xiao, D., 2004) attempted to develop anti-seismic planning for disaster risk reduction, and coordinate it with urban planning by GIS. Li (Li, D.; Liu, H., 2013) discussed the data arrangement and analysis process for a GIS spatial database in the research of historical towns' reconstruction.

In summary, the remote historical villages are not concerned much during post-disaster building recovery. Moreover, the recovery studies in China usually concentrate on conservation, reconstruction planning, or tourism development through a conventional top-down perspective, while paying inadequate attention to the behavior, needs, and impediments of the local people during the post-disaster phase. Therefore, this research focuses on analyzing the real condition of the people's post-disaster repair and retrofit activities.

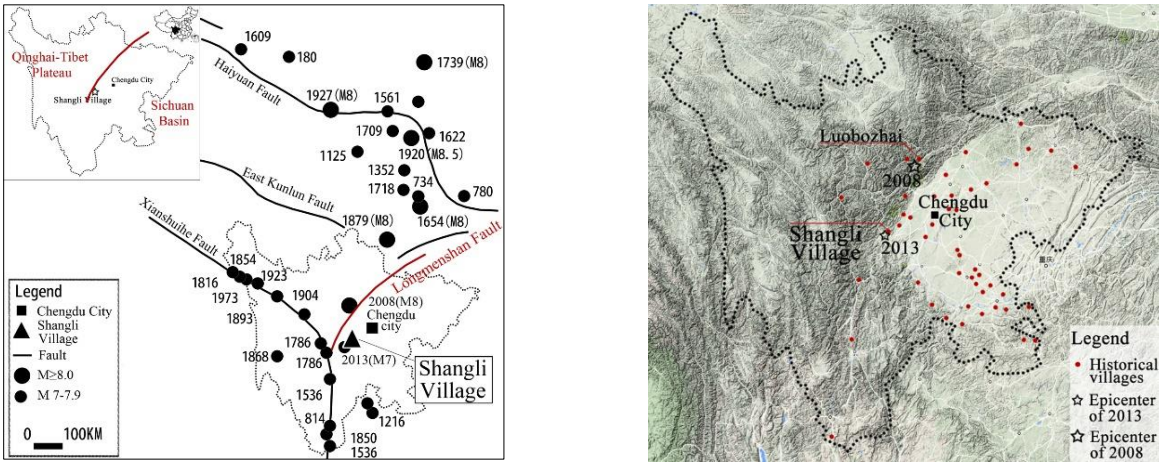
3.3 Shangli Village and its' multi-hazard risk

3.3.1 Multi-hazard risk and historical villages in Sichuan area

Earthquakes occur frequently in Southwest China because of the rapidly expanding and uplifting Qinghai–Tibet Plateau, as well as the escaping Asian continent, caused by the Indian Plate wedging into Eurasia. Strong shocks are generated when orogenic belts with good rheology press strongly against the ancient lands with poor rheology along their borders. Within the Sichuan area, the Longmenshan Mountains run through the edge of the Qinghai–Tibet Plateau and the Sichuan Basin. It is the steepest plateau border in the world and climbs from piedmont alluvial plains at an altitude of 500 m to the Plateau at an altitude of 5000 m within a distance of only 40–50 km, northwest to southeast (Ji, S.C., 2009). According to recorded history, three earthquakes greater than magnitude 8.0 have occurred along this fault zone, and 16 earthquakes stronger than a magnitude 7.0 have affected the Sichuan area (Figure 3. 1(a)).

Within the last decade, the Wenchuan Earthquake, magnitude 8.0, which occurred on May 12, 2008, left more than 69,000 dead (MOCA, 2008). The Lushan Earthquake, magnitude 7.0, on April 20, 2013, killed 193 people and affected approximately two million more (CEA, 2013). In addition, seasonal rainstorms frequently cause the fast-flowing rivers along the deep valleys to rise suddenly due to the steep terrain, which usually leads to flooding in the mountainous villages along the rivers in the Sichuan area.

On the other hand, the Sichuan area was the center of the South Silk Road around the 5th century because of its important geographic location. As the carriers of the colorful cultural heritage, the historical villages in this area have outstanding value. However, 40% (19) of the 48 remaining historical villages (MOHURD, 2014; Sichuan Provincial Government, 2014) are located in the mountainous area, and 31% (15) are on the



(a) (b)

(a) Historical earthquakes' distribution in Eastern Qinghai–Tibet Plateau (Source: Author, based on Ji, S. C., 2009)

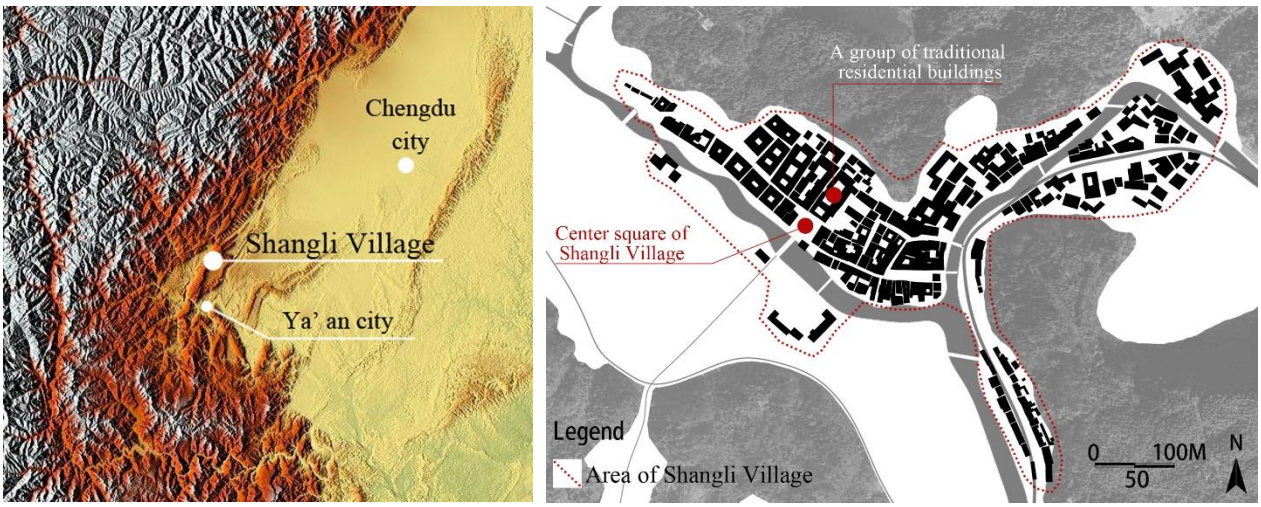
(b) Location of Shangli and historical villages in Sichuan province (Source: Author, based on Google Map and USGS)

Figure 3. 1 Historical earthquakes and historical villages' distribution in Sichuan area

boundary between the mountainous area and the basin (Figure 3. 1(b)). These villages not only face a high risk of natural disasters—with a high density of wooden buildings meaning a serious risk from the fire caused by earthquake—but precarious road connections also make them vulnerable to isolation, with consequent obstruction to emergency evacuation and rescue.

3.3.2 Shangli Village

Located 168 km away from Chengdu, Sichuan's provincial capital (Figure 3.1), Shangli town is widely known for its traditional aspect as an ancient post town along the South Silk Road. It is administratively composed of nine villages, among which, Wujia Village is the only area that maintains the original historical architecture and landscape. Therefore, this study uses the name of "Shangli Village" (Figure 3.2) to define the study area with a concept of spatial scale that is also easier to distinguish by name than "Wujia Village".



(a) Location of Shangli Village (b) Layout of Shangli Village

Figure 3. 2 Location and layout of Shangli Village

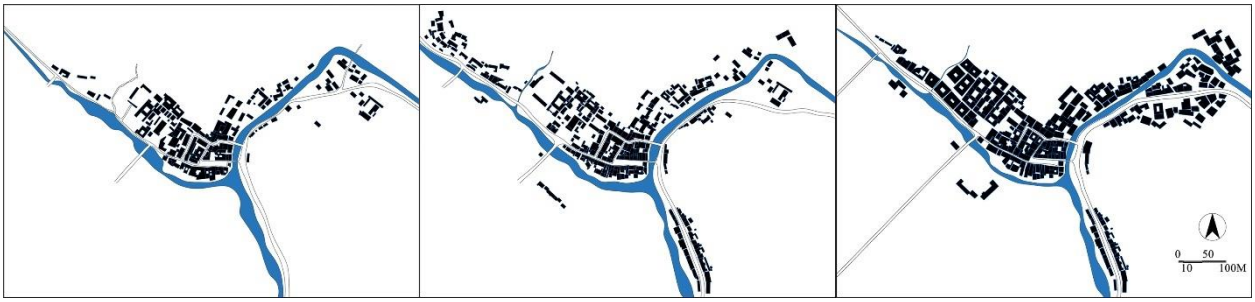
(a) Center square of Shangli Village (b) A group of traditional residential buildings

Figure 3. 3 Center square and traditional residential buildings in Shangli Village

Shangli Village is situated on the "most auspicious point" according to Feng Shui, the traditional Chinese approach of settlement location. The village is surrounded by continuous foothills in three directions, with rivers flowing from both the east and west and meandering south after converging in front of the village (Figure 3.2). Shangli Village has 280 households, and a total population of 1099 in 2013. 99% of the population is ethnic Han, and 1% is Tibetan women married to local people. Nearly all the population worked in agriculture before 2005, while 80% had turned to tourism-related industries by 2013, because of the second round of government-conducted tourism planning projects in 2005 after the first round in 1987. Figure 3.3 shows a group of traditional residential buildings in the center square of Shangli Village, which are the best-preserved traditional buildings in this village, while most of the other residential buildings are dramatically changed during the recent three decades.

3.3.2.1 Spatial growth and increasing building density

As stated above, the tourism planning projects conducted by the government in 1987 and 2005 exerted profound effects on the village in every respect. Also in the wake of fast population growth from the 1980s within a limited construction area of only 0.16 km^2 (area within the red dotted line in Figure 3.2), Shangli village experienced a remarkable spatial and building area growth during three periods within four decades. During the 1980s, Shangli Village was still a traditional agricultural village; except for the town administration office, school, and a cinema, all the buildings were one-storey residential buildings and the total area of buildings was 19,553 m^2 (Figure 3. 4 (a), Table 3.2). Along with the growth of the population and the accumulation of wealth, the building area increased over 1.6 times, reaching 31,285 m^2 in 2003, with 27% two-storey and 11% three-storey buildings. The floor area ratio increased from 0.12 in the 1980s to 0.29 (Figure 3. 4 (b), Table 3.2). The spatial evolution of the village has shown the stimulating effects of tourism following the first conservation and tourism planning episode in 1987. Shangli village also changed greatly during the ten years after the implementation of the new conservation and tourism program by local government in 2005. By 2015, the core area was totally transformed into two-storey and three-storey buildings, with even multi-storey buildings higher than that, mainly for commercial accommodation. The total building area surged to 2.8 times that of 2003 (Figure 3. 4 (c), Table 3.2).



(a) Shangli Village during the 1980s (b) Shangli Village in 2003 (c) Shangli Village in 2015

Figure 3. 4 Layout of Shangli Village during the 1980s, 2003, and 2015

(Source: Author, based on Ruan, Y. S., 2013 (a), 2003 map provided by Village Committee (b), and 2015 Google Earth Map (c))

Table 3. 2 Spatial growth in Shangli Village

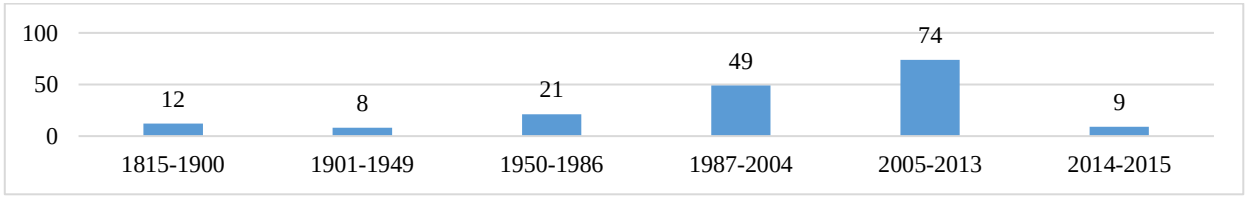
	Area of buildings in Shangli Village (m^2)			Proportion of building structural types (%)				Proportion of building story (%)				Function
	Building Area	Total Area	Floor area Ratio	Wood	Wood-Brick	Confined-Brick	RC	1F	2F	3F	≥4F	
1980s	19,553	19,553	0.12	93	5	2	0	≈100	0	0	0	R
2003	31,285	46,325	0.29	54	15	31	0	62	27	11	0	R, R^2, H
2015	52,201	131,678	0.82	26※2	9※2	58※2	7※2	54※1		46※1		H, R, R^{2}※3

※1 The proportion in 2015 is based on the data of that, core area, left blue circle are in the mass one and two floors buildings, buffer area, right blue circle are in the mass three and four floors buildings.
※2 The proportion is based on the statistical data of 2013.
※3 R: Residential; R2: Restaurant; H: Hotel.
(Source: Author, based on the map data of the 1980s, 2003, 2015, and interviews)

3.3.2.2 Building types and characteristics

There are in total 321 buildings in Shangli Village according to the mapping data of 2015-different from the official data in 2013, which shows 280 buildings calculated in the light of one building per household. Based on the information collected on 173 buildings using the questionnaire survey, as Figure 3.5 shows, the present buildings in Shangli village were mainly built between 1950 and 2013. Twenty-one were built between 1950 and 1986 before the first conservation and tourism development plan were conducted. Forty-nine buildings were built between 1987 and 2004, between the two conservation and tourism development plans. In addition, 74 buildings have been built after 2004, stimulated by the second conservation and tourism development plan. As a historical village, 12 buildings built before 1900 remained, maintaining the architectural style of the Qing dynasty; eight buildings had been built between 1901 to 1949 before the end of the war. Only nine buildings had been rebuilt in 2014 and 2015 after the 2103 disasters (Figure 3.5).

Because Shangli village is famous for its history as a post town and regional trade center along the South Silk Road, the buildings were decorated using the traditional style required by the conservation and tourism development plans. Thus, it was not easy to distinguish the inner building features just from the façades. This study prefers to classify the buildings by the structure types, in order to match the damage analysis. Based on the measurement, observation, and interview surveys, the 280 buildings were classified into four types: wooden buildings (W), wooden–brick buildings (WB), confined-brick buildings (CB) and reinforced



N=173

*1949: The year that the PRC. was founded

1987: The year of the 1st Conservation and tourist development plan was implemented

2005: The year of the 2nd Conservation and tourist development plan was implemented

2013: The year of the Lushan earthquake happened

Figure 3. 5 Age of buildings in Shangli Village

Table 3. 3 Samples of the four-type buildings in Shangli Village

Type No.	Year of built	Layer	Households		Building Materials				Spatial usage				
			House-holds	Residents	Load-bearing structure	Exterior Wall	Façade	Roof	Business (B)		Private (P)		Area proportion of B to P
									Function	Layout	Function	Layout	
W-1	1815	2	>1	>8	Wooden pillars and beams	Wooden plank, Clay, Bamboo	Wooden plank	Wooden structure & Clay tile	Altar Exhibition	Central 1F	Bedroom	Sides of 1F 2F	0.05
W-2	1930	2	1	4		Wooden plank			Shop	Front 1F	Kitchen	Back of 1F	0.30
											Bedroom	2F	
W-3	1985	2	1	6		Wooden plank, Brick			Inn	Sides of 1F	Kitchen	Back of 1F	0.44
											Living	Central 1F	
											Bedroom	2F	
WB	2003	2	1	4	Wood pillars, beams, Brick	Wooden plank, Brick			Inn	2F	Live	1F	1.00
CB	2015	3	1	>2	Concrete pillar, Ring beam, Brick wall	Brick			Restaurant	1F	Live	3F	2.22
									Inn	2F			
RC	2009	4	1	4	Reinforced concrete	Brick			Inn	2F, 3F	Live	4F	2.15
									Garage	Front 1F	Kitchen	Back of 1F	

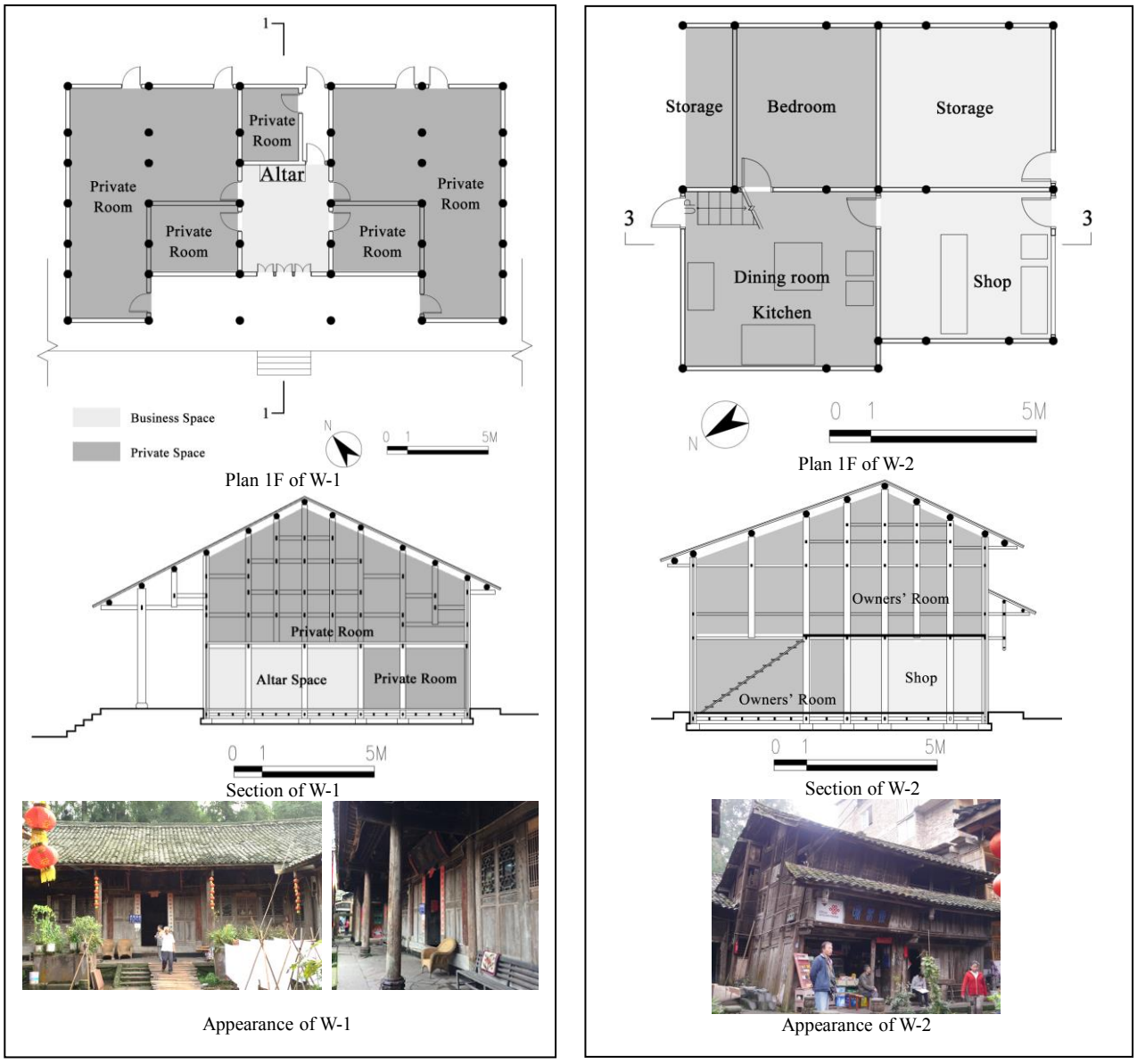
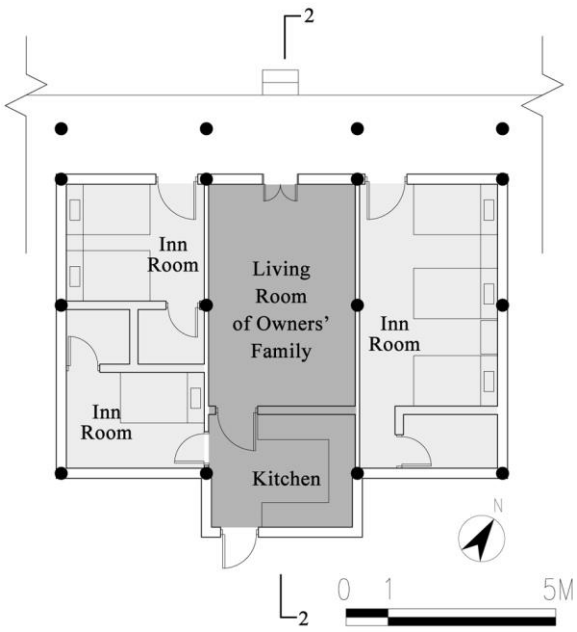
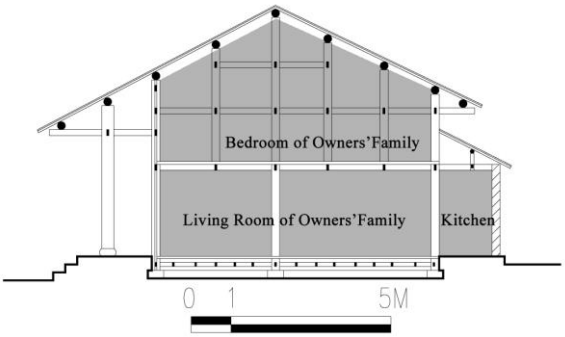


Figure 3. 6 Building samples of wooden buildings (W)W-1 and W-2

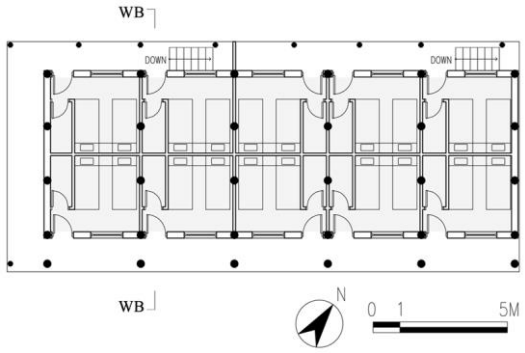


Plan 1F of W-3

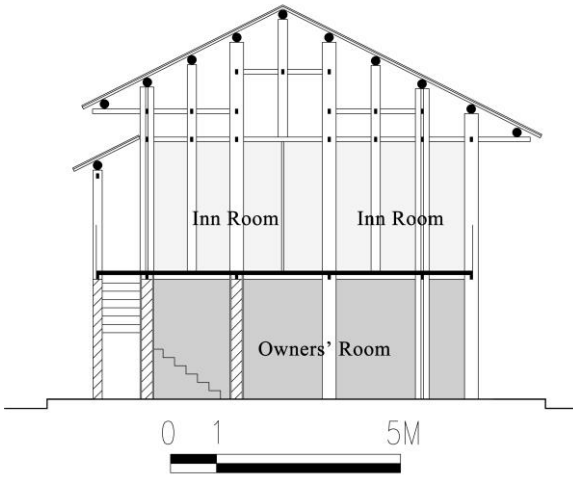


Section of W-3

Appearance and living room of W-3



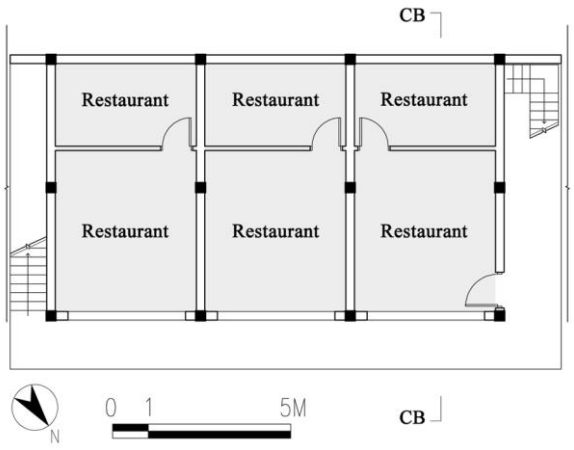
Plan 2F of WB



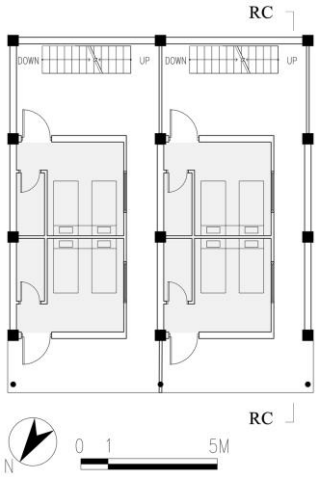
Section of WB

Appearance and wooden facing of WB

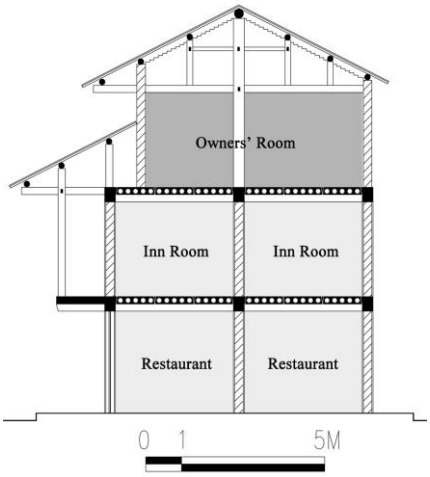
Figure 3. 7 Building samples of wooden buildings (W)W-3 and wooden-brick building (WB)



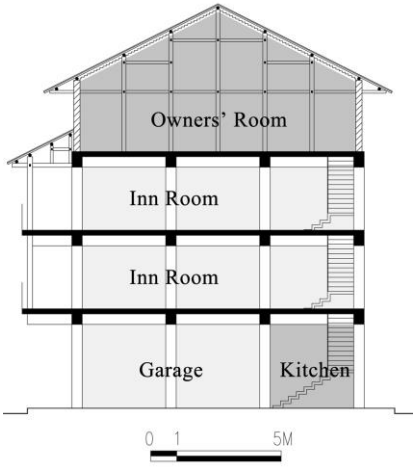
Plan 2F of CB



Plan 2F of RC



Section of CB



Section of RC

Structure of CB

Appearance of RC

Figure 3. 8 Building samples of confined-brick (CB) and reinforced concrete buildings (RC)

concrete buildings (RC) according to the load-bearing structure and materials (Table 3.3, Figure 3.6-3.8). The wooden buildings could be subdivided into three types based on different wall materials. Of the 280 houses in Shangli village, 73 (26%) are wooden buildings (W); 24 (9%) are wooden–brick buildings (WB); 163 (58%) are confined-brick buildings (CB). In addition, there are also 20 (7%) reinforced concrete buildings (RC). Wooden buildings maintain the original wooden construction, with walls made of wooden boards, hand-woven bamboo coated with loam, or bricks. Wooden–brick building has wooden frames and brick walls that together constitute the structural bearing system. In confined-brick buildings, the load-bearing system is constituted by concrete pillars and ring beams, together with brick walls. The smallest number of buildings is of reinforced concrete construction.

The buildings in Shangli village have three typical features. First, the trend of the wooden-brick, confined-brick and reinforced-concrete building is growing quickly, owing to the ease of production and transportation, and the low-cost of bricks after the 1980s. By 2003, the village consisted of 15% wooden-brick and 31% confined-brick buildings. Furthermore, by 2013 the proportion of confined-brick building had reached 58%, becoming the most common (Table 3.2). Second, in spite of the differences in structures, the traditional wooden roof is a common feature among all four types of buildings. This is required by the local government in order to maintain the village's traditional appearance. Third, in order to maintain the historical appearance of the village, the façades of confined-brick and reinforced concrete buildings are covered with wooden materials, even though the fire risk is intensified.

3.3.3 Disasters and damages in Shangli Village

3.3.3.1 Damage caused by earthquake

Within a decade, two earthquakes devastated the Sichuan area. With a straight-line distance of only 9.5 km from the epicenter of the Lushan earthquake in 2013, Shangli was significantly affected. Fortunately, there were no casualties, but all buildings were damaged. A joint investigation team comprised of experts, village leaders and village representatives evaluated the damage and categorized it into three levels: mild, moderate, and severe. Table 5 shows the building damage, based on the official data of damage levels for subsidy distribution, together with the interview data. Among all 280 households, only six buildings (2%) were only mildly damaged—a few tiles fell from the roof, and small cracks appeared in the walls, but the structure remained safe. In comparison, 183 buildings (65%) were moderately damaged—the roof collapsed slightly, tiles fell, and cracks up to one cm wide appeared on the walls, and the shape of structure also slightly changed—and 91 buildings (33%) were severely damaged—the load-bearing beams and walls cracked significantly, the foundations subsided, and the roof collapsed (Table 3. 4).

According to the cross tabulation of building types and damage (Table 3.4), 86% of the wooden buildings were slightly or moderately damaged and 14% were severely damaged. The main damage occurred to the walls, including clay falling and cracking, and tiles falling from the roof. In the severely damaged wooden

Table 3. 4 Building damages caused by the 2013 Lushan earthquake in Shangli Village

Building Typology	Total	Damage level		
		Mild※1	Moderate※2	Severe※3
Total	280 (100%)	6(2%)	183(65%)	91(33%)
(W) Wooden buildings	73 (26%)	4(5%)	59(81%)	10(14%)
(WB) Wooden-Brick buildings	24 (9%)	0(0%)	19 (79%)	5(21%)
(CB) Confined Brick buildings	163 (58%)	1(1%)	91(56%)	71(43%)
(RC) Reinforced-Concrete buildings	20 (7%)	1(5%)	14(70%)	5(25%)

(N=280; Source: Author, based on the basic data provided by Shangli Town Administration)

※ 1 Mild: A few tiles fell from the roof, and small cracks appeared in the walls, but the structure is safe.

※ 2 Moderate: The roof slightly collapsed, tiles fell, cracks less than 1 cm wide on the wall.

※ 3 Severe: The load-bearing pillars, beams, and walls significantly cracked, foundation subsided, the roof collapsed.

※ Basic data resources from Wujia village committee, which provide an accuracy of household- unit, is not precise enough to every building. Therefore, the total number of 280 is slightly different from the actual number of buildings.

buildings, a common feature is that the structure tilted caused by the broken wooden pillars that had been deteriorated due to floods and poor maintenance. In the wooden–brick buildings, because the wooden frames and brick walls carried the weight together, the failure characteristics were mainly cracks and deformation in the brick walls and dislocation of the wood roof trusses. Confined-brick buildings were found to be most vulnerable, which tends to be a common feature of non-engineered brick buildings in developing countries. Poor quality of materials, inadequate steel reinforcement, and poor workmanship led to weak sections and poor detailing. Consequently, 43.6% of the confined-brick buildings were severely damaged. Moreover, reinforced concrete buildings, which are supposed to be stronger to an earthquake, were found that 25% are severely damaged and 70% are moderately damaged. The failure characteristics were similar to but less significant than, the brick buildings.

3.3.3.2 Damage caused by floods

Surrounded by two rivers, Shangli Village is at risk of floods every year during July, August, and September. These months' account for more than 70% of the annual rainfall. On August 2, 1988, with a rainfall of 320 mm/h, the entire village, including 20 km2 of farmland, was flooded. A 200-m stone embankment, as well as the single-storey classrooms in the school, were destroyed (Editorial Board of Ya' an City Record, 2000).

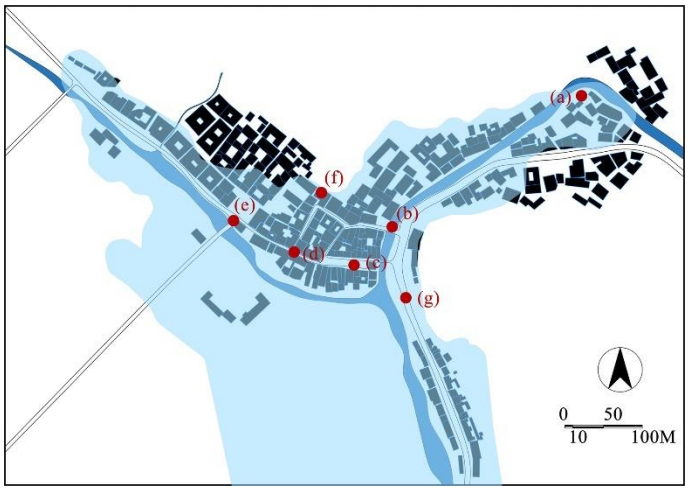
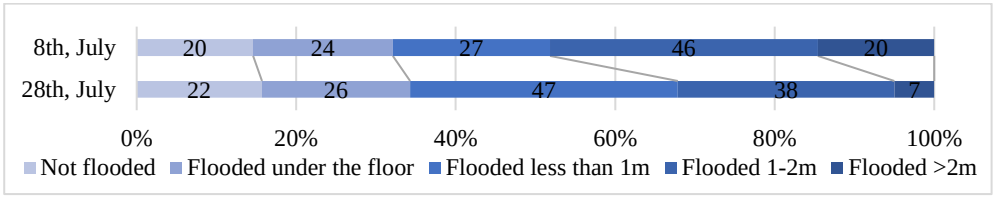


Figure 3. 9 Flooded area in July 2013



N=137

Figure 3. 10 Flooded situations in 2013

(a) Inundated house on spot (a) in figure. 3.9

(b) Obstructed floodwater on spot (b)

(c) Damaged furniture in inundated square on spot (c)

(d) Inundated street on spot (d)

(e) Destroyed bridge on spot (e)

(f) Rotten pillars on spot (f)

(g) Blocked road on spot (g)

(Source: Photos (a) and (f) are taken by Author, the others are provided by a village committee staff)

Figure 3. 11 Damage caused by floods in Shangli Village

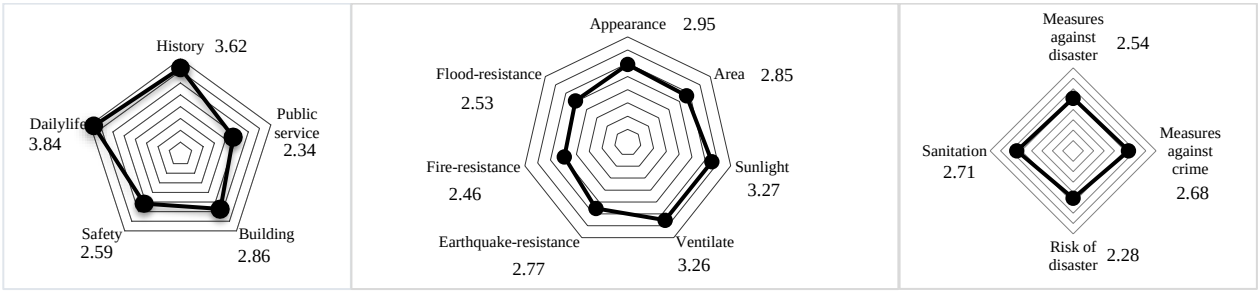
On July 8 and 28, 2013, two floods that were as devastating as the 1988 flood severely affected the village (Figure 3.9, 3.10) just three months after it was struck by an earthquake. According to the questionnaire survey, in total, 67.9% of the respondents' houses were inundated by the flood on July 8. Within those houses, 42.8% had floodwaters higher than one meters (Figure 3.10). The house located in the spot (a) was flooded by 1.5 meter-high floodwater (Figure 3.9 and 3. 11(a)). In addition, 19.7% of the respondents' houses had less than one meter of water. Moreover, the flood on July 28 inundated 65.7% of the respondents' houses again. There were 32.1% of the houses still had floodwaters higher than one meter, and 33.6% had less than one meter (Figure 3.10). The bridge located in the spot (b) blocked the bamboo destroyed by the rainstorm, caused the river raised fast thus destroyed the old stone bridge, which is a heritage built during the Qing dynasty (Figure 3. 11(b)). The inundated houses with foundations, pillars, and floors soaked in the floodwater, the furniture were also washed out and destroyed (Figure 3.11(c)). When the floodwater poured the main streets and rushed into the houses, the residents tried to hold it back but failed (Figure 3.11(d)). The rush of floodwater destroyed the bridge on the spot (e), which is the only outbound road (Figure 3.11(e)). The wooden pillar of the house located on the spot (f) was soaked and got rotten by floodwater (Figure 3.11(f)). Landslides due to heavy rainfall temporarily blocked roads (Figure 3.11(g)) on the spot (g).

In summary, Shangli Village is the closest existing historical village to the epicenters of 2008 and 2013 earthquakes that survived (Figure 3.1). There were no casualties, but all of the buildings were impacted. In addition, the village was flooded twice, on July 8 and 28, three months after the earthquake. Landslides temporarily blocked roads, and nearly all the buildings were flooded. In particular, wooden buildings damaged by the earthquake were further impacted by the floods, as the local people had not had time to effect repairs. However, our preliminary investigation has found that, in 2015, the local people have still not effectively repaired the damage caused by the earthquake and floods two years earlier. Moreover, they do not seem to be concerned about retrofitting the buildings for better disaster-resistance. When struck by disasters, the decision-making, and management of repair and retrofit tends to be more complicated than in ordinary villages because of the particular issues of conservation and tourism in the historical villages. Therefore, the following sections will explore the reality and the reasons behind.

3.4 People's repair and Retrofit activities in Shangli Village

3.4.1 Perception of local people towards living environment after disasters

In order to grasp the background and motivation of people's repair and retrofit activities, this section focuses on the people's perception of the living environment after the earthquake and floods in 2013. Based on the above literature reviews, Wakabayashi (Wakabayashi, N. Kojima, T. Hirate, K., 1998) employed five components to represent the living environment of the city area, including culture and history, services and convenience, public space, safety and sanitation, and buildings and streets. In addition, Takamine (Takamine, K.; Naoki, M., 2013) paid more attention to the buildings' conditions and their relationship to daily life. Rural planning (Edition Committee of Rural Planning., 2003) focused more on the infrastructure in the rural



N=174, Max value: 5.00

(a) Perception of living environments (b) Perception of Building conditions (c) Perception of Safety conditions

Figure 3. 12 People's perception of living environment after disasters

area. Therefore, this study utilized five components: history, public services, building, safety, and daily life, and a total of 25 sub-components to investigate the people's perception of their living environment. Figure 3.12(a) shows the results of a questionnaire survey about people's perception on their living environments. It indicates that they gave the most negative evaluation on public service, buildings and safety conditions. Most of the respondents were unsatisfied with their buildings and worried about their safety. Moreover, within the seven sub-components representing building conditions, more than four-fifths of the respondents are comparatively much more unsatisfied with the limited earthquake-resistance and flood-resistance of their buildings (Figure 3.12(b)). In addition, within the four sub-components of safety, the risk of disaster and the measures against disaster were most worrying for the local people (Figure 3.12(c)). On this occasion, were the local people effectively motivated to conduct repair and retrofit activities? The following sections analyze and discuss their repair and retrofit activities.

3.4.2 General information about buildings investigated

Among the 150 respondents of the questionnaire survey, 11 households' buildings were totally rebuilt after the disasters (Table 3.5). Except for these, this study collected 184 repaired and non-repaired building samples from the 150 respondents, since some households possessed more than one building. Of the 184 samples, 30% were wooden buildings, 10% were wooden–brick buildings, 52% were confined-brick buildings, and 8% were reinforced-concrete buildings. In addition, within the 184 samples, there were 46 buildings (25%) which were built before 1981 (buildings B) and 138 buildings (75%) were built after 1980 (buildings A). The following analyses are all based on these samples (Table 3.6).

Table 3. 5 11 rebuilt houses in Shangli Village

No.	Original Type	Damage Situation	Rebuilt Type	Year Rebuilt
2.10	CB	Severely	CB	2013
2.11	RC	Severely	RC	2015
2.22	CB	Moderately	CB	2015
2.32	W	Moderately	RC	2013
2.40	CB	Moderately	RC	2014
2.64	CB	Severely	CB	2014
2.65	CB	Severely	CB	2015
2.67	CB	Severely	RC	2014
2.75	RC	Severely	CB	2014
5.2	CB	Moderately	CB	2015
5.14	CB	Severely	CB	2014

Table 3. 6 General information of investigated houses in Shangli Village

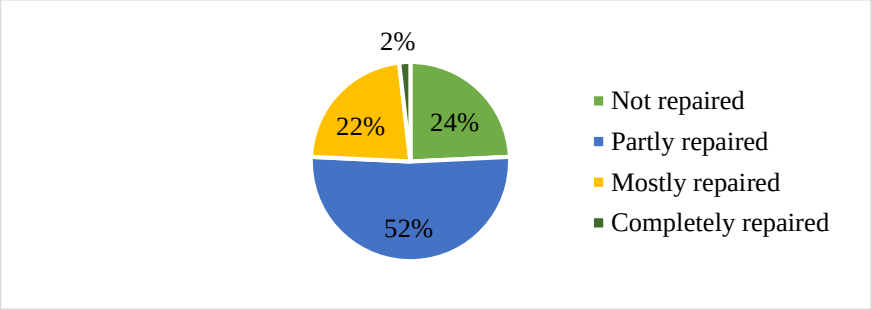
	W	WB	CB	RC	Total (%)
Buildings B※1	33	10	3	0	46※2 (25%)
Buildings A※1	23	8	92	15	138※3 (75%)
Total	56	18	95	15	184※4 (100%)
Proportion (%)	30	10	52	8	—

※1 Buildings B: built before 1981; Buildings A: built after 1980
※2 46 buildings =46 owners*1 building
※3 138 building =130 owners*1 building + 4 owners*2 buildings
※4 184 samples were collected from 150 respondents

3.4.3 Repair activities

3.4.3.1 Outline of repair activities

Building repair in Shangli Village was individually arranged by each family according to their own decisions, rather than in a concentrated period by the public agency since such concentrated repair would cause unnecessary interruption to the tourism. An investigation on the repair activities was conducted in August 2015, two years after the earthquake and floods. According to the level of repair, all the samples were of four types: "not-repaired", "partly repaired", "mostly repaired" and "completely repaired" buildings. The "partly repaired" refers to buildings where less than half of the damage was repaired; "mostly repaired" refers to buildings where more than half, but not all of the damage was repaired; "completely repaired" refers to buildings where all damage were repaired. Because of the practicality of the questionnaire, this study uses the above definitions of the level of repair, rather than any more accurate definition. The repair activities include that the cracks on the pillars and walls were fixed, collapsed roofs were mended, and the tiles were newly paved. Based on the statistical data, within 165 buildings, 24% were not repaired, 52% were only partly repaired, 22% were mostly repaired, and a mere 2% were completely repaired (Figure 3.13).

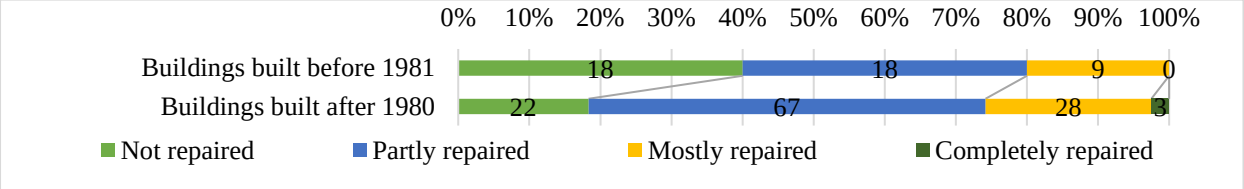


N=165

Figure 3. 13 Repair situation

3.4.3.2 Repair activities according to the age of buildings

The repair activities showed differences according to the age of the buildings. 40% of the buildings built before 1981 were not repaired, while only 18% of the buildings built after 1980 were not repaired. Moreover, the three completely repaired buildings were all built after 1980 (Figure 3.14). In sum, the older buildings built before 1981 were repaired less.

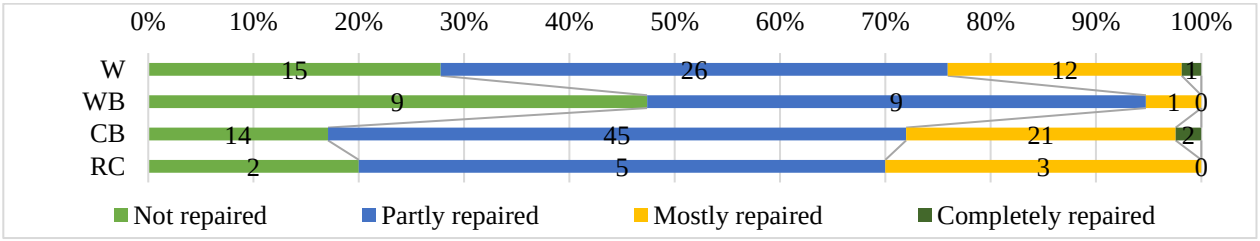


N=165

Figure 3. 14 Repair activities according to age of buildings

3.4.3.3 Repair activities according to the building types

This section analyzes the repair activities according to the building types. The data shows that nearly 30% of the wooden buildings and almost half of the wooden–brick buildings were not repaired, comparing to that less than one-fifth of the reinforced concrete and confined-brick buildings were not repaired (Figure 3.15). In sum, the traditional wooden and wooden-brick buildings were repaired less.

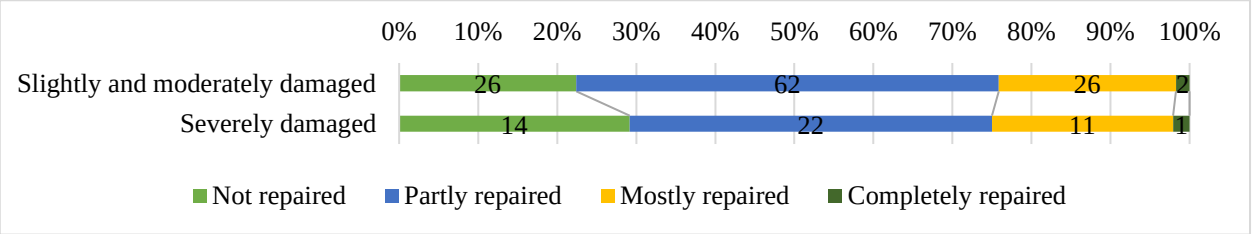


N=165

Figure 3. 15 Repair activities according to building types

3.4.3.4 Repair activities according to the damage situations

This section examines how repair activities related to the damage situations. The result of cross analysis unexpectedly shows that 71% of the severely damaged buildings were repaired to a different extent, less than that 78% of the slightly and moderately damaged buildings were repaired (Figure 3.16). In sum, the severely damaged buildings were repaired less.



N=164

Figure 3. 16 Repair activities according to damaged situations

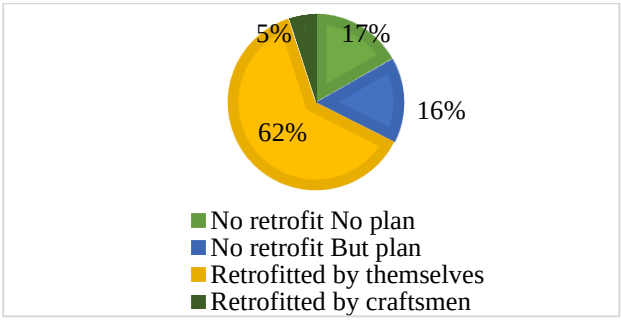
3.4.4 Disaster-resistant retrofit activities

Based on the field survey, disaster-resistant retrofit activities in Shangli village are not specialized – there is no testing for the performance of the buildings, no specialized retrofitting design, and no professional

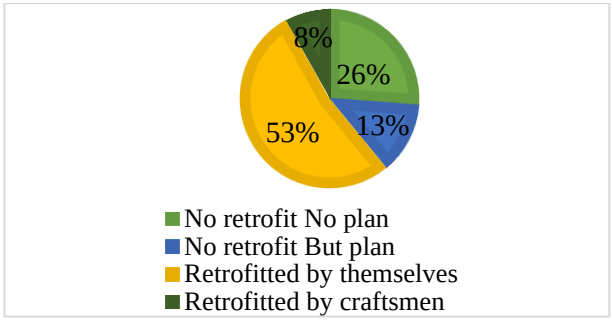
construction workers. In reality, "disaster-resistant retrofit" in Shangli village consisted of informal improvement during the process of repair. According to the risk of natural disaster in this village, this section analyzes these non-engineered informal "disaster-resistant retrofit" activities from two aspects: earthquake-resistant retrofit and flood-resistant retrofit.

3.4.4.1 Outline of earthquake-resistant retrofit and flood-resistant retrofit activities

The local people conducted earthquake-resistant retrofit by means of adding supplementary elements such as metal mesh to strengthen the pillars, walls, consolidate the connections, and support the roofs. Within the 179 buildings, 62% were simply reinforced by the owner themselves, while 31% of the buildings were without any anti-seismic reinforcement. In addition, within the 31% without seismic reinforcement, there are 17% where the owners also had no plans to conduct reinforcement. (Figure 3.17(a)). As far as flood-resistant retrofit was concerned, the local people simply brushed up the waterproof coating. In line with the trend for earthquake-resistant retrofit, 53% of the buildings were simply brushed up by the owners themselves, while 39% were not. Moreover, there were 26% of the buildings where the owners gave no consideration at all to flood-resistant retrofit (Figure 3.17(b)).

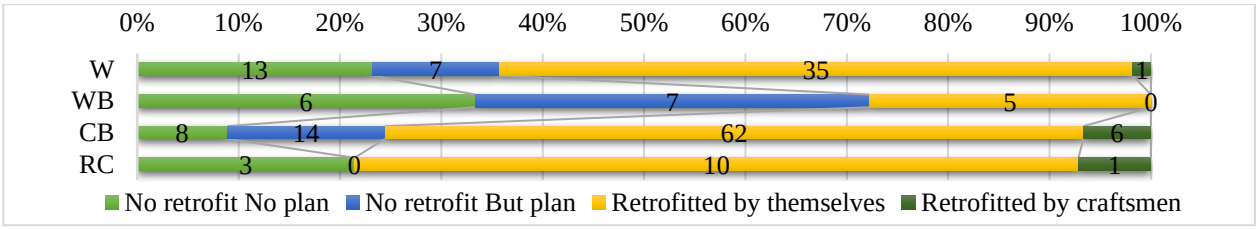


N=179 (a) Earthquake-resistant retrofit

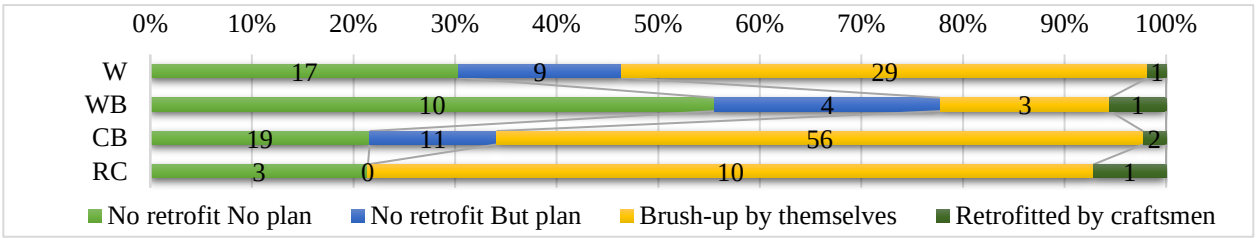


N=177 (b) Flood-resistant retrofit

Figure 3. 17 Disaster-resistant retrofit situation



N=178 (a) Earthquake-resistant retrofit according to building types



N=176 (b) Flood-resistant retrofit according to building types

Figure 3. 18 Disaster-resistant retrofit activities according to building types

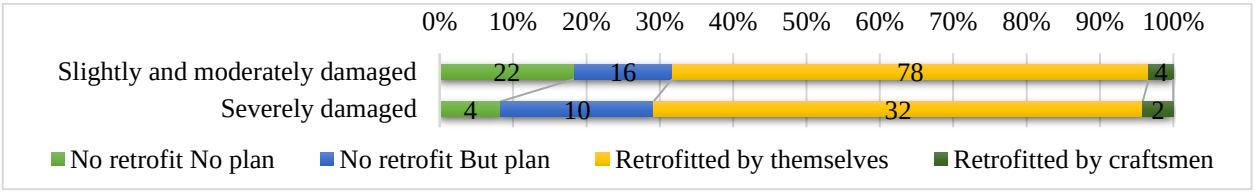
3.4.4.2 Disaster-resistant retrofit activities according to building types

According to the building types, both common features and differences are found between the earthquake-resistant retrofit and flood-resistant retrofit activities. The result shows that, first, wooden–brick buildings were almost without retrofit (Figure 3.18(a)). Second, except for wooden–brick buildings, most of the buildings, irrespective of the types, were simply retrofitted by the owners themselves. Third, more attention was paid to earthquake-resistant retrofit (67%) than to flood-resistant retrofit (59%) (Figure 3.18(b)).

3.4.4.3 Disaster-resistant retrofit activities according to damage situations

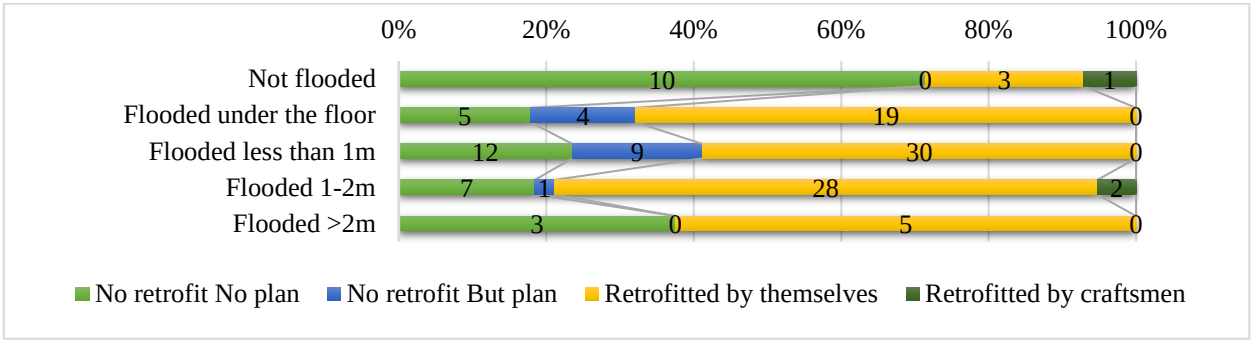
This section analyzes the relationship between earthquake-resistant activities and earthquake damage, as well as flood-resistant retrofit activities and flooded situations.

Firstly, among 168 buildings affected by the earthquake, the earthquake-resistant retrofit activities of slightly and moderately damaged buildings appeared to follow the same trend—more than 65% buildings were simply retrofitted by the owners. However, among the buildings without retrofit, owners of severely damaged buildings seemed more motivated to conduct a retrofit in the future (Figure 3.19(a)). Secondly, it is understandable that most of the owners whose buildings were not flooded have almost no plan to conduct the flood-resistant retrofit, and more than half of the other owners whose buildings were flooded retrofitted their buildings by themselves. However, comparing with the retrofit proportion under different flood level in Figure 3.19(b), the flood-resistant retrofit activities of flooded buildings have no certain relationship with the levels of flooded situations.



N=168

(a) Earthquake-resistant retrofit according to earthquakes damaged situations



N=139

(b) Flood-resistant retrofit according to flood-affected situations

Figure 3. 19 Disaster-resistant retrofit activities according to damage situations

3.4.5 Sub-conclusion of repair and retrofit activities of local people

Affected by the earthquake and floods in 2013, the local people were comparatively much more unsatisfied with the limited earthquake-resistance and flood-resistance of their buildings. However, the repair activity was limited, and disaster-resistant retrofit activity was informal and has still not been taken seriously.

Firstly, one-quarters of the buildings were still not repaired by 2015. More than half of the buildings were just partly repaired, with 22% were mostly, and only 2% were completely repaired by means of fixing the cracks on the pillars and walls, mending the collapsed roofs, and paving new tiles on the roof. Secondly, the older building built before 1981, the traditional wooden and wooden-brick buildings, and the severely damaged buildings were repaired less. Thirdly, informal disaster-resistant retrofit activities were basically conducted by means of adding supplementary elements such as metal mesh to strengthen the pillars, walls, consolidate the connections, and support the roofs mainly on self-help basis. Fourthly, earthquake-resistant retrofit was given a lot more attention than flood-resistant retrofit. Fifthly, among the different types of buildings, wooden–brick buildings were mostly without retrofit. Finally, there was no significant difference in retrofit activities between different damage levels. However, as the level of the damage became more severe, the motivation for earthquake-resistant retrofit increased.

3.5 Factors that affected people's repair and retrofit response in Shangli Village

According to the dissatisfaction of local people towards the earthquake-resistance and flood-resistance of their buildings after the earthquake and floods in 2013, their limited repair and retrofit activities should be traced back to the impediments they experienced.

In this section, this study will firstly show the reasons of limited repair and retrofit activities from the perspective of local people. Secondly, this study will verify these reasons and identify the actual impediments. Finally, in order to identify the particular impediment for the less-repaired older buildings, wooden and wooden-brick buildings, and severely damaged buildings, here will discuss the impediments to buildings of different ages, types, and damaged situations.

3.5.1 Reasons for people's limited repair and retrofit activities

3.5.1.1 Outline of reasons

This study found the reasons from the viewpoint of local people themselves according to the questionnaire survey. Why didn't they repair or retrofit, or only repaired their buildings partly? Generally speaking, the reasons are insufficient financial capacity, limited access to building technology, administrative licensing problems, and no necessity (Figure 3.20). Additionally, another reason is discovered through structured interview surveys: the impediment to decision-making due to spatial and property right subdivisions. The following will discuss and verify the four crucial reasons: insufficient financial capacity, limited access to building technology, administrative licensing problems, and an impediment to decision-making.

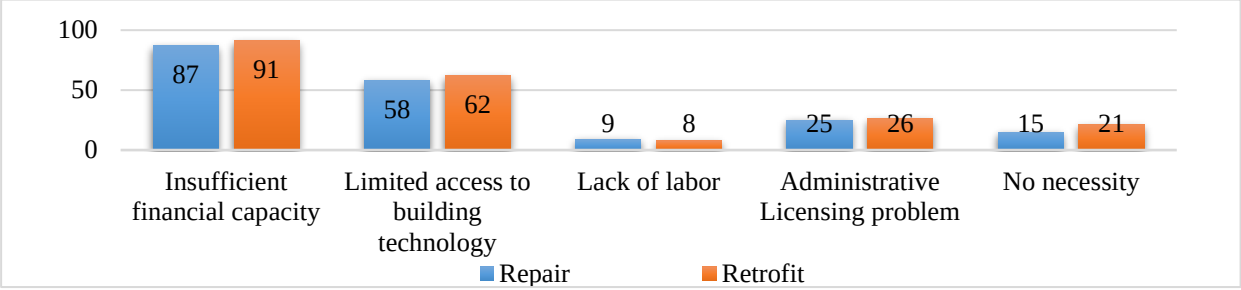


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Figure 3. 20 Reasons of limited repair and retrofit activities

3.5.1.2 Insufficient financial capacity

Though the most-mentioned reason of their limited repair and retrofit activities was insufficient financial capacity, the economic situation actually shows a different aspect based on the available data. The new tourism planning and project conducted during 2005 dramatically accelerated the economic development. Of the 280 households, 223 households have thrown themselves into business instead of traditional agriculture by 2009. Comparing to the per capita income of $1102 in Chinese rural areas in 2011, the per capita income in Shangli town was $3939, which is even higher than the per capita of $3789 among urban population (National Bureau of Statistics of PRC., 2012). The total tourism income reached $29.77 million in 2011, while the deposit and loan in local credit cooperatives also showed the flourishing situation of the local economy (Table 3.7). On the other hand, the local government distributed subsidy to all families for repair and maintenance after the earthquake in 2013 according to the damage situations evaluated by the joint investigation team. Those categorized with mild level damage received CNY 1000 ($158), those with moderate level damage received CNY 3000 ($473), and those with severe level damage received CNY 5000 ($788) (Table 3.8). Even though, most of the villagers are not active to repair activities as stated above.

Table 3. 7 Brief financial situations of Shangli town※

	Business Operator (households)	Per capita Income ($)	Tourism Income (million$)	Local credit cooperatives (million $)	
				Deposit	Loan
2004	—	444.33	—	4.38	0.86
2005※1	57	507.28	0.63	—	—
2008	>200	803.45	13.66	8.66	1.5
2009	223	960.68	—	—	—
2011	—	>3,939※2	29.77	—	14.18

※Financial situation observation is based on the available data in Shangli town, whose economic core zone is Shangli Village.
※1 2005: the tourism started to be remarkably motivated benefit from the conducted tourism plan.
※2 Per household annual income $15,754, average 4 persons per household.
(Source: Author, based on the data from the HP of Yucheng District and News of Sichuan)
http://118.118.73.67/mob/GovOpView.aspx?id=29552, Sep. 23, 2011(accessed on Oct. 25, 2015)
http://local.newssc.org/system/2010022/000931150.html, Feb. 2, 2010(accessed on Oct. 25, 2015)

Table 3. 8 Subsidy to Shangli villagers after the earthquake in 2013

Subsidy according to damage situation after earthquake in 2013					
Slightly damaged house	$158	Moderately damaged house	$473	Severely damaged house	$788

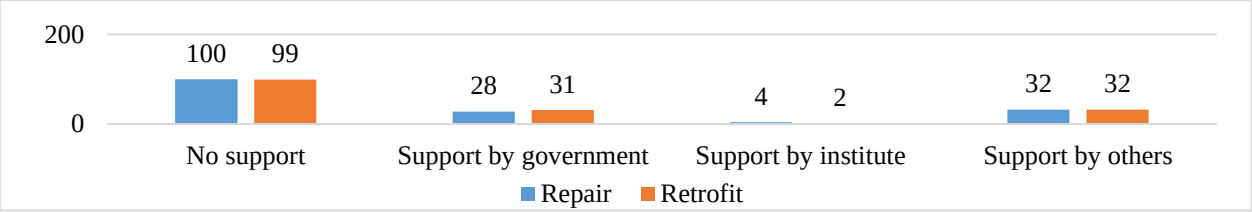
(Source: Author, based on interview survey with the village committee leaders)

Based on the income situation of the local people and the subsidy, it was proved that the financial capacity could not be considered a reason for the limited repair and retrofit activities. At least, a real reason behind is the lack of supervision of the subsidy usage.

3.5.1.3 Limited access to building technology

The construction work in the remote mountainous area can be called "non-engineered construction"; it is usually managed and undertaken by the local people themselves and local craftsmen. Thus, poor quality of materials and poor workmanship may have caused the unreasonable damage to the villages. Limited access to building technology could be the cause of that.

This study surveyed that whether a technical support was provided to the local people for a housing repair and retrofit. It shows that they have almost never received any technical support, especially for the repair and retrofit of old buildings built before 1981. Furthermore, it was also found that there was no effective mechanism for giving local people access to technical support from professionals or institutes (Figure 3.21).



N=164

Figure 3. 21 Technical support to local people for building repair and retrofitting

3.5.1.4 Administrative licensing problem

The construction work in Shangli Village is strictly controlled by the local government from the tourism development in 2005, to promote the conservation of the village to a certain extent during the period without disasters. However, with the motivation of tourism rather than conservation, in reality, strict management noticeably impeded the repair and retrofit activities of local people after disasters. Due to the lack of access and connection to the government departments and the relevant organizations, most of the local people have no alternative but to give up finally. The complicated procedures of application for building licenses (Figure 3.22) resulted in 25 buildings being still without repair or with incomplete repair in 2015.

Taking the example of Mr. Wen's house, this wooden building was severely damaged by earthquake and floods, leaning severely towards the neighboring building (Figure 3.23 (a)), with the pillars and walls seriously distorted and cracked (Figure 3.23 (b), (c)). The owner kept on asking for permission for reconstruction until 2015 and even applied for a safety appraisal report as a requirement (Figure 3.23 (d)). However, two years after the disasters, he was still waiting for approval, with the family of 14 living in the tumbledown building. The explanation from local government was that they have to control the number of buildings that are under construction at one time to avoid any detrimental effect on tourism.

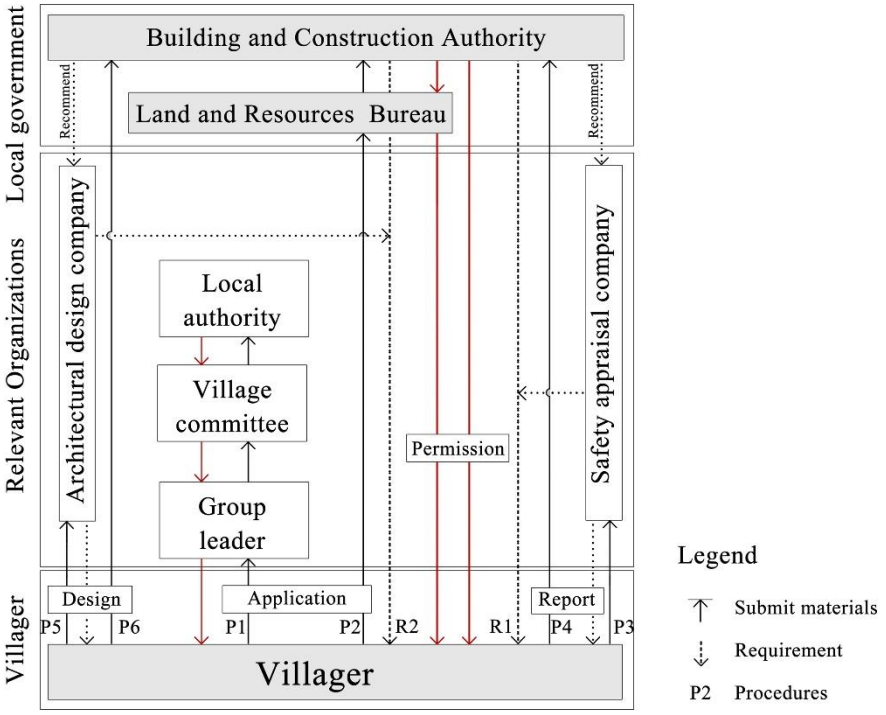
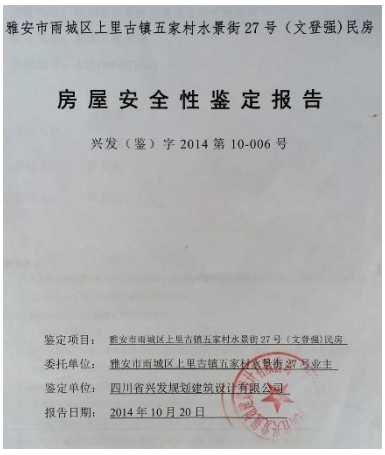


Figure 3. 22 Procedures for administrative license application

(a) Leaning building

(b) Cracked backwall

(c) Distorted wall and pillars


雅安市雨城区上里古镇五家村水景街 27 号（文登强）民房

房 屋 安 全 性 鉴 定 报 告

兴发（鉴）字 2014 第 10-006 号

鉴定项目： 雅安市雨城区上里古镇五家村水景街 27 号（文登强）民房

委托单位： 雅安市雨城区上里古镇五家村水景街 27 号业主

鉴定单位： 四川省兴发规划建筑设计有限公司

报告日期： 2014 年 10 月 20 日

(d) Safety appraisal report

Figure 3. 23 Damage situations of Mr. Wen's house (a,b,c) and the safety appraisal report (d)

3.5.1.5 Impediment to decision-making due to property right subdivision

In addition to the above, another reason was found through the interviews: the impediment to decision-making due to property right subdivision. Due to the densification of the village, as well as the control of construction works, buildings in large courtyards were divided into several units for each sub-family. Moreover, some family building is divided into several units to rent out. Taking the Han family's courtyard as an example. It originally consisted of three families living as one big household inside of the gray area, as shown in Figure 3.24. However, at present, the buildings are remarkably modified, with 10 households living inside. Moreover, the buildings of two yards in the front part belong to the local government. That is to say, this courtyard, which appears as an integrated building group, actually belongs to 11 owners (Figure 3.24). Consequently, it is difficult for anyone sub-family or renter to make a decision. Likewise, it is difficult to reach an agreement between different owners. Thus, ownership differentiation caused by spatial densification also directly affects repair and retrofit activities.

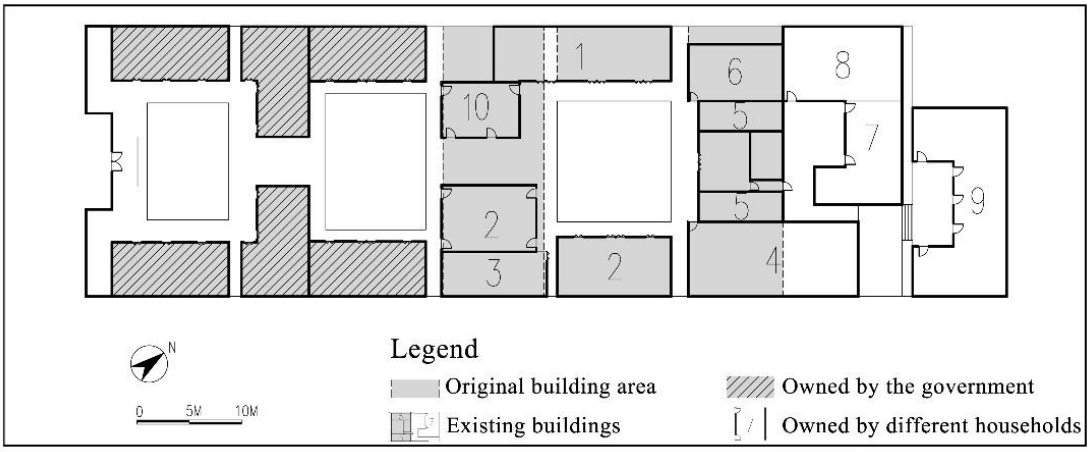


Figure 3. 24 Property right subdivision and densification of spatial usage in Han family's courtyard

3.5.1.6 The factors caused people's limited repair and retrofit activities

In conclusion, the factors caused people's limited repair and retrofit activities are limited access to building technology, the administrative licensing problem, and an impediment to decision-making due to property right subdivision.

3.5.2 Particular impediments

According to the former analyses, the buildings built before 1981, the wooden and wooden-brick buildings, and those severely damaged, were repaired less, comparing with the buildings built after 1980, modern building types of confined-brick and reinforced concrete, and slightly or moderately damaged buildings. In order to identify the particular factor of these less-repaired buildings, this section discusses the impediments according to the different building ages, building types, and damage situations by using cross-analysis.

3.5.2.1 Impediments according to different building ages

As analyzed above, the older buildings built before 1981 were repaired less. Referring to the reasons, as Figure 3.25 shows, the repair activities on the buildings built before 1981 were particularly impeded by the administrative licensing problem, comparing with the buildings built after 1980. Reconstruction work on an older building is taken more seriously than on a newer building, which is a reasonable and necessary policy of the local agency for managing the historical village, but it leads to the limited repair and retrofit activities on these old buildings.

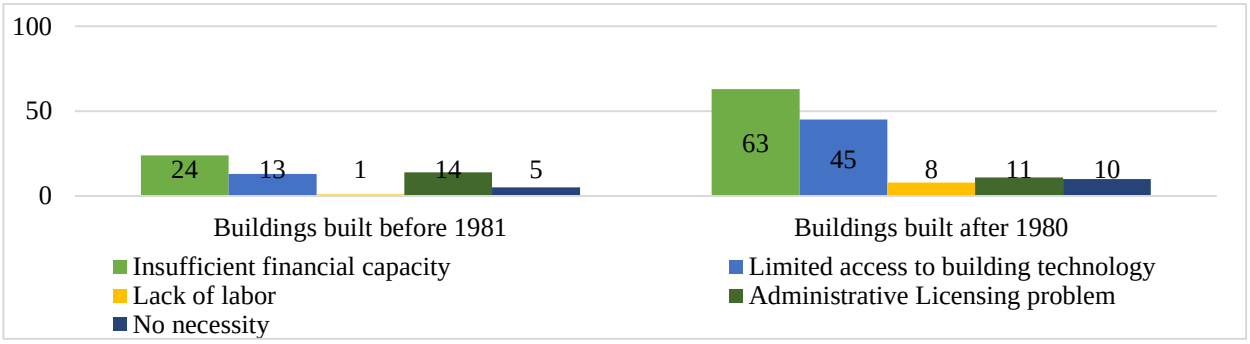


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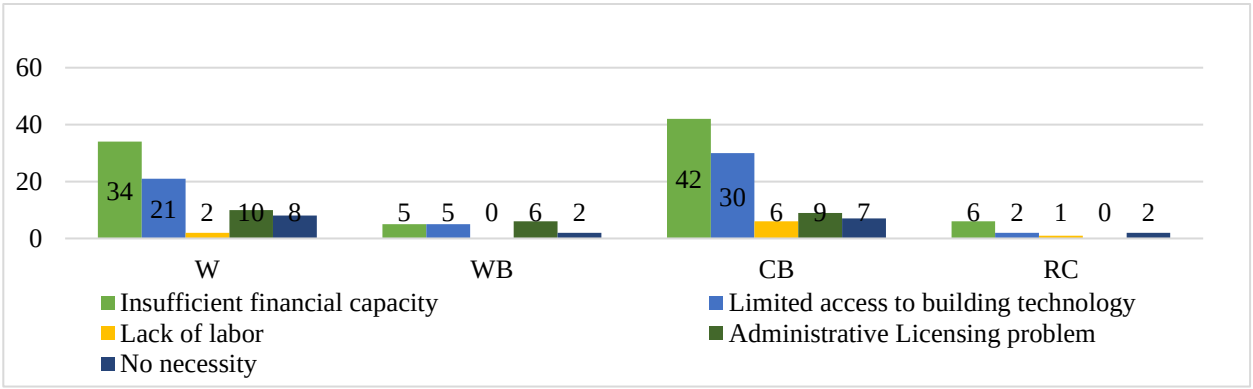
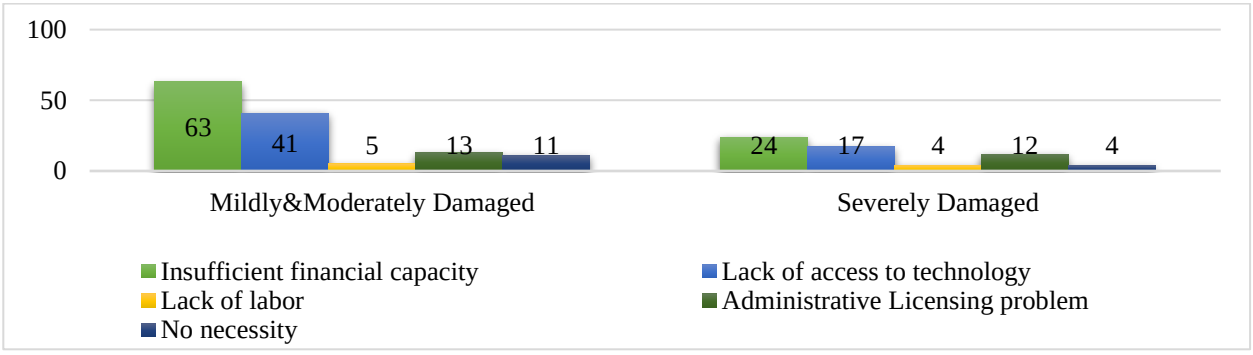
Figure 3. 25 Reasons according to building ages



N=150 Multichoice

Figure 3. 26 Reasons according to building types



N=150 Multichoice

Figure 3. 27 Reasons according to damage situations

3.5.2.2 Impediments according to the different building types

As analyzed above, the traditional wooden and wooden-brick buildings were repaired less. In searching for the reasons, we found that except for the wooden buildings were slightly affected more by the administrative licensing problems, the impediments between wooden, wooden-brick buildings and confined-brick, reinforced concrete buildings have not many differences (Figure 3.26).

3.5.2.3 Impediments according to the different damage situations

As analyzed above, the severely damaged buildings were repaired less. The analysis of impediments according to damage situations shows that the impediments to the severely damaged building have no much differences with the slightly and moderately damaged buildings (Figure 3.27). No particular reason affected the less-repaired severely damaged buildings.

In conclusion, the buildings built before 1981 were particularly impeded to the effective repair activities by the administrative licensing problem. The less-repaired wooden and wooden-brick buildings and severely damaged buildings have no particular impediment.

3.5.3 Sub-conclusion of impediments to the people's limited repair and retrofit response

According to the discussions above, Firstly, the impediments could be attributed to limited access to building technology, administrative licensing problem, and impediments to decision-making due to property right subdivision. Secondly, the insufficient financial capacity could not be considered as an impediment, it appears that the real reason behind was the lack of supervision of the subsidy usage. Thirdly, the repair activities on the buildings built before 1981 were particularly impeded by the administrative licensing problem.

3.6 Conclusion of the chapter

The purpose of this chapter was to identify the factors that affected the local people's repair and retrofit activities after disasters in the historical mountainous village. Based on a case study of Shangli village, this paper firstly surveyed the natural and social situations and classified the building types of Shangli Village. Secondly, it investigated the disasters that have ever affected Shangli Village, and the damage caused within the last decade. Thirdly, it investigated the repair activities and cross-analyzed the differences of repair activities according to different buildings ages, different building types, and different damage situations. Fourthly, it investigated the local people' s earthquake-resistant and flood-resistant retrofit activities and cross-analyzed the differences among different building types and earthquake damage and flood situations. Fifthly, it analyzed the reasons for limited repair and retrofit activities, verified the actual and particular impediments. The conclusions are as follows.

The local people were comparatively much more unsatisfied with the limited earthquake-resistances and

flood-resistances of their buildings after the disasters in 2013. However, repair activity was inactive and incomplete, and disaster-resistant retrofit activity was informal and has not really been taken seriously yet.

Firstly, three-quarters of the buildings were still not repaired or just partly repaired, with 22% were mostly, and only 2% were completely repaired by means of fixing the cracks on the pillars and walls, mending the collapsed roofs, and paving new tiles on the roof. Secondly, the older building built before 1981, the traditional wooden and wooden-brick buildings, and the severely damaged buildings were repaired less. Thirdly, the owners themselves conducted informal disaster-resistant retrofit activities by means of simple improvement. Fourthly, earthquake-resistant retrofit was given much more attention than flood-resistant retrofit. Fifthly, among the different types of buildings, wooden–brick buildings were mostly without retrofit. Finally, there was little difference in retrofit activities among different damage levels. However, as the damage became more severe, the motivation for earthquake-resistant retrofit increased.

The actual impediments to the repair and retrofit activities could be attributed to limited access to building technology, administrative licensing problem, and impediments on decision-making due to property right subdivision. Firstly, the reason from the perspective of local people, insufficient financial capacity, could not be considered as an actual impediment, given the economic situation of local people and the subsidy payments, it appears that the real reason behind the insufficient financial capacity was the lack of supervision of the subsidy usage. Secondly, most of the local people have never received any technical support; in particular, there is no effective mechanism for giving local people access to technical support from professionals or institutes. Thirdly, the complicated procedures of application for building permit resulted in many owners leaving their buildings without repair and retrofit. Fourthly, the property rights subdivisions have really impeded the decision-making for repair and retrofit. Fifthly, the actual impediments to the repair and retrofit activities should be the limited access to building technology, the administrative licensing problem, and an impediment to decision-making due to property right subdivision. Finally, the repair activities on the buildings built before 1981 were particularly impeded by the administrative licensing problem.

Based on the findings above, recommendations could be considered as follows. Firstly, the local agencies should simplify the process of building permit application, and provide attentive services by cooperating with professional organizations, instead of burdening the local people with the complicated contact to a professional network. Secondly, a platform should be established in cooperation with by local agencies, professionals, institutes, social organizations, and volunteers to enable the local people to have an access to technical support in the post-disaster phase. Thirdly, the usage of the subsidy should be supervised for effective implementation of the post-disaster repair and retrofit. Fourthly, the local agencies should create and continually update a database of historical buildings in order to provide the owners with appropriate assistance for conservation.

Finally, since the impediments to post-disaster recovery and reconstruction are rooted in the local context

of social, economic, and political management, the other historical villages in Southwest China may have similar problems, which we or other researchers will keep going further on this topic. In addition, as we stated that the recovery and reconstruction in the remote historical village are not a well-developed process and research field, especially in China. This case study might be helpful for stimulating the relevant research in future.

CHAPTER 4. PEOPLE'S BUILDING IMPROVEMENT RESPONSE TO MULTI-HAZARD RISK IN DALI VILLAGE

This chapter focuses on the local people's pre-disaster building improvement response to multi-hazard risk in historical Dali Village. It analyzes local government's and residents' disaster-resistant building improvement activities responding to the multi-hazard risk of fire, landslides, and floods. Additionally, it identifies the factors that affected people on their response. Based on the research findings, recommendations are provided for better disaster-resistant building improvement.

4.1 Outline of the chapter

This chapter focuses on people's pre-disaster building improvement activities responding to multi-hazard risk in Dali Village. Its purpose is to identify the factors that affect the people's disaster-resistant building improvement activities. Hence, this study conducted research activities through three principal methods in July 2015 and in February 2016 (Table 4.1).

First, the author sought to understand the conservation planning and its implementation by interviewing five staffs from the Dali Conservation Program Office. The policies and measures related to disasters and heritage conservation were clarified by interviewing two village leaders. Second, people's disaster experiences, housing damage, their improvement activities, and the difficulties that hamper their activities were investigated through structured interviews. The fire-related samples were selected through spatially uniform sampling (Figure 4.1). The landslide and flood-related samples comprised all the available owners among the households affected by these two disaster types. Third, the author recorded the detailed building improvement measures through observation surveys.

Table 4. 1 Outline of field surveys for people's building improvement activities in Dali Village

Disaster	Methods	Sample Size		Sampling Strategy	Content
Accidental fires	Interviews	Dali Conservation Program Office staffs	5 persons		Conservation planning
		Village leaders	2 persons		Policies and measures
	Structured interviews	Villagers	115valid/115collected/115 delivered (Total 309 households)	Spatially uniform sampling* (Figure 4. 1)	Experience, damages, measures, and difficulties
	Observations	Building structure	300 buildings (Total 300 buildings)	All	Building transformation
		Inner space	260 buildings	All the available owners	Fire-resistant measures
Land-slides	Structured interviews	Village leaders	2 persons		Policy and measures
		Villagers	39 households (Total 56 were affected)	All the available owners	Experience, damages, measures, and difficulties
	Observations	56 (Total 56 buildings were affected)		All	
Floods	Structured interviews	Village leaders	2 persons		Policy and measures
		Villagers	38 households (Total 64 were affected)	All the available owners	Experience, damages, measures, and difficulties
	Observations	64 (Total 64 buildings were affected)		All	

* Spatially uniform sampling is a systematic sampling strategy through which the samples are regularly distributed in a given spatial context. The selected samples were adjusted minutely according to the owners' willingness to cooperate.

Figure 4. 1 115 sampled households for structured interview surveys

* The topographic map data was provided by the Dali Conservation Program Office.

4.2 Previous studies on pre-disaster housing improvement

No study could be found through a literature review that considers people's building improvement in response to multi-hazard risk at the community level. At the macro level, some studies have concentrated on social and institutional improvement (Allen, K.M., 2006.; Mercer, J., 2010; Folke, C., et al., 2002), while other have focused on construction management improvement (Bosher, L., et al. 2007). One study, which focused on people's improvement activities in existing living spaces, considered building safer cities to adapt to disaster risk in the future at the city level (Kreimer, A., Arnold, M.,& Carlin. A, 2003).

Among the studies about Dong villages, some have discussed the local wisdom for fire prevention and mitigation (Tang, Y., 2015.; Liao, J.X., 2012.; Ma, Y. Fan, S., 2012; Liao, J.X., 2013.; He, Y. Kuroda, N., 2014). For instance, they introduced the traditional firefighting water system and separately sited granaries. Other studies have analyzed the vulnerabilities of Dong villages (Liao, J.X., 2012.; Wang, D. Liu, K., 2015; Huang, Y., 2013.; Hong, C., 2015.; Tang, Y., 2015.; Liao, J.X., 2013.; China Youth Daily, 2014; Chinese government, 2016). Such as the remarkably low fire-resistant compact wooden buildings without a fire compartment, the tradition of firewood utilization, the aged electrical wiring systems, and insufficient firefighting facilities, etc. Several studies introduced fire risk mitigation programs (Tang, Y., 2015.; Liao, J.X., 2013.; He, Y. Kuroda, N., 2014). Such as the "fire protection pilot projects", which aim to improve the kitchens, wooden buildings, firebreaks, electrical wiring systems, and water systems in rural villages. However, most of the previous studies have focused on governmental activities, no study was found regarding the local people's building improvement activities in historical Dong villages.

4.3 Dali Village and its' multi-hazard risk

4.3.1 Dong ethnic minority and particularly high multi-hazard risk to historical villages in Guizhou

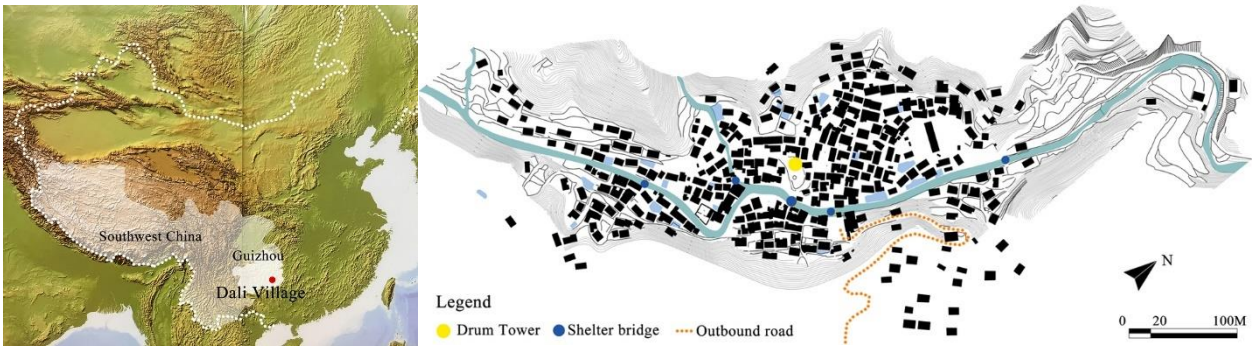
Ethnic minorities in Guizhou constitute 37.84% of the local population. The Dong ethnic minority, the 12th largest ethnic minority in China in terms of population, lives mainly in the mountainous area of Southwest China, in particular, Guizhou. Twenty Dong villages encompassing settlements where the cultural traditions of the Dong ethnic minority are well preserved have been included in the Tentative List of properties considered for nomination to the World Heritage List, in recognition of their outstanding universal value (UNESCO, 2013).

However, as residing close to water is the most important settlement custom of Dong villages, their houses are distributed on mountain slopes along rivers (UNESCO, 2013). Adapting to the limited availability of flat land and local resources in the mountainous environment, these historical villages tend to present compact layouts with traditional buildings constructed from wooden materials from time immemorial. These Dong villages are exposed to high risks of a number of hazards such as fire, landslide, and flood due to the mountainous environment and high-density wooden buildings. In addition, the local people customarily use open fires for cooking and heating. Moreover, the original electrical networks, which were assembled in the rural areas of Southeast Guizhou in the 1980s, are gradually running out of capacity in the wake of modern electrical facilities and appliances becoming universal over the last 30 years. Lacking a high-capacity electrical network, in combination with the local people's misoperation on their buildings' aged wiring systems, many accidental fires occur (Huang, Y., 2013). Moreover, located on the mountain sides, the historical villages usually lack sufficient water resources and firefighting facilities for the initial stage of firefighting. Thus, these historical villages are extraordinarily threatened by fire risk. For instance, reviewing the major accidental fires nationwide based on Liao (Liao, J.X., 2012.), of the 33 major accidental fires that occurred in historical villages in China during the last two decades, 25 happened in Dong villages, including one on the World Heritage Tentative List. These fires not only caused the loss of cherished historical buildings and landscapes but also considerably disrupted the communities' socio-cultural environment. In light of the above, it may be observed that the historical Dong Villages have a particularly high fire risk. Moreover, in contrast to other heritage types, a historical village is also a living space; residential buildings are the core elements of a historical village heritage. Therefore, the building improvement response to the multi-hazard risk can be interpreted as a basic strategy for heritage conservation.

In addition, Guizhou area is especially prone to serious geological hazards such as landslides, collapses, mudslides, heavy rains, and flash floods. A sudden increase of rainfall during rainy seasons of every year continue to causing the risk of landslides and flash floods in the mountainous area and to affecting the buildings that distribute along the border of the mountain slopes and along the river. Overall, the historical villages in Guizhou face a particularly high risk of fire and geological hazards.

4.3.2 Dali Village

Dali Village is located in the Qiandongnan Miao and Dong Autonomous Prefecture in the southeast of Gui-



(a) Location of Dali Village (b) Layout of Dali Village

Figure 4. 2 Location and layout of Dali Village

(Source: Author, (a) is redrawn based on Atlas of PRC., 2009)

(a) Dali Village

(b) Typical residential buildings

(c) Stilted residential house above pond

(d) Stilted granary above pond

Figure 4. 3 Dali Village and their indigenous fire-resistant building method

zhou Province (Figure. 4.2), which was started to be established during the 1730s. The population of the village keeps increasing after the Second World War, in particular, during the recent four decades. According to the record in 2016, Dali Village has 300 households and 1,308 Dong ethnic minority residents. Most of them still rely on traditional terrace farming. At the same time, there is also a trend that younger generations

prefer to go out of the village to work as migrant labors. Thus, generally speaking, the number of residential buildings are increasing in the wake of the registered population growth. Adapting to the terrain and limited flatland, the wooden buildings are spread compactly alongside the river (Figure. 4.3(a)), leading to the typical vulnerabilities of Dong villages to an accidental fire, landslides, and flooding. Typical residential buildings in Dali Village are wooden two-, or three-story wooden buildings (Figure. 4.3(b)). People were used to building their wooden buildings in an indigenous fire-resistant way, in particular, most of the buildings those located away from the river were usually stilted near water (Figure. 4.3(c)). Moreover, for the food security, granaries were also separately built and stilted above a pond (Figure. 4.3(d)). However, along with the population growth and due to insufficient flatland resources for residential building construction, the village layout is getting increasingly compact, while many ponds were buried and occupied as construction land. In addition, the residential buildings are also changing in the last two decades. At present, of the 300 residential buildings, 212 are traditional two- or three-story wooden buildings, and the other 88 buildings are somewhat transformed. Overall, a typical cultural landscape of Dong ethnic settlement is well-preserved in Dali Village, which was included in China's World Heritage Tentative List in 2006.

4.3.3 Accidental fires and resultant damage in Dali Village in the last 100 years

Since the Dong ethnic minority had no written language until 1958 (Zheng, G., Yang, Q., 1985), there is no record of accidental fire in Dali Village. Limited information from the memories of elderly villagers was collected through interviews with them. Over the past 100 years, Dali Village has experienced eight accidental fires (Figure 4.4). Of these, three were major accidental fires. In the 1920s, Drum Tower, the symbol of this Dong village and built on the highest flat ground in the village center, burned down. The current Drum Tower was rebuilt in 2005 (Figure. 4.5(a)). Historically, Drum Tower and its square have provided a venue for the entire village to assemble for meetings, festival celebrations, and other public activities. In the 1940s or 1950s (the exact year could not be determined from the interviews), nearly half of the village was burned down by huge accidental fire. In the 1980s, the oldest example of traditional residential buildings was affected by an accidental fire (Figure 4.5(b)). The rest of the accidental fires were promptly controlled, preventing them from spreading over a larger area (Figure 4.5(c), (d)).

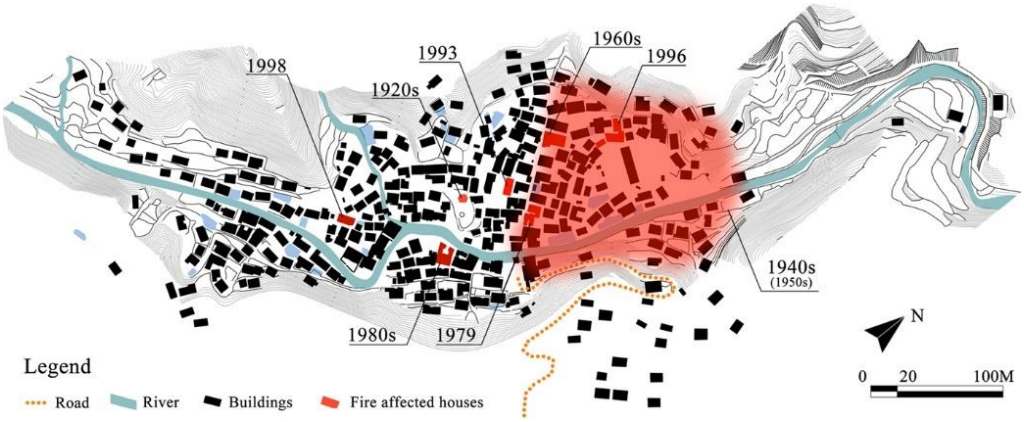


Figure 4. 4 Accidental fires locations in Dali Village in the last 100 years

(a) Drum Tower, rebuilt in 2005, the original tower burned down during the 1920s

(b) The oldest example of traditional residential buildings in Dali Village, which were affected by an accidental fire during the 1980s

(c) The houses affected by an accidental fire in 1993

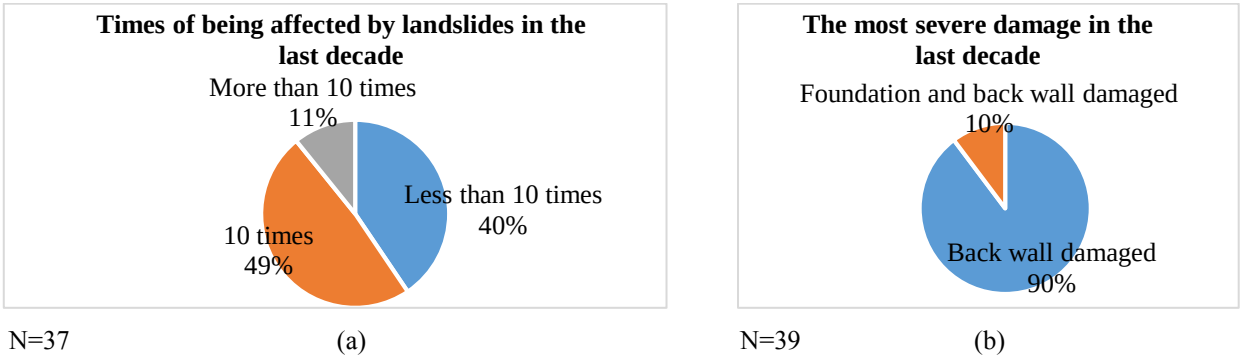
(d) The houses affected by an accidental fire in 1998

Figure 4. 5 Resultant damage in Dali Village caused by accidental fires in the last 100 years

4.3.4 Landslides and resultant damage in Dali Village in the last decade

The houses in Dali Villages are distributed on mountain slopes along rivers and are thereby exposed to a geological hazard risk. During the rainy seasons in the last decade, 56 buildings distributed along the border of the mountain slopes experienced varying degrees of damage due to landslides (Figure 4.6). Of the 39 households investigated, excluding two owners who were not able to recall, 40% were affected by landslides less than ten times in the last decade, 49% experienced landslide damage ten times, and 11% were affected by landslides more than ten times or more than once a year (Figure 4. 7(a)). In addition, 90% of the 39 investigated buildings experienced damage to back walls, while the other 10% of the buildings suffered damages to both their foundations and back walls (Figure 4. 7(b)). Figure 4. 8 shows a building with soil foundations that have already collapsed.

Figure 4. 6 Buildings affected by landslides in the last decade



N=37 (a) N=39 (b)

(a) Times of being affected by landslides in the last decade

(b) The most severe damage affected by landslides in the last decade

Figure 4. 7 Resultant damage in Dali Village caused by landslides in the last decade

Figure 4. 8 The most severely affected building, whose foundations collapsed

4.3.5 Floods and affected area in Dali Village in the last 30 years

Residing close to the water is the most important settlement custom of Dong villages (UNESCO, 2003), which is clearly manifested in Dali Village. This feature of Dong villages' location allows easy access to water resources for not only daily use but also firefighting. However, simultaneously, residing close to the water also poses a flood risk to these Dong villages. In the history, the households that located their buildings approaching the riverbank are affected by floods several times. Within the last 30 years, Dali Village experienced two floods in 1996 and in 1997, which affected totally 64 buildings along the river (Figure 4. 9). In the flooded area shown in Figure 4.9, the most severely affected buildings were inundated with water levels reaching nearly two meters. Figure 4. 10 shows a building along the riverbank that was inundated with water levels of around one meter. The water stain on the wooden wall surfaces remains visible.

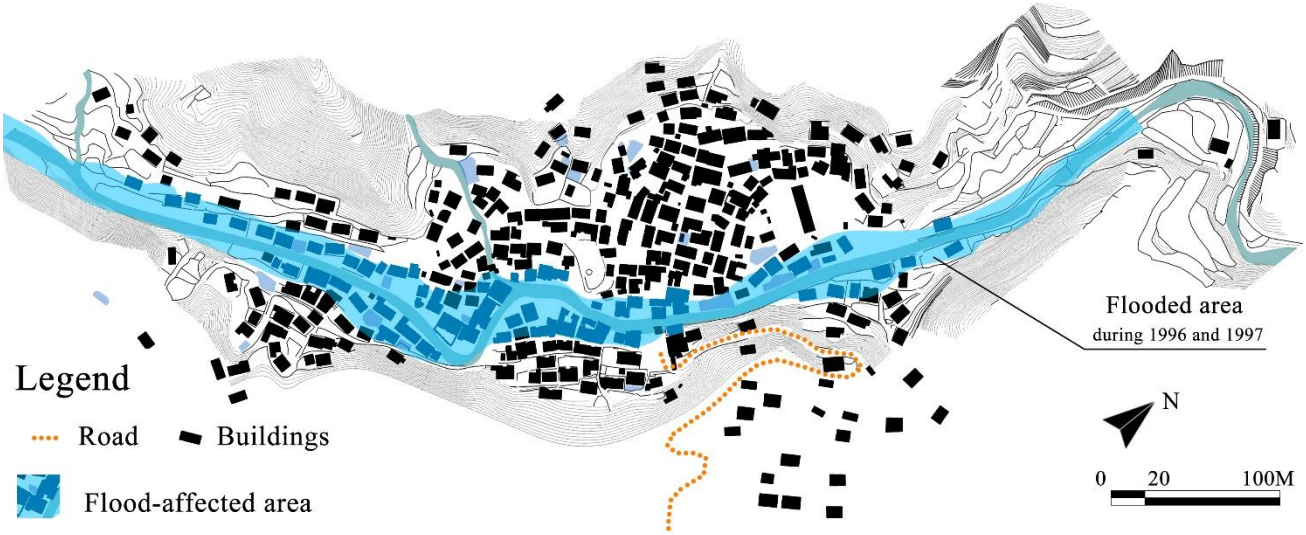


Figure 4. 9 Flooded area during the floods in 1996 and 1997

Figure 4. 10 A building without flood countermeasures was inundated up to about one meter

4.4 Local government's response to multi-hazard risk in Dali Village

4.4.1 Disaster-related regulations for historical villages at the national level

Currently, there are no integrated regulations or strategies regarding multi-hazard risk in historical villages in China. The government's chief concern is fire safety, due to the traditional Chinese wooden buildings' inherent vulnerability to fire risk. In the last two decades, major accidental fires have frequently struck historical towns and villages, causing devastating loss. Therefore, the Fire Department of the Ministry of Public Security, the Ministry of Housing and Urban-Rural Development of the PRC, and the State Administration of Cultural Heritage jointly issued the "Fire Prevention Technical Guidelines for Historical Towns and Villages" in April 2014. It introduced technical guidelines cover five aspects of fire prevention: fire safety evaluation, fire mitigation plan, building fire safety, firefighting facilities, and fire hazard control (Chinese Government, 2014). Of the ten guidelines concerning building fire safety, two measures are recommended to improve the wooden buildings' fire-resistance. The first suggestion is using non-combustible materials or fire-retardant materials when renewing the buildings. The second suggestion is building the gables higher than the roof by using non-combustible materials as a firebreak. However, the first suggestion does not explain any methods for improving the fire resistance of existing wooden buildings without replacing the original materials, such as a practicable fire-retardant treatment process. The second suggestion tends to be limited in the scope of its application. For instance, the purely wooden architectural characteristic of buildings in Southeast Guizhou is aesthetically ill-suited to brick gables higher than the roof; their structures are also not able to support a brick gable.

Overall, while the fire safety regulations for historical towns and villages at the national level provide several technical guidelines for historical villages, the methods of improving the existing wooden buildings' fire-resistance remains unclear.

4.4.2 Disaster-resistant building improvement regulations and programs at the provincial level

Compared to other disasters, the fire safety of historical towns and villages is also the main focus at the provincial level. Targeting fire risk, the Guizhou provincial government issued the "Fire Protection Regulations" in 2002 (Legislative affairs office of the state council, 2002). In these regulations, the government encourages the local people to transform their wooden buildings using fire-resistant materials, but no detailed rules and guidelines were contained in the regulations or otherwise explained. Thus, the disaster-resistant building improvement activities at the local level have no rules to follow and no guidelines to which to refer.

The local government also focuses on fire risk more than other risks. As stated above, the causes of the extremely frequent accidental fires that occur in the historical villages in Guizhou can be attributed to the low fire-resistance wooden buildings, the compact layout without firebreaks, the traditional lifestyle of utilizing open fires for cooking and heating, the aged wiring systems, insufficient water resources for

firefighting, insufficient firefighting facilities, etc. (Liao, J.X., 2012; Tang, Y., 2015; Liao, J., 2013; Wang, D. & Liu, K., 2015; Huang, Y., 2013; Hong, C., 2015). Accordingly, to reduce the fire risk in the rural villages of Southeast Guizhou, the local government plans to conduct a program of "Five Improvements", which aims to replace the open fire oven in the kitchen with a brick oven, to replace the aged wiring systems, to improve the wooden buildings into brick or other fire-resistant materials, to create firebreaks in compact wooden villages, and to improve the water system to ensure the sufficient availability of firefighting water resources.

4.4.3 Two fire-resistant building improvement projects in Dali Village

As stated above, the local government plans to conduct five programs to improve the fire-resistance in rural villages. In Dali Village, the local government conducted two programs, providing not only financial support but also materials and skilled workers. Each household's traditional cooking space with a ground oven (Fig. 11(a)) was transformed into a brick oven (Fig. 11(b)), and the aged electrical wiring installed during the 1980s (Fig. 12(a)) was replaced in every home (Fig. 12(b)) in 2008. The wiring was then upgraded again in 2015. All of the 24 household owners interviewed believed that these projects had effectively reduced their fire risk (Fig. 13).

Based on our investigation, however, the oven transformation was not considered to be fully effective. Reporting on their usual practices, 84% of the households surveyed continue to use a ground oven (Figure 4.14(a)), 44% use a gas oven instead of a brick oven (Figure 4.14(b)), and 32% use an induction cooker instead of a brick oven (Figure 4.15(a)). The brick oven is too big for most families' needs since the young members usually move out of the village for work. In addition, while the walls surrounding the brick oven were rebuilt with brick in 64% of the households, the remaining 36% still have highly flammable wooden walls (Figure 4.15(b)).

(a) (b)

(a) The ground oven surrounded by wooden walls in the traditional cooking space

(b) The transformed brick oven surrounded by brick walls

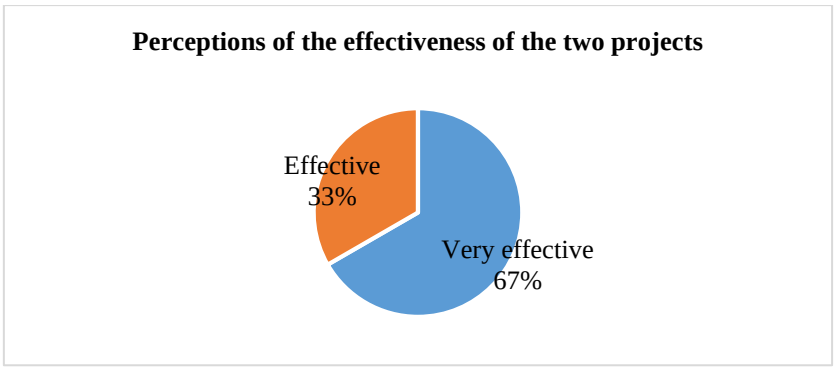
Figure 4. 11 Ground oven transformation

(a) (b)

(a) The meandering aged electrical wiring installed during the 1980s

(b) The improved electrical wiring

Figure 4. 12 Aged electrical wiring replacement



N=24

Figure 4. 13 Local people's perceptions of the effectiveness of the two projects

(a) Ground oven (b) Gas oven

Figure 4. 14 Open fires still in use

(a) Induction cooker in use (b) Timber walls surrounding the oven

Figure 4. 15 Induction cooker in use and timber walls surrounding the oven

4.4.4 Disaster-related terms in the conservation plan and projects in Dali Village

Dali Village is one of the 51 historical villages that were designated as pilots of integrated conservation and development program by the State Administration of Cultural Heritage. The Dali Conservation Program Office developed a conservation plan and implemented conservation projects during 2014 and 2015. Based on the interview with five staffs in the office, it was found that the conservation plan, currently in the process of being developed, integrates concerns about multi-hazard risk in Dali Village with several measures. First, it plans to divide the village into six fire districts and to create firebreaks by using an exterior fire sprinkler system. Second, it plans to strengthen the heritage buildings' foundations along the river to protect against floods. Third, it plans to protect the slopes surrounding the heritage buildings to guard against landslides. Moreover, it also focuses attention on earthquakes and lightning strikes. Although this plan focuses attention on the multi-hazard risk in Dali Village, the measures it proposes only target the buildings that have been identified and registered as heritage properties. The plan does not consider the village as a whole in terms of conservation and disaster risk reduction.

The conservation projects comprise ten aspects: heritage restoration, environment treatment, infrastructure improvement, fire safety, tourism facilities development, community development, eco-tourism development, traditional industries development, media platform development, and research and publication. To minimize the impact of restoration, the conservation plan requires using the original materials and construction methods through restoration. The utilization of new materials and new construction methods that without the permission from the State Technical Appraisal are restrained. According to the interviews with two village leaders, the heritage restoration projects did not involve disaster-related measures: instead, they strengthened the building foundations, repaired or replaced the building components, removed the additional extensions, etc. Consequently, the conservation projects on building restoration made no progress towards disaster-resistant building improvement. Overall, measures targeting multi-hazard risk were proposed in the Dali Village conservation plan. However, no disaster-resistant building improvement progress was made in the conservation projects.

4.5 Local people's building improvement response to multi-hazard risk

4.5.1 Fire-resistant building improvement activity by the local people

4.5.1.1 Fire-resistant building transformation

The original residential buildings in Dong villages are purely constructed from highly flammable wood without a fire-resistant coating. Of the 300 buildings investigated in Dali Village, 71% retain the traditional style, while 29% have been transformed (Table 4.2). All of the transformed buildings retain upper stories of the original wooden materials and form; only their first stories have been transformed into one of four types (Figure 4.16). The transformation can be considered effective in enhancing buildings' fire resistance to some extent. However, it has remarkably affected the original architectural characteristics and the landscape of this historical village.

Table 4. 2 Four types of first-story fire-resistant building material transformation in Dali Village

Types		Pillar	Beam	Wall	Abbreviation	Number (%)
Non-transformed buildings (Original)		Wood	Wood	Wood	W-W-W	212 (71%)
Transformed buildings	Type 1	Wood	Wood	Brick	W-W-B	25 (8%)
	Type 2	Brick	Wood	Brick	B-W-B	22 (7%)
	Type 3	Brick	RC	Brick	B-RC-B	4 (1%)
	Type 4	RC	RC	Brick	RC-RC-B	6 (2%)
	Unclear	—	—	Brick	—	31 (10%)

N=300 buildings

4.5.1.2 Fire-resistant exterior coating

The fire-resistant exterior coating of a building's roof, eaves, and facade slows down the speed of fire spread between buildings. All of the buildings investigated in Dali Village were built with a traditional wooden roof truss covered with gray clay tiles (Table 4.3, Figure 4.17 (a)), and the eaves are lack a fire-resistant coating (Table 4.3, Figure 4.17 (b)). The facades of the traditional wooden buildings that have not undergone transformation have no fire-resistant coating (Figure 4.2(b)), while 27% of the transformed buildings have no coating on their brick walls (Figure 4.18(a)), and 73% have a cement mortar or ceramic tile coating (Figure 4.18(b), (c)).

Table 4. 3 Fire-resistant exterior coating of buildings in Dali Village

Types	Roof coating	Eaves coating	Facades coating	
			First story	Upper stories
Non-transformed buildings (212)	100% covered with gray clay tiles	0%	0%	0%
Transformed buildings (48)			73%	0%*

N=260 buildings

*The transformed buildings are all retaining the upper stories with their original form and wooden materials without coating.

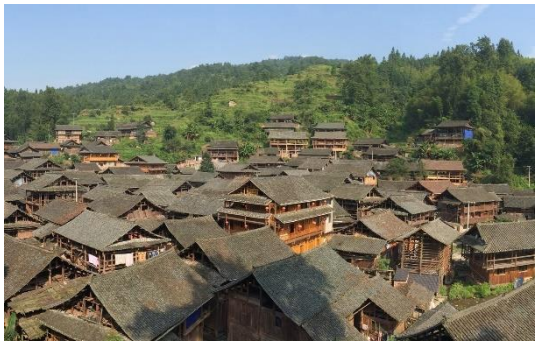
(a) Type 1

(b) Type 2

(c) Type 3

(d) Type 4

Figure 4. 16 Four types of first-story fire-resistant building material transformation



(a) Building roofs paved with gray clay tiles

(b) Wooden roof truss and eaves without a fire-resistant coating

Figure 4. 17 Tile-paved building roofs and wooden roof truss and eaves without fire-resistant coating

(a) (b) (c)

(a) Transformed building with brick walls and without coating
(b) Transformed building with brick walls and cement mortar coating
(c) Transformed building with brick walls and ceramic tile coating

Figure 4. 18 Transformed buildings' fire-resistant exterior coating on brick walls

However, the upper stories of all the transformed buildings still retain their wooden facade without a fire-resistant coating. Moreover, to keep the original landscape, the local government covered several transformed houses' brick walls with wood (Figure 4.16(d)), negating the previous fire-resistance improvement.

4.5.1.3 Difficulty of implementing fire-resistant building improvement activities

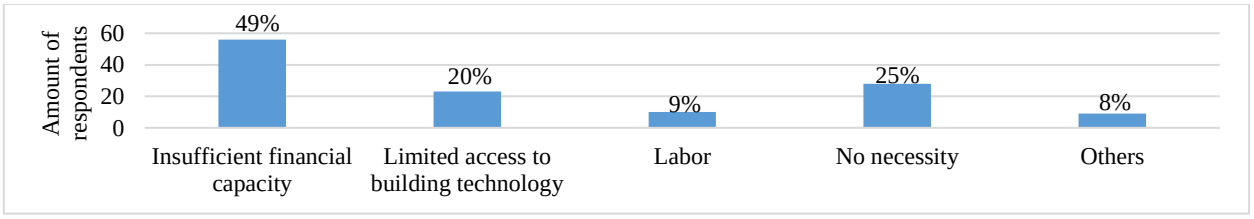
It can be observed that the local people's building improvement activities have been limited based on the above analysis. In order to explore the factors that affected people's response, this study conducted a questionnaire survey to investigate the reasons for their limited activities. Through this survey, it was found out that 49% of the respondents' response were hampered by insufficient financial capacity, while 25% of them believed that improvement activity is unnecessary, and 20% claimed that they lacked access to fire-resistant building technology (Figure 4.19).

4.5.2 Building improvement response to landslide risk

Regarding the countermeasures against landslides, the local people's options comprise building retaining walls, strengthening the building foundations, or moving to a safer place.

4.5.2.1 Retaining wall construction and building foundation strengthening

Of the 39 households investigated (Figure 4.20(a)), 18% have 0.6 m to 1.8 m retaining walls built from single-skin brick (Figure 4.20(b)) while 82% have no retaining wall, including one surveyed household that



N=114 Multichoice

Figure 4. 19 People's difficulties in implementing fire-resistant building improvement

N=39 (a) (b) (c)

(a) The percentage of houses in Dali Village that have constructed a retaining wall
(b) Single-skin brick retaining wall
(c) This household was clearing the mud after a landslide and planning to build a concrete retaining wall

Figure 4. 20 Retaining wall construction

(a) (b)

(a) The most severely affected building, whose foundations have already collapsed
(b) This household was repeatedly repairing and strengthening the foundations with stone and cement

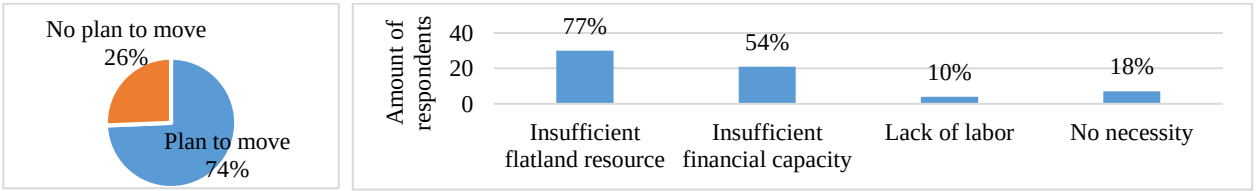
Figure 4. 21 Building foundation strengthening

was in the process of clearing mud after a landslide and planning to build a concrete retaining wall (Figure 4.20(c)). The seven households that have already built a retaining wall observed that their houses no longer suffered from the damage caused by landslides since it prevented the dirt and gravel falling from the slopes and hitting their buildings. In addition, all of the 32 households without a retaining wall attribute its absence to insufficient financial capacity.

Of the four households, whose building foundations were damaged by landslides, only one owner whose building foundations collapsed (Figure 4.21(a)) had continued to repair and strengthen the foundations with stone and cement during the last few years (Figure 4.21(b)). The other three households said that lacked the financial capacity to respond to the risk. Even for the family which continued to take remedial action, it was becoming increasingly difficult to cover the average annual cost of USD 754 to repair the foundations though this owner works in the city as a migrant worker.

4.5.2.2 Plan to move to a safer flatland and the associated difficulties

Of the 39 households investigated, 74% plan to move to safer flatlands, while 26% have no plans to move (Figure 4.22(a)). All of them are yet to do so. 77% have problems finding a flatland for constructing their new houses, while 54% are hampered by insufficient financial capacity, and 10% are also worried that they do not have sufficient labor to move and construct a new house. In addition, 18% consider that there is no necessity to move (Figure 4.22(b)). It can be seen that insufficient flatland resource and financial capacity are two difficulties that hampered people's response.



N=39 (a) N=39 Multichoice (b)

(a) Local people's plans regarding moving to a safer flatland
(b) Difficulties of moving to a safer flatland

Figure 4. 22 Local people's plans regarding moving to a safer flatland and difficulties

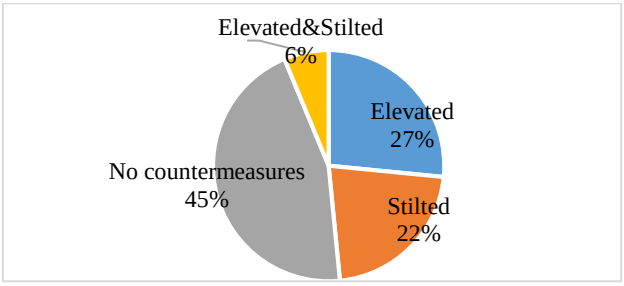
4.5.3 Building improvement response to flood risk

4.5.3.1 Building improvement activities

It was discovered through the investigation that the local people have responded to flood risk through two methods: elevating the foundations and raising the buildings on stilts. As Figure 4.23 shows, of the 64 buildings investigated, 27% have foundations that have been elevated with stone (Figure 4.24(a)) to between approximately 0.3 and 4 m above the riverbank; 22% have been raised on stilts (Figure 4.24(b)) to between approximately 0.4 and 3 m above the foundations with wooden, brick, and stone pillars; and 6% have been raised on stilts above the elevated foundation (Figure 4.24(c)) with a total height above the riverbank 3.1 to 5 m. The other 45% of the households have not implemented any countermeasure to flood risk (Figure 4.10).

4.5.3.2 The reasons for not implementing countermeasures to flood risk

As the Figure 4.25 shows, of the 29 buildings that have no countermeasures to flood risk, the owners of 14 buildings do not consider it is necessary to care about flood risk since their houses have not been severely affected



N=64

Figure 4. 23 The building improvement responses to the flood risk in Dali Village

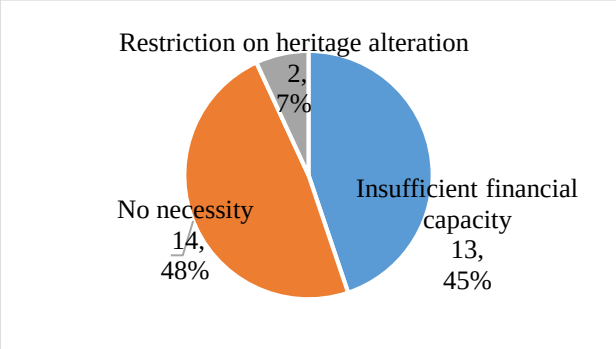
(a) (b) (c)

(a) This building's foundations have been elevated to 2.4 meters higher than the riverbank

(b) This building has been stilted to 2 meters higher than the riverbank

(c) This building has been stilted to 2.5 meters above the 2.5 meters elevated foundations, totaling 5 meters higher than the riverbank

Figure 4. 24 Residential buildings' flood countermeasures



N=29

Figure 4. 25 Reasons for not having flood countermeasures

by floods. The owners of another 13 buildings attribute their lack of countermeasures to insufficient financial capacity. Finally, the last two buildings are registered as architectural heritage: although owned by the local people, their building-related conservation issues are entirely managed by the government. The measures taken by the government were explained in the former section 4.3. Activities by the owners that may lead to altering the heritage are restricted.

4.5.4 Discussion

4.5.4.1 The local people's difficulties with building improvement activities and perceptions of the multi-hazard risk

The local people's limited building improvement activities can mainly be attributed to insufficient financial capacity, limited access to building technology, and the perception that there is no necessity to conduct them.

Considering, first, the local people's insufficient financial capacity, the rural villages in China are experiencing an upsurge in residential building transformation, which needs to be supported by finance capability enhancement. In 2015, the per capita disposable income of the rural villages in Southeast Guizhou was a mere USD 1,009 (Rongjiang county government, 2016), compared to the average amount of USD 1,721 in the rural areas of the whole nation (NBOSPRC, 2015). Therefore, the local people's limited improvement activity is understandable. Regarding the second explanation, limited access to building technology, as analyzed in the previous section regarding the technical measures for improving the existing wooden buildings' fire-resistance, the local people there have no rules to follow and no guidelines to which to refer at the local level.

As regard the perception there is no necessity, it was found during the structured interviews that fatalism plays a prominent role in the local community's risk perception. The Dong ethnic minority has been used to continuous migration and disasters throughout their history; thus, they may have no custom of pursuing eternal buildings. In addition, most of the respondents sincerely noted the deterrent effect of traditional community regulations. It is customary for the owner of a building that catches fire and affects the neighbors' buildings or even the whole village to be seriously punished by the whole community. According to the new

community regulations issued by the Dali Village Committee in 2016, the owner whose building causes a fire must compensate others for their loss, conduct night patrols for one month, and provide rice, meat, and rice wine (90 kg each) to compensate the villagers who contributed to the collective firefighting. Therefore, the local people, particularly the older people, insist that fire prevention awareness is much more important and effective than the building improvement since they do not know any measures that can improve the inherent vulnerability of wooden houses.

Moreover, insufficient flatland resources also hampered the landslide-affected families making plans to move to a safer flatland. According to the village leader, to reduce the building density in this village, the village committee is planning to construct a new village several kilometers away from the present village. This forthcoming relocation may reduce the landslide risk to several families.

4.5.4.2 The existing historical wooden buildings' fire-resistance improvement methods

The regulations or technical guidelines at the national and provincial level suggest that the local people should use non-combustible materials or fire-retardant materials when renewing their wooden buildings, but the method for improving the fire resistance of a large number of existing wooden buildings remains unclear. Since it is impossible to replace the original materials of these existing wooden buildings, the key problem that needs to be addressed is to find a practicable fire-retardant treatment process. Smearing the buildings' exterior and interior surfaces with a transparent fire-retardant coating is a practicable method, but the transparent fire-retardant coating is not widely used because its performance will decrease and it will whiten (losing its transparency) after a certain period of time (Zhang, Z., 2007). Progress on the transparent fire-retardant coating seems crucial. If fire-retardant wooden materials can be widely used, this village may at least be increasingly resistant to fire risk after several decades through the buildings' natural succession.

Another problem is how to control the impact of using non-combustible materials or fire-retardant materials in a heritage village. Rural villages in China are experiencing an upsurge in residential building transformation: most of the residential buildings at present are constructed from adobe or brick (Gao, Y., 1995.). In Dali Village, 29% of the buildings have been partly transformed by bricks or concrete. These transformations can be considered to enhance the buildings' fire-resistance to some extent, but simultaneously dramatically affects their original architectural characteristics. Having realized this, the local government has covered some houses' brick walls with wood to restore their original wooden appearance. It represents a dilemma between disaster risk reduction and heritage conservation within this historical village, which faces a multi-hazard risk. Moreover, this is not a special case: a historical village in Sichuan Province named Shangli, which the author investigated a year ago, is confronted by the same dilemma (Du, F., Okazaki, K., Ochiai, C., Kobayashi, H., 2016).

4.6 Conclusion of the chapter

This study investigated the local government and the people's building improvement responses to multi-

hazard risk and identified the difficulties hampering building improvement activities in Dali Village. The conclusions are as follows.

First, the fire risk is the main concern of the regulations and programs at both the national and the provincial levels. The technical guidelines on fire-resistant building improvement at both the national and the provincial levels suggest that the local people should use non-combustible materials or fire-retardant materials when renewing the wooden buildings, but the methods for improving the fire resistance of a large number of existing wooden buildings remain unclear. The two improvement programs of transforming ground oven and replacing aged electrical wiring, which has been completed in Dali Village, have effectively reduced the fire risk according to the villagers' perceptions. However, this study found that the oven transformation program was not considered to be fully effective based on the investigation. Ground ovens are still being used since the transformed brick oven is too big for most families' needs since the young members usually move out of the village for work. Moreover, one-third of the brick oven are still surrounded by highly flammable wooden walls. In addition, the Dali Village conservation plan, which is still in the process of being developed, proposes measures targeting multi-hazard risk but only focuses on heritage buildings. The conservation projects that have been completed focused on heritage restoration, etc., with no disaster-resistant building improvement activity conducted.

Second, without detailed technical rules and guidelines, the local people's fire-resistant building improvement activities tended to be limited and not executed properly. Nearly one-third of the households we investigated have replaced the first stories of wooden buildings with brick or concrete to reduce the fire risk. However, all of the non-transformed buildings and the upper stories of the transformed buildings still retain wooden facades without a fire-resistant coating. These transformations can be considered to enhance the fire-resistance to some extent while simultaneously dramatically affecting the buildings' original architectural characteristics. Insufficient financial capacity and limited access to fire-resistant building technology have also hampered the local people's activities. Regarding landslide risk, due to insufficient flatland resources and financial capacity, the majority of the local people cannot respond to landslide risk. Of the 39 households investigated, 18% of the local people had built a single-skin brick retaining walls and 82% had no retaining wall at all. In addition, 74% of them planned to move to a safer flatland and 26% have not planned to move. Insufficient flatland resource and financial capacity are two difficulties that hampered people's response. Regarding flood risk, of the 64 inundated buildings along the riverbank, 27% have foundations that have been elevated using stone; 22% have been raised on stilts using wooden, brick, and stone pillars; 6% have been raised on stilts above the elevated foundations; and 45% have no countermeasures to flood risk. Of the 29 buildings without countermeasures, the owners of 14 buildings did not consider it necessary to protect their buildings against flood risk since flooding did not severely affect their houses. Another 13 owners attributed their lack of countermeasures to insufficient financial capacity. In addition, the building-related conservation issues of two heritage buildings are entirely managed by the

government, resulting in the imposition of restrictions on the owners' activities that may lead to alteration of the heritage.

Based on the above conclusions and discussions, this study proposes the following recommendations concerning institutional, technical, and financial aspects to reduce the disaster risk in the context of World Heritage conservation.

First, the historical village is a particular type of cultural heritage, in which the local community co-exists with the surrounding natural environment while preserving their culture. Its conservation needs to focus attention on the subsistence, originality, and integrity of the whole community. Thus, governments at the national, provincial, and local level should introduce a specialized conservation system with institutional, financial, and technical regulations. These regulations should fully address the multi-hazard risk, instead of only tackling the major risk, and must also make provision for the whole community, instead of only focusing on the heritage building. Of course, decision-making on the investment and distribution of resources could be arranged according to a priority classification.

Second, the government should encourage the development of materials and technology targeting disaster-resistant improvement of the historical buildings and historical villages. At the local level, the technical guidelines need to be detailed and specifically targeted. Regarding the local people's difficulty of limited access to building technology, a sensible practical approach would be to involve social organizations and certified volunteers in providing long-term professional technical support within the community.

Third, the local people lacking sufficient financial capacity to take remedial action are bearing all the risks by themselves, resulting in the formation of a vicious circle of "low resistance-disaster-damage-insufficient financial capacity-limited response-low resistance." The availability of various forms of financial support is essential to break this vicious cycle. The whole community needs to engage in insuring the buildings to thereby share the multi-hazard risk facing the whole village. Low-interest or interest-free loans and subsidies should be provided to the local people to motivate them to engage in effective disaster-resistant improvement activities.

Overall, this study strongly advocates a multi-hazard risk targeted policy, detailed regulation at the local level, development of new materials and technology targeting historical wooden buildings, long-term technical support, and multiple channels of financial support.

CHAPTER 5. DEFINITION OF COMMUNITY DISASTER COPING CAPACITY (CDCC)

This chapter gives a definition of community disaster coping capacity (CDCC) and proposes a CDCC assessment framework for the case villages, using individual disaster coping capacity (IDCC), actual community disaster coping capacity (ACDCC), and potential community disaster coping capacity (PCDCC).

5.1 Outline of the chapter

This chapter focuses on explaining the definition of community disaster coping capacity (CDCC) in this study, based on reviewing the previous studies related to disaster coping capacity at the community level. According to the definition, this chapter proposed a CDCC assessment framework for the case studies in two historical villages. In this framework, factors, components, and sub-components which extracted from previous studies are included or excluded, adapting to the social and organizational conditions at the community level in China.

5.2 Previous research on disaster coping capacity at the community level

Despite increasing attention is now paid to the capacity of disaster-affected communities to recover with little or no external assistance (Manyena, S.B., 2006), there is a limited theoretical understanding of this concept, which is usually being mix-used with 'resilience' and variously defined at the community level, individual level, and even at the ecological system level. At the community level, it refers to the capacity to adapt, withstand, respond, cope with, or to bounce back the extreme event without suffering devastating losses, damage, diminished productivity, or quality of life without a large amount of assistance from outside the community (Comfort, L., 1999; Miletti, D.S.,1999; Bruneau, M., 2003; Timmerman, P., 1981; Wildavsky, A., 1991; Paton, D. & Johnston, D., 2001; Chenoweth, L., & Stehlik, D., 2001; UNISDR, 2005; Pelling, M., 2003). In particular, one study defines it as "a community's capacities, skills, and knowledge that allow it to participate fully in recovery from disasters" (Coles, E., & Buckle, P., 2004), directly mentioned disaster.

There are also some studies defined it at the individual level as the capacity for successful adaptation, positive functioning, competence, despite high-risk status, chronic stress, or following prolonged or severe trauma (Egeland, B., 1993; Masten, A.S., 1999; Butler, L., et al., 2007). Some studies emphasized both individual and community in the statement as the ability of individuals and communities to deal with a state of continuous long-term stress and the ability to find unknown inner strengths and resources in order to cope effectively and to adapt flexibly (Ganor, M., 2003; Norris, F. H., 2008). However, It is still not clear how this concept should be operationalized and what its determinant factors are or how they can be measured (Mayunga, J.S., 2007). Few studies proposed conceptual frameworks composed of social, natural, economic, physical, and human capitals (Mayunga, J.S., 2007; Bollin, C., et al., 2006). But they are still too broad to

be used as guidance for policy and measures, even the author recognized that it is practically not possible to measure all the indicators because of the limitation of data availability. Even in the UNISDR's strategy for 2005-2015, it remains uncertain.

In Japan, the terminology of '地域防災力' in Japanese is widely used as the local community's comprehensive capacity of coping with disaster. In English, the statements of 'community disaster mitigation capability', 'local ability of disaster prevention', 'regional disaster prevention ability', and 'coping capacity of the local community against disasters', etc. This research uses 'community disaster coping capacity (CDCC)' to conclude the definition of that it represents the comprehensive capacity of the local community to cope with disaster during emergencies through the cooperation of all community members (Kaji, H.& Tsukagoshi, I., 2013). The CDCC composes of Risk awareness (リスク認知), Actual community disaster coping capacity (顕在力), and Potential community disaster coping capacity (潜在力) (Nagamatsu, S., et al., 2009). Most of the studies focused on the Actual community disaster coping capacity, but the potential community disaster coping capacity is increasingly being mentioned during latest decade. That means it is getting widely recognized that the CDCC depends on not only practical strategies but also the potential coping ability rooted in daily relationships and community cohesion.

However, the 'community' in these studies was regarded as surrounding 'neighborhood associations' or 'volunteer disaster mitigation organization' under the special social context in Japan, therefore, it cannot be flexibly used, especially in developing countries where the community-level disaster risk reduction organization and strategy are far from developed. Even though the elaborate factors for community disaster coping capacity assessment at the community level are worth, and these studies are reviewed as follows from three aspects: CDCC assessment framework, individual factors, and components, community factors and components.

5.2.1 Assessment framework of disaster coping capacity at the community level

Several studies in Japan proposed methodological frameworks for CDCC assessment with individual indicators and community indicators (Okanishi, Y., et al., 2006; Abe, Y., et al., 2007; Gohnai, Y., et al., 2007; Hori, T., et al., 2007; Takeuchi, S., 2011). However, no widely-accepted CDCC assessment framework has been developed yet.

Okanishi, Y. et al. initially proposed two factors of '実践的防災力' (Actual community disaster coping capacity (ACDCC)) and '潜在的防災力'(Potential community disaster coping capacity (PCDCC)). The former refers to the actual community capacity, which can be strengthened by actual disaster reduction plan and improvements. The latter refers to the inherent community capacity, which rooted in community cohesion that might empower the community cooperation for coping with disaster during an emergency (Okanishi, Y., et al., 2006). In order to clarify the ACDCC, Okanishi, Y., et al. analyzed the disaster risk

awareness of the targeted communities and the implementation of the disaster mitigation measures in the targeted communities. In order to clarify the PCDCC, Okanishi, Y., et al. analyzed the various community activities to understanding the connection among local people. The community activities were classified into four types: Connection strengthening activities of all community members, such as festivals, etc.; Basic community activities, such as public facilities' management; Connection strengthening activities of special groups, such as activities of elder group, women group, etc.; Community improvement activities, such as resource recycling and street cleaning activities, etc.

Abe, Y. et al., Gohnai, Y., et al., Hori, T. et al. proposed a quantitative assessment framework. The five indexes are individuals' disaster risk awareness, common people's disaster coping ability, neighborhood disaster organizations' disaster coping ability, community basic ability, implementation of community activities. Each index has three-level hierarchical items. First, the individuals' disaster risk awareness is examined by disaster training participation, earthquake countermeasures implementation, awareness of emergency facilities' location and usage. Second, common people's disaster coping ability is examined by the implementation of disaster training and implementation of disaster risk awareness enhancement activities, which is further analyzed by frequency, participation, and types. Third, neighborhood disaster organizations' disaster coping ability is examined by available personnel during an emergency, available facilities, awareness of the leaders, first aid ability. Fourth, community basic ability is examined by the percentage of permanent residence, participation in the neighborhood association, etc. Fifth, implementation of community activities include events and volunteer activities, and activities for community development, etc. (Abe, Y., et al., 2007; Gohnai, Y., et al., 2007; Hori, T., et al., 2007). However, of the complex items of five indexes, the items targeted individuals are mixed with the items targeted the neighborhood association, some items are similar and excessively divided. For instance, after the disaster training participation appeared in the items of the first index, the implementation frequency and the percentage of participation are used again for the second index, which can be seen also as an individual index.

Takeuchi et al. proposed a qualitative CDCC assessment framework for villages in the remote mountainous area. Particularly, they took an isolation risk into consideration. The framework is composed of isolation risk, basic community properties related to disaster risk management, and the implementation of disaster risk mitigation measures (Takeuchi S. et al., 2011). The isolation risk is examined by the regional terrain, disaster risks, the distance from a local agency, and the number of outbound roads. The basic community properties are examined by human resource and community activity, and the connection with local organizations. The implementation of disaster risk mitigation measures is examined by disaster risk reduction plan and infrastructure, facility improvement.

5.2.2 Individual factors and components

Several studies proposed various individual factors, which can be concluded into mainly four components: disaster risk awareness, disaster preparedness, participation in disaster training, and cooperation willingness.

Tokyo Fire Department examined the disaster coping capacity of residents by three factors: firefighting capacity, evacuation capacity, and emergency rescue capacity. Each factor is examined by training experience, facility preparation, participation in the disaster mitigation activities, the existence of the leader, and the cooperation willingness (Tokyo Fire Department, 1995). In China, local governments are in charge of the disaster-related issues of villages by a top-down approach, including facility equipment and organization development at the community level. Thus, the components of residents' facility preparation and the existence of the leader are excluded. The other components could be included in this study. Hori. T., et al. proposed two factors of the individual risk awareness and emergency coping capacity. The detailed components related to the individuals' disaster coping capacity are disaster preparedness, participation in disaster training, and knowledge of the facilities' location and knowledge of how to use a facility (Hori, T., et al., 2007). All these components could be included in this study. Hu Z. et al. summarized emergency behaviors to evaluate emergency response capacity (Hu, Z., et al., 2004). As individuals' basic responding ability, emergency action could be included in this study. Matsuda, Y. et al. analyzed individual preparedness mainly based on housing safety improvement and knowledge of how to use a fire extinguisher (Matsuda, Y., 2004). Since the residential buildings in rural areas are the major risk-bearing bodies, the component of housing safety improvement could be included in this study. In particular, according to Kamio, the local people's disaster risk awareness should be a component of disaster coping capacity (Kamio, H., & Imamura, F., 2005). Nagamatsu defined individuals' disaster risk awareness as 'the level of understanding the regional disaster risk' (Nagamatsu, S., 2009). Wakabayashi N. examined the local people's disaster risk awareness by factors of disaster cognition, disaster experience, and disaster preparedness (Wakabayashi, N., et al. 2000).

On the whole, all the components that extracted from previous studies are classified as follows: individual risk awareness, individual disaster preparedness, and individual potential responding ability. The included sub-components are understanding of disaster risk, disaster damage estimation; disaster-resistant building improvement, other preparedness measures; knowledge of emergency action, awareness of facilities location and how to use a facility. The sub-components of participation in disaster education and training are also included but classified into community components since these collective action may represent more about the disaster coping ability at a community level.

5.2.3 Community factors and components

As stated in section 5.2.1, Okanishi, Y. et al. proposed two factors of '実践的防災力' (Actual community disaster coping capacity (ACDCC)) and '潜在的防災力'(Potential community disaster coping capacity (PCDCC)). In order to review various studies focus on the community factors of the CDCC, this study discusses by using the classification of ACDCC and PCDCC.

The ACDCC refers to the actual community capacity, which can be strengthened by actual disaster reduction plan and disaster mitigation measures (Okanishi, Y., et al., 2006). In order to compare several

targeted communities' ACDCC, Okanishi, Y., et al. analyzed the activity level of 11 disaster mitigation activities. The 11 disaster mitigation activities include disaster risk reduction plan, earthquake-resistant building retrofitting promotion, identification of the vulnerable areas and vulnerable people in the community, hazard map preparation and distribution, agreement conclusion with local companies, regular community meeting, disaster imagination training, evacuation training, and storage of disaster response equipment. They classified the communities into four types in terms of the activity level of disaster mitigation activities: active type with community disaster mitigation activities, the government-led type with increasing community activities, government-led type, and inactive type. Considering the undeveloped situation of community-based disaster management in rural areas of China, the components of identification of the vulnerable areas and vulnerable people in the community, hazard map preparation and distribution, agreement conclusion with local companies and regular community meeting are excluded. In addition, other studies proposed some actual disaster mitigation measures that present similar scope as ACDCC. For instance, Hori, T., et al. proposed two community factors: fundamental community asset and volunteer disaster mitigation organization's disaster coping ability. Fundamental community asset includes several components such as the percentage of permanent residents, the frequency of community activity, etc. Volunteer disaster mitigation organization's disaster coping ability includes several components such as disaster risk awareness of the organization leader, first aid, and emergency rescue ability, storage of the disaster response equipment, and the human resource of the organization (Hori, T., et al., 2007). All of these sub-components could be included to the component of community disaster mitigation organization. Takeuchi et al. also proposed two factors: disaster risk reduction plan and infrastructure improvement. Disaster risk reduction plan includes components of vulnerable area inspection, emergency response system establishment, disaster training, etc. Infrastructure improvement includes components of evacuation site and route improvement, information transmission equipment improvement, and storage of disaster response equipment (Takeuchi, S., et al., 2011). All of these sub-components could be included.

The PCDCC refers to the inherent community capacity, which rooted in community cohesion that might empower the community cooperation for coping with disaster during an emergency (Okanishi, Y., et al., 2006). In order to clarify the PCDCC, Okanishi, Y., et al. analyzed various community activities to understand the connection among local people. The community activities were classified into four types: connection strengthening activities of all community members, such as festivals, etc.; basic community activities, such as public facilities' management; connection strengthening activities of special groups, such as activities of elder group, women group, etc.; and community improvement activities, such as resource recycling and street cleaning activities, etc. In addition, they also indirectly proved the effect of active community activities as a potential community disaster coping capacity. Because they found a positive correlation between the activity level of daily activities and disaster mitigation activities. Therefore, community activity could be included with the community groups and activities adjusting to the local condition in Chinese communities in rural areas. Other studies proposed some factors with the similar scope

as PCDCC. For instance, Hori, T., et al. proposed one community factor, the activity level of community capacity improvement activities. It includes four types of activities: administrative proposal activity, community planning meeting, volunteer activity, and community event (Hori, T., et al., 2007). These sub-components could be included. Takeuchi et al. proposed two factors: human resources and community activity. Human resources include components of households, community activity leader or organization, etc. (Takeuchi, S., 2011). Since it is clearly stated that village committees in local communities in China are in charge of community issues, the sub-component of community activity leader or organization could be excluded. In addition, Kaji, H., et al. proposed social capital as a part of CDCC (Kaji, H.& Tsukagoshi, I., 2013).

According to the World Bank, social capital at the household level is examined by six sections: groups and networks, trust and solidarity, collective action and cooperation, information and communication, social cohesion and inclusion, and empowerment and political action. Although social capital has been conceptualized at the micro, middle and macro levels, the tools needed to measure social capital at the level of households or individuals are very different from those needed to measure social capital at the country level. The SC-IQ (the Integrated questionnaire for the Measurement of Social Capital) focuses on measurement at the micro level that is, at the level of households or individuals (The World Bank, 2003). (1) Groups and networks. This is the category most commonly associated with social capital. The questions here consider the nature and extent of a household members' participation in various types of social organizations and informal networks, and the range of contributions that one gives and receives from them. (2) Trust and solidarity. In addition to the canonical trust question asked in a remarkable number of cross-national surveys, this category seeks to procure data on trust towards neighbors, key service providers. (3) Collective action and cooperation. This category explores whether and how household members have worked with others in their community on joint projects and or in response to a crisis. (4) Information and communication. Access to information is being increasingly recognized as central to helping poor communities have a stronger voice in matters affecting their well-being (The World Bank, 2003). This category of questions explores the ways and means by which poor households receive information regarding market conditions and public services, and the extent of their access to communication infrastructure. (5) Social cohesion and inclusion. "Communities" are not single entities, but rather are characterized by various forms of division and difference that can lead to conflict. Questions in this category seek to identify the nature and extent of these differences, the mechanisms by which they are managed, and which groups are excluded from key public services. Questions pertaining to everyday forms of social interaction are also considered. (6) Empowerment and political action. Individuals are "empowered" to the extent they have a measure of control over institutions and process directly affecting their well-being (The World Bank, 2003). The questions in this section explore household members' sense of happiness, personal efficacy, and capacity to influence both local events and broader political outcomes.

On the whole, no widely-accepted CDCC assessment framework and a universal list of factors have been developed yet. In this study, the community factors include actual community disaster coping capacity (ACDCC) and potential community disaster coping capacity (PCDCC). All the components that extracted from previous studies for ACDCC are classified as follows: disaster risk reduction planning, community disaster mitigation organization, and disaster mitigation measures. All the components that extracted for PCDCC are classified as follows: community asset, community connection, and community participation in disaster-related activities. The detailed components and sub-components are explained in next section.

5.3 Definition of Community Disaster Coping Capacity (CDCC) in this study

This research proposes an integrated framework of CDCC (Table 1.1). In this framework, CDCC can be explained by individual disaster coping capacity (IDCC), Actual community disaster coping capacity (ACDCC), and potential community disaster coping capacity (PCDCC). The detailed explanations of factors, components, and sub-components are as follows.

5.3.1 Individual disaster coping capacity (IDCC)

IDCC, which is defined as the individuals' comprehensive capacity of coping with disaster, can be examined based on risk awareness, disaster preparedness, and potential responding ability of individuals.

Individual risk awareness includes sub-components of individuals' understanding of disaster risk and disaster damage estimation. Individual disaster preparedness can be analyzed through two sub-components: individuals' disaster-resistant building improvement and other preparedness measures. In particular, the disaster-resistant building improvement activity in a historical village can be considered not only as a disaster preparedness measure but also as a heritage conservation measure in terms of disaster mitigation. Individual potential responding ability can be investigated through two sub-components: individuals' knowledge of emergency action and their awareness of facilities location and usage.

5.3.2 Actual community disaster coping capacity (ACDCC)

ACDCC, which is defined as the visible capacity represented by actual community disaster risk reduction measures, can be examined based on disaster risk reduction planning, community disaster mitigation organization, and disaster mitigation measures.

The component of disaster risk reduction planning refers to that whether the community has a disaster risk reduction planning, which depicts a holistic view of disaster risk reduction measures, and its degree of perfection. The component of community disaster mitigation organization refers to that whether the community has established a specialized organization to manage the disaster risk reduction issues and its maturity. Disaster mitigation measures can be classified into four steps:pre-disaster risk reduction, initial stage response, damage control, and evacuation. Each of them includes several sub-components to help to target the specific measures. Pre-disaster risk reduction measures can be analyzed by government's disaster-

resistant building improvement, disaster risk inspection, and disaster education. Initial stage response measures include disaster alarm and information transmission, facilities arrangement, inspection, and maintenance, and disaster response training. Damage control measures can be examined through investigating the community's village improvement for damage control and effort for sufficient facilities and other resources. Evacuation measures include evacuation route and evacuation site improvement, and evacuation training.

5.3.3 Potential community disaster coping capacity (PCDCC)

PCDCC, which is defined as the inherent potential capacity rooted in community cohesion that might empower the community cooperation for coping with disaster during an emergency, can be examined based on community asset, community connection, and community participation in disaster-related activities.

Community asset includes community organizations, management, community events, and collaboration work. To understand these basic elements that supporting a functioning community is the starting point. Community connection, which can be reflected by social capital, is examined by six sections: groups and networks, trust and solidarity, collective action and cooperation, information and communication, social cohesion and inclusion, and empowerment and political action. This component and its sub-components

Table 5. 1 Proposed framework of Community Disaster Coping Capacity (CDCC)

	Components		Sub-components	References
IDCC	Individual risk awareness		Understanding of disaster risk	(Nagamatsu, et al., 2009)
			Disaster damage estimation	(Kamio, et al. 2005)
	Individual disaster preparedness		Individuals' building improvement	(Tokyo Fire Department, 1995)
			Other preparedness measures	(Hu, et al., 2004), (Matsuda, 2004)
	Individual potential responding ability		Knowledge of emergency action	(Hori, et al., 2007), (Matsuda, 2004), (Tokyo Fire Department, 1995), (FDMA, 2003)
			Awareness of facilities location and usage	
ACDCC	Disaster risk reduction planning			(Takeuchi, et al., 2011), (Okanishi, et al., 2006)
	Community disaster mitigation organization			(Okanishi, et al., 2006), (Hori, et al., 2007)
	Disaster mitigation measures	Pre-disaster risk reduction	Government's building improvement	(Takeuchi, et al., 2011) (FDMA, 2003) (Gojo City, 2014) (Himoto, k., et al., 2008)
			Disaster risk inspection	
			Organization of disaster education	
		Initial stage response	Disaster alarm and information transmission	
			Facilities inspection and maintenance	
			Organization of disaster response training	
		Damage control	Village improvement for damage control	
			Sufficient facilities and other resources	
		Evacuation	Evacuation route and evacuation site	
			Evacuation training	
PCDCC	Community asset		Community organizations and management	(Hori, et al., 2007), (Okanishi, et al., 2006), (Takeuchi, et al., 2011)
			Community events and collaboration work	
	Community connection (Social capital)		Groups and networks	(Takeuchi, et al., 2011), (Kaji, et al., 2013), (Okanishi, et al., 2006) (Wakabayashi, et al., 1998) (The World Bank, 2003)
			Trust and solidarity	
			Collective action and cooperation	
			Information and communication	
			Social cohesion and inclusion	
			Empowerment and political action	
	Community participation in disaster-related activities		People's participation in disaster education and training	(Hori, et al., 2007)
			Participation willingness for disaster-related activities	(Wakabayashi, et al., 1998)

manifest a community's basis of developing community-based activities. Community participation in disaster-related activities is going to be analyzed by investigating people's participation and their participation willingness for disaster-related activities.

5.4 Conclusion of the chapter

This chapter explained the definition of community disaster coping capacity (CDCC) in this study and proposed a CDCC assessment framework for the case studies in two historical villages. In this study, CDCC is analyzed by three components: individual disaster coping capacity (IDCC), actual community disaster coping capacity (ACDCC), and potential community disaster coping capacity (PCDCC).

IDCC is defined as the individuals' comprehensive capacity of coping with disaster. It can be examined based on risk awareness, disaster preparedness, and potential responding ability of individuals. ACDCC is defined as the visible capacity represented by actual community disaster risk reduction measures. It can be examined based on disaster risk reduction planning, community disaster mitigation organization, and disaster mitigation measures. PCDCC is defined as the inherent potential capacity rooted in community cohesion that might empower the community cooperation for coping with disaster during an emergency. It can be examined based on community asset, community connection, and community participation in disaster-related activities.

CHAPTER 6. INDIVIDUAL DISASTER COPING CAPACITY (IDCC)

This chapter presents a detailed analysis of IDCC in the two case historical villages through three components: individuals' risk awareness, disaster preparedness, and potential responding ability. Based on the results, a comparative discussion on the features of IDCC between the two case villages is presented.

6.1 Outline of the chapter

In this chapter, IDCC, which is defined as the individuals' comprehensive capacity of coping with disaster, is examined based on risk awareness, disaster preparedness, and potential responding ability of individuals.

Individual risk awareness includes sub-components of individuals' understanding of disaster risk and disaster damage estimation. Individual disaster preparedness can be analyzed through two sub-components: individuals' disaster-resistant building improvement and other preparedness measures. In particular, the disaster-resistant building improvement activity in a historical village can be considered not only as a disaster preparedness measure but also as a heritage conservation measure in terms of disaster mitigation. Since the individuals' disaster-resistant building improvement in two case villages have been separately extracted as the former chapter of three and four, individual disaster preparedness section in this chapter focuses on the other disaster preparedness measures. In addition, individual potential responding ability can be investigated through two sub-components: individuals' knowledge of emergency action and their awareness of facilities location and usage.

In order to assess the individuals' disaster coping capacity through a quantitative approach, this study needs to focus on one risk in each village, which has ever remarkably affected the village in history rather than other disasters. Therefore, in Shangli Village case, the investigation on people's risk awareness, preparedness, and potential responding ability targets earthquake, while an accidental fire is a target in Dali Village case. The following sections elaborate on each component and sub-components of the individuals' disaster coping capacity in the two case villages.

6.2 Case study in Shangli Village

Targeting earthquake disaster, the investigation on the people's risk awareness, preparedness, and potential responding ability in Shangli Village is based on questionnaire survey in October 2014 and supplementary questionnaire survey in August 2015. During the first survey, questionnaires were distributed to all 280 families in Wujia village (Shangli's core area). Of those questionnaires, 216 were collected, of which 174 were valid, producing a 62% valid response rate. The questionnaire includes basic information, understanding of disaster risk, disaster-resistant building improvement activity, other disaster preparedness measures. During the supplementary questionnaire survey, questionnaires were distributed to all 280 families on two topics: earthquake-resistant building repair and retrofit activity, and disaster awareness. Of

Table 6. 1 Outline of individual disaster coping capacity (IDCC) field surveys in Shangli Village

Methods	Date	Object	Total sample size			Contents
			Delivered	Collected	Valid	
Questionnaire Survey	Oct. 2014	Villagers	280	216	174	Understanding of disaster risk, disaster-resistant building improvement activity, other disaster preparedness measures
Supplementary questionnaire survey	Jul. 2015	Villagers	280	247	142	Earthquake-resistant building repair and retrofit activity
			280	265	154	Disaster damage estimation, knowledge of emergency action and their awareness of facilities location and usage

the former topic questionnaires, 247 were collected and 142 were valid; Of the later topic questionnaires, 265 were collected and 154 were valid (Table 6.1).

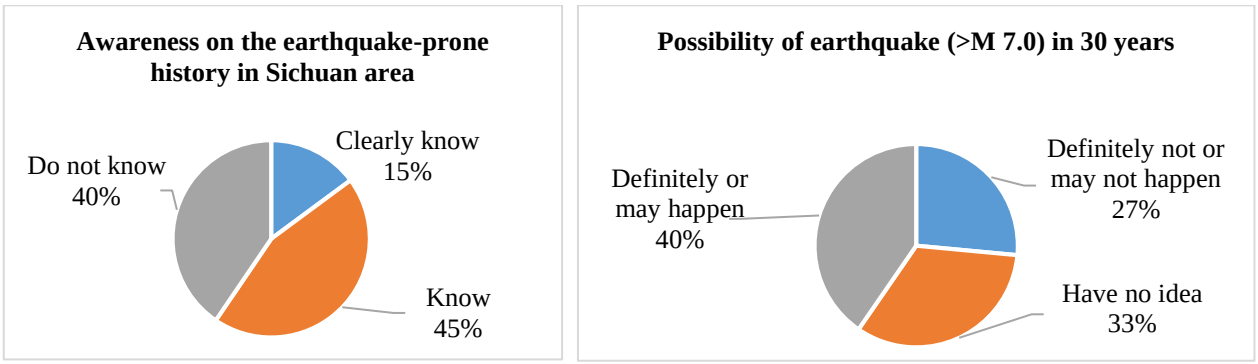
The following sections explain the analyses of people's risk awareness, preparedness, and potential responding ability based on the surveys in Shangli Village.

6.2.1 Individual risk awareness in Shangli Village

Individuals' risk awareness in Shangli Village is examined based on an understanding of earthquake risk and earthquake damage estimation.

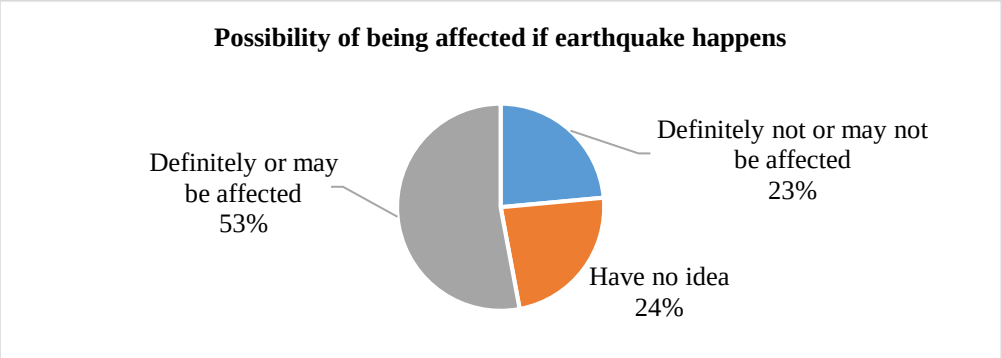
The respondent is firstly asked understanding of earthquake risk in their Sichuan area. Though experienced Wenchuan Earthquake in 2008 and Lushan Earthquake in 2013, 40% of the respondents still completely unaware of that Sichuan is a historically earthquake-prone area. Rarely 15% of the respondents clearly know and 45% of the respondents aware of that (Figure 6.1(a)). In addition, when referring to the possibility of a huge earthquake (>M 7.0) happening again within 30 years, 27% of the respondents maintain a relatively optimistic perspective, thinking that it may definitely not or may not happen, while 40% believe it will definitely happen or may happen (Figure 6.1(b)). Regarding the assumption of a large earthquake happens again, 53% of the respondents believe their houses will definitely and may be destroyed again respectively, while 23% believe their houses will definitely not or may not be destroyed again (Figure 6.2).

Therefore, it could be interpreted that people in Shangli Village tend to still have an unclear understanding



N=121 (a) N=151 (b)

Figure 6. 1 Individuals' understanding of earthquake risk in Shangli Village



N=153

Figure 6. 2 Individuals' earthquake damage estimation in Shangli Village

of the regional risk. However, their awareness of earthquake risk in future is remarkably high after experienced the two major earthquakes. In addition, more than half of them are anxious about that their lives will be affected by earthquake again in the future. In summary, people in Shangli Village seems to have a high-risk awareness of earthquake.

6.2.2 Individual disaster preparedness in Shangli Village

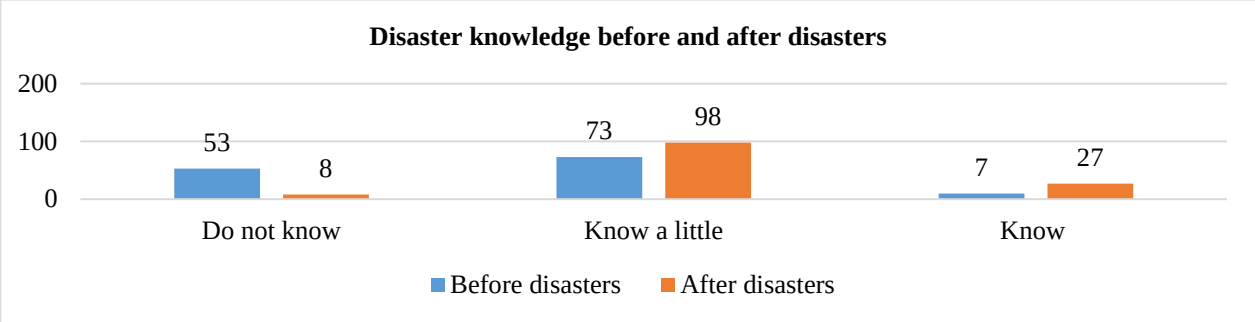
Individual disaster preparedness can be analyzed through individuals' disaster-resistant building improvement and other preparedness measures. Since the building improvement in Shangli Village has been stated in the third chapter, therefore, in this section, only a brief summary of building improvement is presented in order to give a complete scenario. The main content focuses on other disaster preparedness measures.

6.2.2.1 Individuals' disaster-resistant building improvement

The local people were comparatively much more unsatisfied with the limited earthquake-resistances of their buildings after the Wenchuan Earthquake in 2008 and Lushan Earthquake in 2013. However, repair activity was inactive and incomplete, three-quarters of the buildings were still not repaired or just partly repaired. Moreover, disaster-resistant retrofit activity was informal and has not really been taken seriously yet. In particular, the traditional wooden buildings were mostly without repair and retrofit. The actual impediments to the repair and retrofit activities could be attributed to limited access to building technology, administrative licensing problem, and impediments on decision-making due to property right subdivision. In addition, the repair activities on the traditional wooden buildings built before 1981 were particularly impeded by the administrative licensing problem.

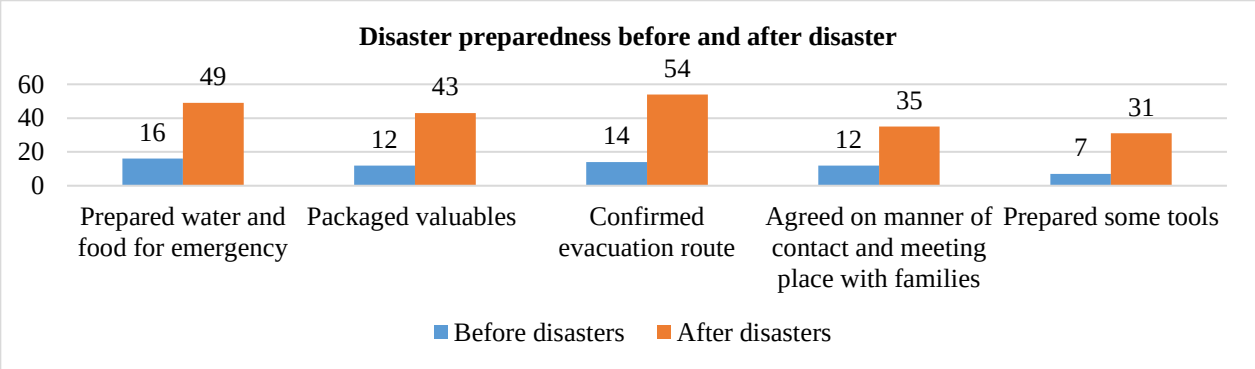
6.2.2.2 Other disaster preparedness measures

Other disaster preparedness measures in this section are examined based on the disaster knowledge and preparedness for an emergency situation. According to the questionnaire survey, local people's disaster knowledge is remarkably enhanced after experienced disasters (Figure 6.3). Simultaneously, their awareness



N=133

Figure 6. 3 Local people's disaster knowledge before and after disasters in Shangli Village



N=96 Multichoice

Figure 6. 4 Local people's disaster preparedness before and after the disaster in Shangli Village

of preparedness also presents a great change after disasters. About half of the respondents prepared water and food for emergency and confirmed evacuation route, while approximately one-third of the respondents packaged valuables for removal during an emergency and agreed on the manner of contact and meeting place with families, and prepared some tools for emergency (Figure 6.4).

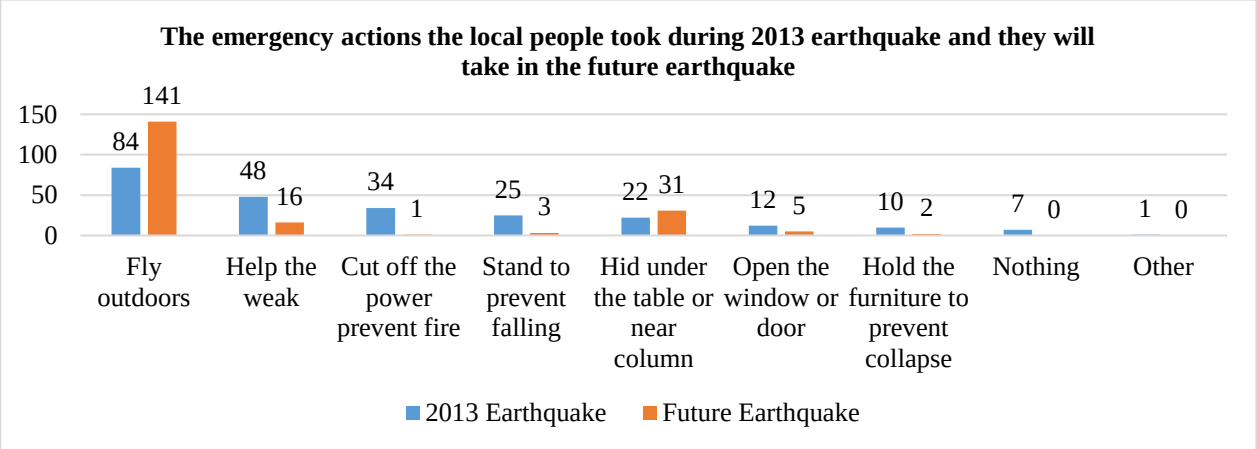
In summary, the individuals' disaster preparedness in Shangli Village is limited. Local people's limited building improvement activity mainly due to limited access to building technology, administrative licensing problem, and impediments on decision-making due to property right subdivision. However, their other disaster preparedness is remarkably enhanced after experienced disasters.

6.2.3 Individual potential responding ability in Shangli Village

Individual potential responding ability in this section are examined based on the knowledge of action at an earthquake emergency, and awareness of location and usage of disaster facilities.

6.2.3.1 Knowledge of action at an emergency of earthquake

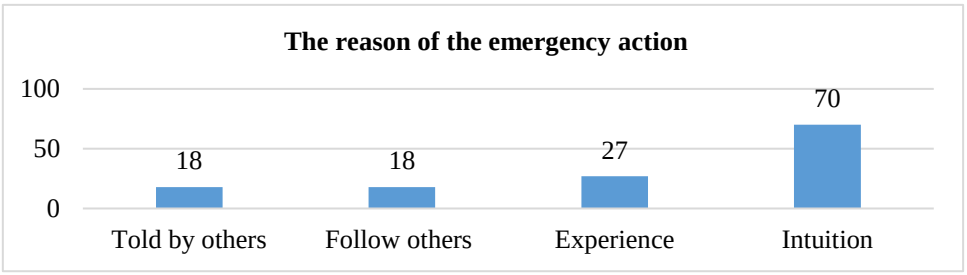
This study investigated emergency actions the local people took during the 2013 Lushan earthquake, and the actions they will take when an earthquake happens in the future through a multi-choice questionnaire survey. When the shaking occurred in 2013, two-third of the respondents fled outdoors, and still three-fourth



(2013 earthquake) N=146 Multichoice

(Future earthquake) N=199 Multichoice

Figure 6. 5 Knowledge of earthquake emergency action in Shangli Village



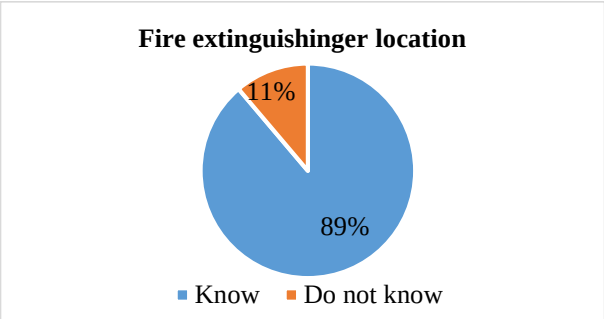
N=117 Multichoice

Figure 6. 6 Reason for people's earthquake emergency action

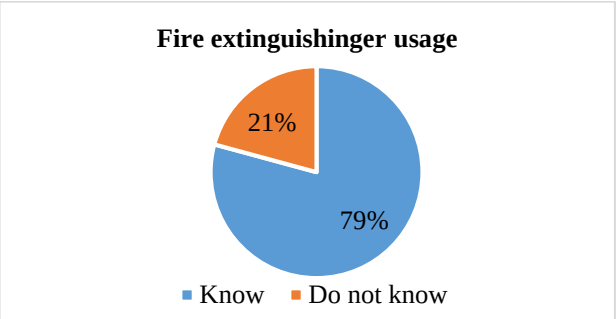
of the respondents will do in a similar way in the future. In the 2013 Lushan earthquake, except for fled outdoor, mainly the respondents helped the weak, cut off the power prevent fire, stand to prevent falling, etc. After experienced, more respondents prefer to choose to fly outdoor and hid under a table or near a column and help the weak (Figure 6.5). In addition, this study also investigated the reasons for their actions, of the 117 respondents, 70 respondents' actions take actions based on their intuition, while 27 relied on their own experience, 18 respondents took action following others, another 18 respondents were told by someone else (Figure 6.6). These results demonstrate that the local people are still at an elementary level of personal knowledge of response to an emergency when an earthquake happens.

6.2.3.2 Awareness of location and usage of disaster facilities

The local government equipped the village with basic earthquake emergency rescue facilities. Of these facilities, a fire extinguisher is the most important equipment for individuals at the initial stage of response, which are assembled to every household and are supposed to be used by villagers when fire emergency or accidental fire caused by an earthquake. According to the survey, 89% of the respondents clearly know the location of the fire extinguisher and 11% do not know (Figure 6.7 (a)). In addition, 79% of the respondents know how to use a fire extinguisher, while 21% of them do not know how to use (Figure 6.7 (b)).



N=152 (a)



N=154 (b)

Figure 6. 7 Awareness of location and usage of disaster facilities

In summary, the individuals' potential responding ability in Shangli Village tends to be limited. Their knowledge of emergency action is still at an elementary level based on intuition and relied on their own experience. However, most of the local people are aware of the location and usage of a fire extinguisher.

6.2.4 Sub-conclusion of the case study in Shangli Village

Individuals' disaster coping capacity in Shangli Village represents a gap between high disaster awareness and poor preparedness and limited potential responding ability. Local people have a high-risk awareness of earthquake, though they still have an unclear understanding of the earthquake risk in Sichuan area. In addition, more than half of them are anxious about that their lives will be affected by earthquake again in the future. However, the individuals' disaster preparedness in Shangli Village is limited. Though their other disaster preparedness is remarkably enhanced after experienced disasters, but the disaster-resistant building improvement activity is remarkably limited mainly due to limited access to building technology, administrative licensing problem, and impediments on decision-making due to property right subdivision. Moreover, the individuals' potential responding ability also tends to be limited. Though most of the local people are aware of the location and usage of basic disaster facility, their knowledge of emergency action is still at an elementary level based on intuition and relied on their own experience.

6.3 Case study in Dali Village

Targeting fire risk, the investigation on the people's risk awareness, preparedness, and potential responding ability to fire risk in Dali Village is based on structured interview survey in July 2015. The structured interview survey was conducted with 115 families in Dali Village (Table 6.2). The 115 villager samples were selected by spatially uniform sampling, a systematic sampling strategy through which the samples are regularly distributed in a given spatial context. The selected samples were adjusted minutely according to

Table 6. 2 Outline of IDCC field surveys in Shangli Village

Methods	Date	Object	Total sample size	Contents
Structured interview survey	Jul. 2015	Villagers	115	Understanding of fire risk, damage estimation, fire-resistant building improvement activity, other disaster preparedness measures, knowledge of emergency action, awareness of location and usage of fire extinguisher

Figure 6. 8 115 sampled households for structured interview surveys

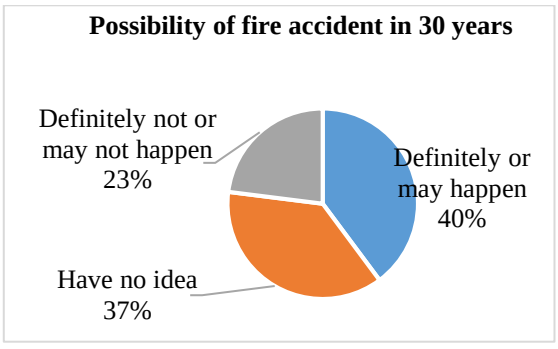
(Source: Author, based on the topographic map provided by the Dali Conservation Program Office)

the owners' willingness to cooperate (Figure 6.8). The content of the structured interview includes basic information, understanding of fire risk, damage estimation, preparedness, knowledge of emergency action, and awareness of location and usage of a fire extinguisher.

The following sections explain the analyses of people's risk awareness, preparedness, and potential responding ability based on the surveys in Dali Village.

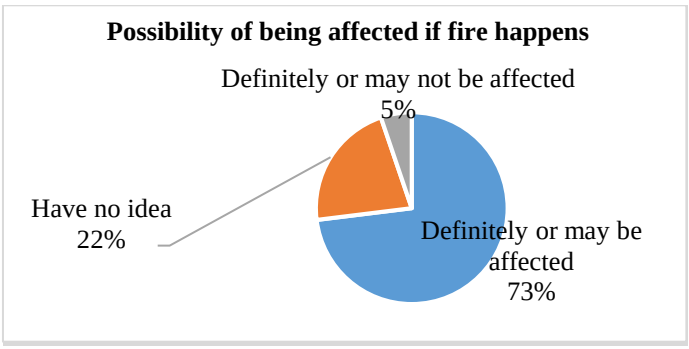
6.3.1 Individual risk awareness in Dali Village

Risk awareness is examined based on an understanding of fire risk and fire damage estimation. The respondent is firstly asked understanding of fire risk in their village. 40% of the respondents believe that a large fire accident will definitely or may happen in the next 30 years, compared to just 23% of the respondents who think that a large fire accident will definitely not or may not happen (Figure 6.9(a)). In addition, 73% of the respondents believe that their buildings will definitely or may be severely affected if a fire accident happens (Figure 6.9(b)). Moreover, the conventional regulations on fire issues still influence the local people's awareness through public pressure. Most of the respondents mentioned seriously about



N=113

(a) Fire risk understanding of the local people



N=115

(b) Fire damage estimation of the local people

Figure 6. 9 Local people's fire risk understanding and damage estimation in Dali Village

the owner whose building that first catches fire and affects the neighbors' buildings or even the whole village will be seriously punished by the whole community[3]. However, the punishment no longer involves the death penalty or expulsion.

6.3.2 Individual disaster preparedness in Dali Village

Among all the vulnerabilities of fire-prone Dong villages examined by previous studies, the vulnerabilities that are supposed to be improved by individual preparedness can be listed as follows: inadequate fire-resistance of wooden buildings, open cooking, and heating with fire, aged electrical wiring system, insufficient firefighting water resources, and insufficient firefighting facilities. Table 6.3 shows the targeted countermeasures in Dali Village that are being implemented by individuals and the local government. Since the building improvement has been stated in the fourth chapter, therefore, in this section, only a brief summary of building improvement is presented in order to give a complete scenario. The following mainly discusses the other countermeasures by individuals: removal of combustible materials from cooking and heating spaces and maintenance of a family firefighting water reserve.

Table 6. 3 Vulnerabilities and the targeted countermeasures at the individual level in Dali Village

Vulnerabilities	Countermeasures	Implementer	
		LG*	Indi*
Inadequate fire-resistance of residential buildings	Fire-resistant building improvement	I	I
Combustible materials in cooking and heating spaces	Removal of combustible materials from fire space	—	I
Insufficient firefighting water resources	Maintenance of firefighting water reserve	—	I
Insufficient firefighting facilities	Firefighting extinguisher purchase	I	—

* LG: Local government; Indi: Individual; I: improved; —: no improvement

6.3.2.1 Fire-resistant building improvement

Without detailed technical rules and guidelines, the local people's fire-resistant building improvement activities tend to be limited and not executed properly. Nearly one-third of the households we investigated have replaced the first stories of wooden buildings with brick or concrete to reduce the fire risk. However, all of the non-transformed buildings and the upper stories of the transformed buildings still retain wooden facades without a fire-resistant coating. These transformations can be considered to enhance the fire-resistance to some extent while simultaneously dramatically affecting the buildings' original architectural characteristics. Insufficient financial capacity and limited access to fire-resistant building technology have also hampered the local people's activities.

6.3.2.2 Removal of combustible materials and maintenance of firefighting water reserve

Combustible materials near a fire were considered as one of the causes that aggravated the fire risk of Dong villages according to the previous studies. Therefore, this study investigated whether the local people paid

[3] According to the new community regulations issued by the Dali Village Committee in 2016, the owner whose building causes a fire must compensate for the loss, conduct night patrol for one month, and provide rice, meat, and rice wine (90 kg each) to serve to the villagers who contributed to collective firefighting.

attention to keeping the cooking and heating space without combustible materials. As table 6.4 shows, most of the investigated buildings keep the space around the fire clean (Figure 6.10 (a), (b), (c)).

Having a water reserve can be considered as an important example of individual preparedness. As previous studies mentioned, the Dong villages used to keep ponds and water reserves for daily use, as well as for firefighting, which can be seen as an indigenous knowledge. However, this system is disappearing in recent years due to climate change and limited land availability (Tang, Y., 2015). A similar situation can be observed in Dali Village. Since the water supply project, which channeled mountain water via a pipe system to every building, the local people are gradually losing the habit of maintaining a water reserve. Among the 27 investigated families, seven are without a water reserve while 20 families keep a small amount of water reserve (Figure 6.11). It seems this may not meet the water needs for initial stage firefighting since the water supply via the pipe system is still unstable.

Table 6. 4 Volume of combustible materials near a fire in 27 residential buildings of Dali Village

	Small amount (S)	Medium amount (M)	Large amount (L)
Cooking space	19	7	0
Heating space	26	0	0

* S: refers to the volume of combustible materials less than 1/10 of the space; M: refers to the volume of combustible materials more than 1/10 but less than 1/5 of the space; L: refers to the volume of combustible materials more than 1/5 of the space. (Tokyo Fire Alarm Equipment Maintenance Association, 1983)

(a) Small amount of combustible materials around cooking space

(b) Medium amount of combustible materials around cooking space (c) Small amount of combustible materials around heating fire

Figure 6. 10 Volume of combustible materials near a cooking or a heating fire

Figure 6. 11 Water reserve adjacent to cooking space

In summary, the individuals' disaster preparedness in Dali Village is limited. Local people's limited disaster-resistant building improvement activity mainly due to insufficient financial capacity and limited access to fire-resistant building technology. In addition, though the local people's other fire protection measures are active, but their fire safety may still be threatened by the poor condition of water infrastructure and disappearing custom of traditional water reserve.

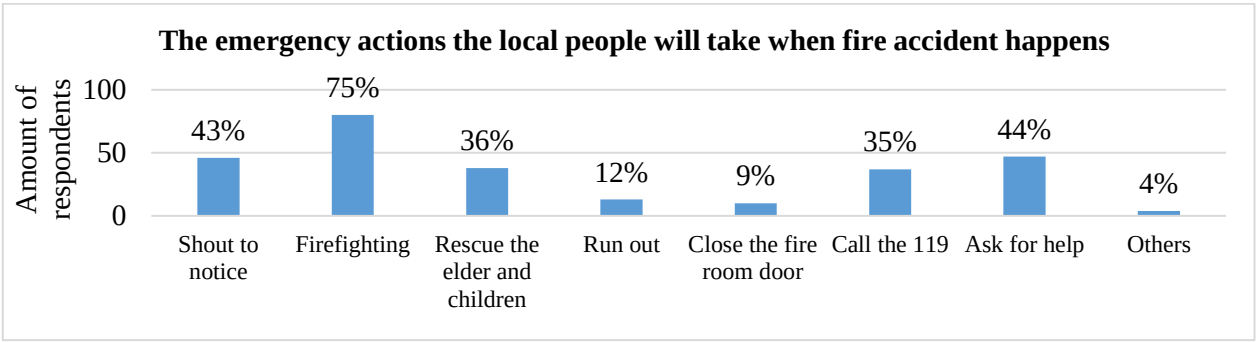
6.3.3 Individual potential responding ability in Dali Village

6.3.3.1 Knowledge of emergency action

The local people tend to have the sufficient knowledge regarding fire emergency action. 75% of the respondents would consider to put out a fire, 44%, and 43% would ask for help or shout to alert the neighbors respectively. 36% would try to save the elderly or children and 35% would report the fire by calling "119", while 12% would consider running away (Figure 6.12).

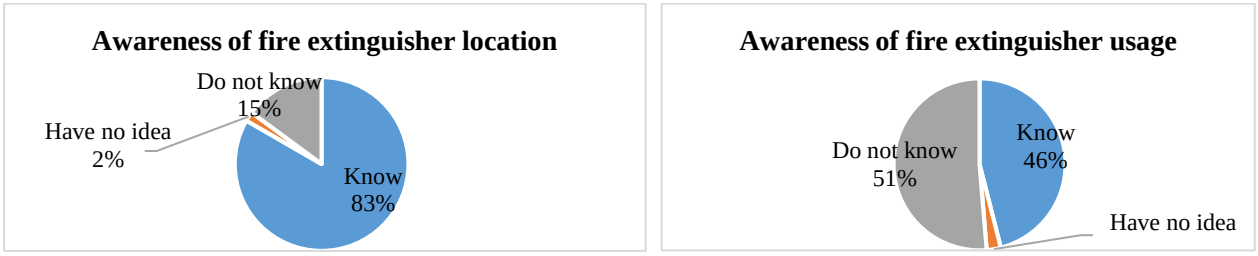
6.3.3.2 Awareness of location and usage of firefighting facilities

A fire extinguisher is the most important equipment for individuals at the initial stage of response. 83% of the respondents clearly know the location of the fire extinguisher, and 15% do not know (Figure 6.13 (a)). However, 51% of the respondents do not know how to use a fire extinguisher (Figure 6.13(b)).



N=107 Multichoice

Figure 6. 12 Local people's knowledge of fire emergency action in Dali Village



N=114 (a) N=113 (b)

Figure 6. 13 Awareness of location and usage of firefighting facilities

In summary, the individuals' potential responding ability in Dali Village tends to be limited. Though most of them are familiar with the emergency action of an accidental fire, but their unawareness of modern firefighting facilities usage such as a fire extinguisher may lead them a failure when emergency firefighting response.

6.3.4 Sub-conclusion of the case study in Dali Village

In Dali Village, the local people' individual disaster coping capacity also represents a gap between high disaster awareness and poor preparedness and limited potential responding ability. The local people seem to have high fire risk awareness. However, without guidance, sufficient financial capacity, and knowledge of fire-resistant building technology, the local people's improvement activities are limited and remarkably affected the original landscape. In addition, though they are cautious to keep combustible materials away from the fire utilization spaces, the water reserve maintenance reflecting indigenous knowledge on preparedness is gradually disappearing. Moreover, there is low potential coping ability manifested by the availability and usage of modern firefighting facility. Although most of the local people know how to react during an emergency and the location of the fire extinguisher, but more than half of them do not know how to use it. They may fail to respond timely to initial stage firefighting without insufficient water reserve nearby.

6.4 Comparative analysis of the IDCC between Shangli and Dali Village

6.4.1 Comparison of individual risk awareness

The individual risk awareness in two case villages has the following common feature and difference.

First, the local people in both Shangli and Dali Village are anxious about that their lives will be affected by disasters in the future, because of their buildings' limited disaster-resistance.

Second, though the local people in both Shangli and Dali Village have a remarkably clearly understanding of disaster risk, the basis of their understanding of disaster risk are different. The local people in Shangli have an unclear understanding of the regional risk since most of them are unaware of that their region is a historical earthquake-prone area. Their understanding of earthquake risk is based on their recent experience

of the two major earthquakes: Wenchuan earthquake in 2008 and Lushan earthquake in 2013. Comparatively, the local people in Dali have a remarkably high awareness of their village's fire risk, which is based on not only their clear understanding of their wooden buildings and compact village's vulnerability but also the public pressure by conventional regulations on fire protection passing down by generations.

As a summary, local people in both of the two case villages tends to be a high-risk awareness, based on the fresh memory of disaster experience in Shangli Village, and based on clear understanding of hazard in Dali Village.

6.4.2 Comparison of individual disaster preparedness

The individual disaster preparedness in two case villages has the following common feature and difference.

First, the local people's disaster-resistant building improvement activity in both Shangli and Dali Village are limited. In Shangli Village, it is mainly due to limited access to building technology, administrative licensing problem, and impediments on decision-making due to property right subdivision. In Dali Village, it is mainly due to insufficient financial capacity and limited access to fire-resistant building technology. Therefore, limited access to disaster-resistant building technology is a common impediment. Lack of clear guidelines on disaster-resistant building improvement and technical support at the local level leads to a limitation of disaster-resistant improvement activity of the traditional buildings in these historical villages. Moreover, it is also difficult for the local government to develop and implement rational and effective strategies for better disaster-resistance of the traditional buildings and historical villages while taking into account the integrity and authenticity of cultural heritage. In addition, the impediment is different from village to village, the insufficient financial capacity is a crucial problem to the people in Dali Village.

Second, local people's other disaster preparedness is remarkably enhanced after experienced disasters in Shangli Village. Local people's fire protection measures in Dali Village are also active, but their fire safety may still be threatened by the poor condition of water infrastructure and disappearing custom of traditional water reserve.

6.4.3 Comparison of individual potential responding ability

The individual potential responding ability in two case villages has the following common feature and difference.

The local people's potential responding ability in both Shangli and Dali Village are limited. In Shangli Village, though people are aware of the location and usage of emergency facilities, but their emergency action is limited and based on intuition and relied on their own experience. In Dali Village, though people are familiar with the emergency action of an accidental fire, but they lack the knowledge of modern firefighting facilities usage. Therefore, the limited potential responding ability of the local people in both of the two villages may lead them a failure when emergency disaster response.

6.5 Conclusion of the chapter

In this chapter, individual disaster coping capacity (IDCC) in Shangli Village and Dali Village are examined based on individuals' risk awareness, disaster preparedness, and potential responding ability.

In Shangli Village, Individuals' disaster coping capacity represents a gap between high disaster awareness and poor preparedness and limited potential responding ability. Local people have a high-risk awareness of earthquake, though they still have an unclear understanding of the earthquake risk in Sichuan area. In addition, more than half of them are anxious about that their lives will be affected by earthquake again in the future. However, the individuals' disaster preparedness in Shangli Village is limited. Though their other disaster preparedness is remarkably enhanced after experienced disasters, but the disaster-resistant building improvement activity is remarkably limited mainly due to limited access to building technology, administrative licensing problem, and impediments on decision-making due to property right subdivision. Moreover, the individuals' potential responding ability also tends to be limited. Though most of the local people are aware of the location and usage of basic disaster facility, their knowledge of emergency action is still at an elementary level based on intuition and relied on their own experience.

In Dali Village, the local people' individual disaster coping capacity also represents a gap between high disaster awareness and poor preparedness and limited potential responding ability. The local people seem to have high fire risk awareness. However, without guidance, sufficient financial capacity, and knowledge of fire-resistant building technology, the local people's improvement activities are limited and remarkably affected the original landscape. In addition, though they are cautious to keep combustible materials away from the fire utilization spaces, the water reserve maintenance reflecting indigenous knowledge on preparedness is gradually disappearing. Moreover, there is low potential coping ability manifested by the availability and usage of modern firefighting facility. Although most of the local people know how to react during an emergency and the location of the fire extinguisher, but more than half of them do not know how to use it. They may fail to respond timely to initial stage firefighting without insufficient water reserve nearby.

In summary, the IDCC in two case villages has the following common feature and difference.

First, the local people' individual disaster coping capacity in both villages represent a gap between high disaster awareness and poor preparedness and limited potential responding ability. Second, the local people in both of the two case villages tend to have a high-risk awareness, which is based on the fresh memory of disaster experience in Shangli Village and based on clear understanding of hazard in Dali Village. Third, the local people's disaster preparedness in both villages is limited. The limited disaster-resistant building improvement activity in Shangli Village is mainly due to limited access to building technology, administrative licensing problem, and impediments on decision-making due to property right subdivision. In Dali Village, it is due to insufficient financial capacity and limited access to fire-resistant building

technology. It can be seen that limited access to disaster-resistant building technology is a common impediment. Lack of clear guidelines and technical support at the local level leads to not only limitation of disaster-resistant improvement of the traditional buildings in these historical villages but also the difficulty of developing rational and effective strategies for better disaster-resistance of the traditional buildings and historical villages. In addition, local people's other disaster preparedness seems active in both villages. Fourth, the local people's potential responding ability in both Shangli Village and Dali Village tend to be limited and have dissimilar features. The local people in Shangli Village are skilled in the location and usage of emergency facilities, but their emergency action is based on intuition and experience. In Dali Village, though people are familiar with the emergency action of an accidental fire, they lack the knowledge of modern firefighting facilities usage. Both of the situation reflects the lack of disaster education and training.

CHAPTER 7. ACTUAL COMMUNITY DISASTER COPING CAPACITY (ACDCC)

This chapter presents a detailed analysis of ACDCC in the two case historical villages through three components: disaster risk reduction planning, community disaster mitigation organization, and disaster mitigation measures. Then, a comparative discussion on the features of ACDCC between the two case historical villages is presented.

7.1 Outline of the chapter

In this chapter, ACDCC, which is defined as the visible capacity represented by actual community disaster risk reduction measures, is examined based on community disaster mitigation organization, disaster risk reduction plans and disaster mitigation measures.

The component of community disaster mitigation organization refers to that whether the community has established a specialized organization to manage the disaster risk reduction issues, and its activities and development. The component of disaster risk reduction plans refers to that whether the community has a disaster risk reduction planning, which depicts a holistic view of disaster risk reduction measures, and its degree of perfection. Since it is already clear that no holistic disaster risk reduction planning is available at the local level, this section integrated scattered disaster risk reduction plans to the next section of disaster mitigation measures. Disaster mitigation measures are classified into four steps: pre-disaster risk reduction, disaster response, damage control, and evacuation. Each of them includes several sub-components to help to target the specific measures. Pre-disaster risk reduction measures can be analyzed by government's disaster-resistant building improvement, disaster risk inspection, and organization of disaster education. Disaster response measures include disaster alarm and information transmission, facilities equipment and maintenance, and organization of disaster response training. Damage control measures can be examined through investigating the community's village measures for damage control and effort for sufficient facilities and other resources. Evacuation measures include evacuation route and evacuation site measures, and evacuation training.

The following sections elaborate on each component and sub-components of the ACDCC in the two case villages.

7.2 Case study in Shangli Village

In order to identify the features of Shangli Village's ACDCC, this study conducted research activities to grasp the current status of community disaster mitigation organization, disaster risk reduction plans, and disaster mitigation measures in Shangli Village. This study is based on the field surveys conducted in August 2015 and in February 2016. In August 2015, two Shangli administrative official staffs were structured interviewed about the village's disaster risk reduction plans and disaster mitigation measures. In February 2016, in order

Table 7. 1 Outline of ACDCC field surveys in Shangli Village

Methods	Date	Object	Total sample size	Contents
Structured Interview	Aug. 2015	Shangli administrative official staffs	2	Volunteer firefighting troop, disaster risk reduction plans, disaster mitigation measures
Questionnaire Survey	Feb. 2016	Volunteer firefighters	10	Participation in volunteer activities, suggestions on organization management and disaster countermeasures

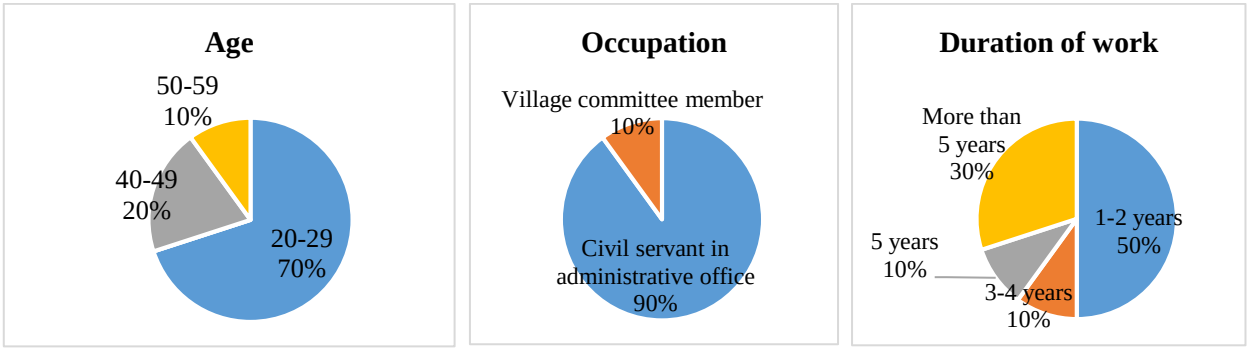
to understand the community disaster mitigation organization in Shangli in-depth, a questionnaire survey was conducted with ten firefighting volunteers, the contents are about their experience as a firefighting volunteer, participation in volunteer activities, and suggestions on organization management and disaster countermeasures (Table 7.1).

7.2.1 Community disaster mitigation organization in Shangli Village

7.2.1.1 Members and activities

The volunteer firefighting troop in Shang Village was established in 2005 by Shangli administrative office according to the local government's regulation. Of the ten members, currently, three are residents of Shang Village, and seven are from outside. All of the members are male, while seven are between 20 and 29 years old, the other three are above 40 years old (Figure 7.1(a)). Designated by the local administrative office, they undertake the roles as volunteer firefighters without payment, simultaneously, nine of them are civil servants in local administrative office and one is village committee member (Figure 7.1(b)). In addition, five of them joined the troop just for one or two years, two have worked three and five years, while another three members have worked more than five years (Figure 7.1(c)).

The disaster-related activities of volunteer firefighting troop in Shangli Village are mainly managing by Shangli administrative office and the village committee according to the local government officials' policies. Table 7.2 shows the brief situation of current disaster-related activities and roles of several implementers. The leading role of the Shangli administrative office and village committee are obviously represented, while



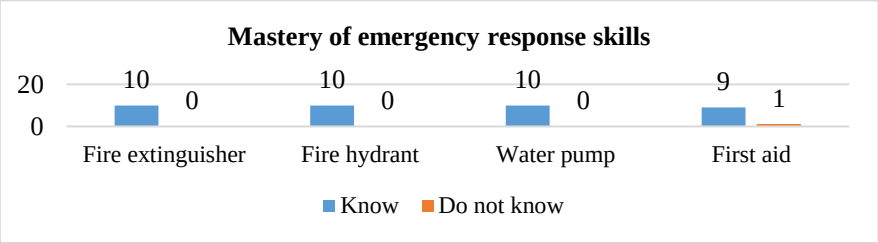
N=10 (a) (b) (c)
(a) Age of the volunteer firefighters
(b) Occupation of the volunteer firefighters
(c) The volunteer firefighters' duration of work

Figure 7. 1 Basic information of volunteer firefighters in Shangli Village

Table 7. 2 Activities of the volunteer firefighting troop in Shangli Village

Contents	Participation of local government	Frequency	Role of implementers			
			Shangli administrative office	Village committee	Volunteer firefighters	Other villagers
Fire prevention work tracking	Yes	Once a month	△	■	○	×
	No	—	—	—	—	—
Fire risk inspection	Yes	Not scheduled	△	■	○	○
	No	Not scheduled	△	■	■	○
Facility inspection and maintenance	Yes	—	—	—	—	—
	No	Once a month	△	■	■	×
Fire education	Yes	Not scheduled	△	■	○	×
	No	Not scheduled	△	■	■	×
Firefighting training	Yes	Not scheduled	△	■	○	×
	No	Once three months	△	■	■	×
Firefighting	No	Emergency	△■	△■	■	○

Note: ×Not involved ○ Participant ■ Main implementer △ Dominant organizer
Source: Author, based on interviews with the village leaders and structured interviews to volunteer firefighters in Shangli Village



N=10

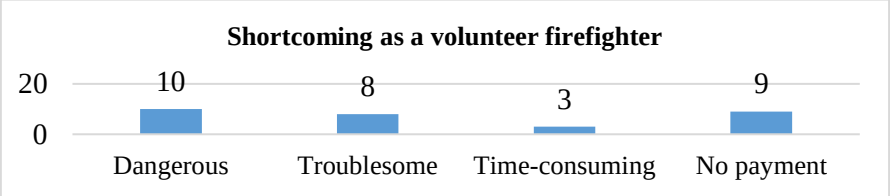
Figure 7. 2 Volunteer firefighters' mastery of basic emergency response skills in Shangli Village

following them, the volunteer firefighting troop plays the role of the main implementer in taking the responsibility for the village's safety (Table 7.2).

Disaster-related activities of volunteer firefighting troop are organized as official affairs of Shangli administrative office. Therefore, according to the survey, all the volunteer firefighters participated in the three times of emergency firefighting, firefighting training once every three months, and facility inspection and maintenance activity once a month in the last year. Consequently, all of the volunteer firefighters' mastery of basic emergency response skills tend to be excellent, they know exactly how to use a fire extinguisher, fire hydrant, water pump and have experience of using that. In addition, nine of them know how to do first aid, while the other one does not know (Figure 7.2).

7.2.1.2 Development and difficulty

The development of the volunteer firefighting troop faces several difficulties. First, the members are lack motivation. Though it is a volunteer organization, the volunteer firefighting troop in Shangli Village was founded by Shangli based on local governments' policy. In addition, most of these members are official staffs and not the residents of Shangli Village. They are designated by the local administrative office to be volunteer firefighters as additional unpaid works. Consequently, most of them have a low level of motivation.



N=10

Figure 7. 3 Respondents' perception on shortcoming as a volunteer firefighter in Shangli Village

When they are asked the merits and shortcomings as a volunteer firefighter, all of ten volunteer firefighters feel proud of being a volunteer firefighter and consider that the experience could bring them useful knowledge. However, they also complain that the work is dangerous, the training is troublesome and time-consuming, in particular, they feel their work has not been recognized if without payment (Figure 7.3).

Second, insufficient membership is another impediment. As stated above, most of the ten members are not native villager and have less motivation to be an unpaid volunteer firefighter. In addition, of all the members, seven consider that the troop needs more members, while three of them believe they already have enough members. Moreover, all of ten members are unsure about whether the members could be stable in the future. Since the volunteer firefighting troop's activities lack reaction with other villagers, it leads to difficult for villagers to obtain the access of understanding the work as a volunteer firefighter and hampers not only the involvement of local people but also the development of volunteer firefighting troop.

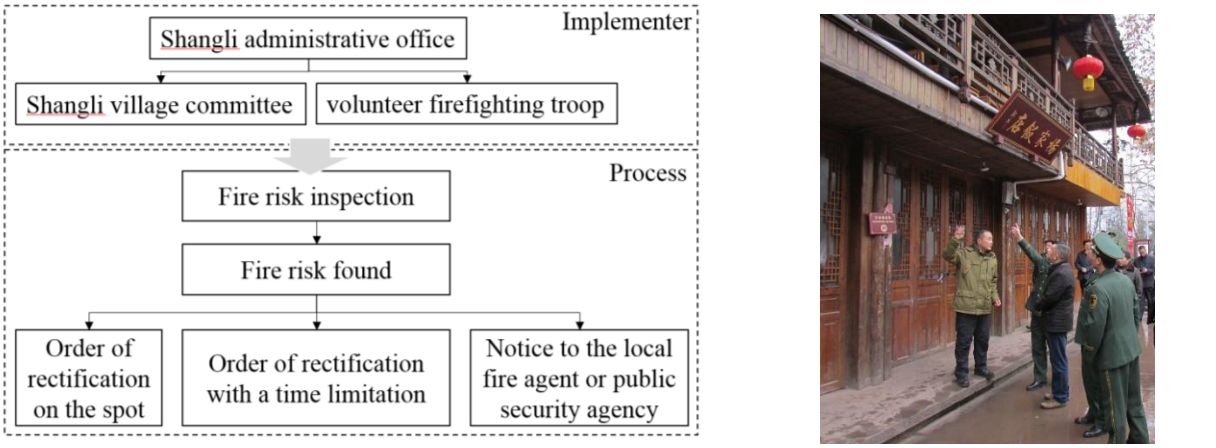
In summary, Shangli Villages has established a volunteer firefighting troop and is developing several primary-step disaster risk reduction activities according to government regulation. The disaster risk reduction activities of volunteer firefighting troop are managed by the Shangli administrative office, while the volunteer firefighting troops play a role of the main implementer. All the activities of the volunteer firefighting troop focus on fire risk only at the present stage. In addition, members' lack of motivation and insufficient membership hamper the troop's development.

7.2.2 Pre-disaster risk reduction plans and measures in Shangli Village

Pre-disaster risk reduction plans and measures are supposed to be analyzed by government's disaster-resistant building improvement, disaster risk inspection, and disaster education. It is found that the local government in Shangli Village has no plan and measure for better building disaster-resistance according to the investigation. Therefore, this section analyzes the plans and measures of disaster risk inspection and disaster education in Shangli Village.

7.2.2.1 Disaster risk inspection

As stated in the section of the volunteer firefighting troop's activity, Shangli administrative office, Shangli village committee and volunteer firefighting troop are in charge of all the disaster-related issues. Their disaster risk inspection focuses on the fire risk and has a plan with a general process and without a certain



(a)Implementer and process of fire risk inspection (b) Fire risk inspection before Spring Festival

Figure 7. 4 Fire risk inspection in Shangli Village

(Source: Author, (a) based on the interview to Shangli administrative office leader)

schedule. When fire risk is found during an inspection, they usually deal with it in three ways according to its severity: order the owner to rectify immediately, to rectify in a certain period of time, or notice the local fire agent or public security agency in very serious cases (Figure 7.4).

7.2.2.2 Organization of Disaster education

During the six years after Wenchuan earthquake happened in 2008, the local government held disaster education two times in Shangli Village, in which, the participants are mainly village committee members. Though they have made little progress on disaster education among adult, the disaster education among students is greatly enhanced in school since the local government started to include disaster education into the curriculum system according to the national regulation after Wenchuan earthquake.

In summary, Shangli Village has developed several pre-disaster risk reduction measures. Though the local administration in Shangli Village has no plan and measure for better building disaster-resistance, they have a plan of disaster risk inspection activity, which focuses on fire risk, with a general operation process but without a certain schedule. In addition, the disaster education is seldom held and the participants are mainly village committee members, while the disaster education among students is greatly enhanced in school.

7.2.3 Disaster response plan and measures in Shangli Village

Disaster response plan and measures in Shangli Village are analyzed by emergency response plan, alarm and transmission system, disaster response facilities equipment, maintenance, and disaster training.

7.2.3.1 Emergency response plan

Shangli Village has made several emergency response plans for accidental fire and flooding. These emergency response plans provide detailed arrangements for response process, staffing, and contact at an accidental fire or other emergencies. When an accidental fire is found, calling for help from professional

firefighting troop and responding by Shangli administrative office are supposed to be started at the same time. According to the emergency response plan, volunteer firefighting troop is going to take facilities and to start the initial stage firefighting. Simultaneously, the other personnel start to implement the emergency cordon, evacuation guidance, firefighting assistance and contact the fire troop based on the arrangement in the emergency response plan. After finishing collective firefighting, the assessment and report are supposed to be done (Figure 7.5).

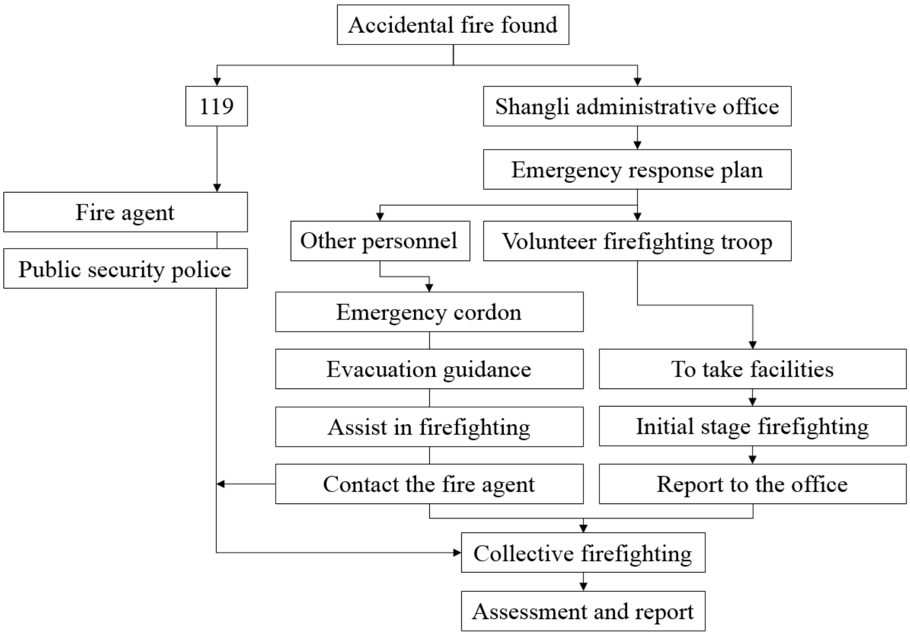
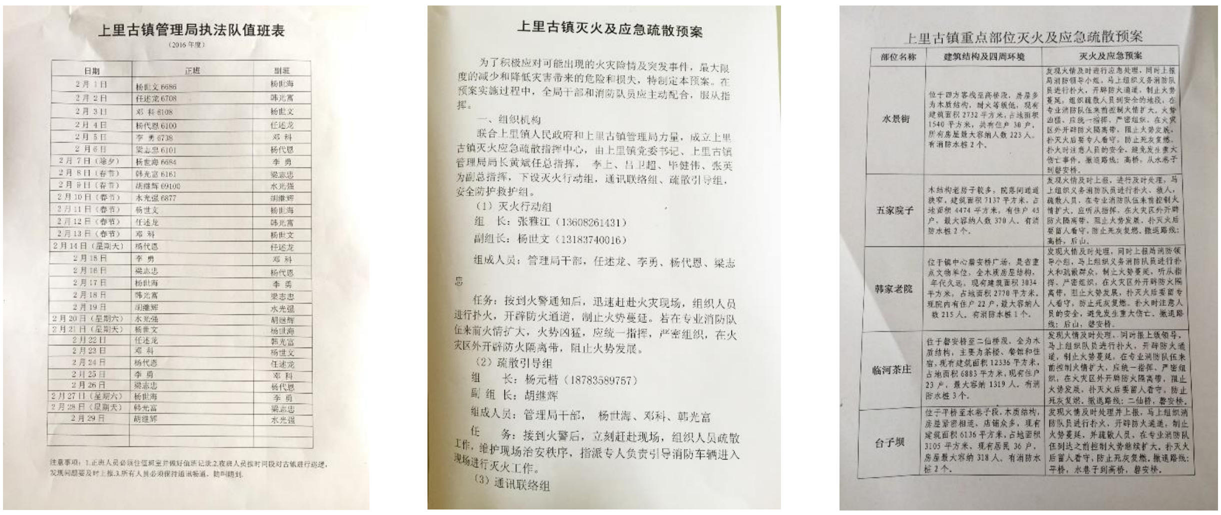


Figure 7. 5 The planned emergency response process at a fire emergency in Shangli Village

(Source: Author, based on the poster provided by Shangli administrative office and the interview to leader)



(a) Personnel placement (b) Emergency plan (c) Specific emergency plan for heritage

Figure 7. 6 Fire emergency response plans in Shangli Village

According to the process above, Shangli administrative office arranges certain person in charge of emergency situation every day during holidays (Figure 7.6(a)). Moreover, in case of a fire emergency happens, the emergency response plan provides the personnel arrangement of three groups: firefighting group, evacuation guidance group, and information transmission group (Figure 7.6(b)). In particular, Shangli administrative office has also developed a heritage-targeted response plan for the heritage gathering area (Figure 7.6(c)).

7.2.3.2 Alarm and transmission system

There has no electric alarm and transmission facilities system assembled in the whole Shangli Village. Fire alarm only assembled on the most important heritage buildings (Figure 7.7). Generally speaking, the local people still alarm emergency response in the most primitive way, shouting in most cases.

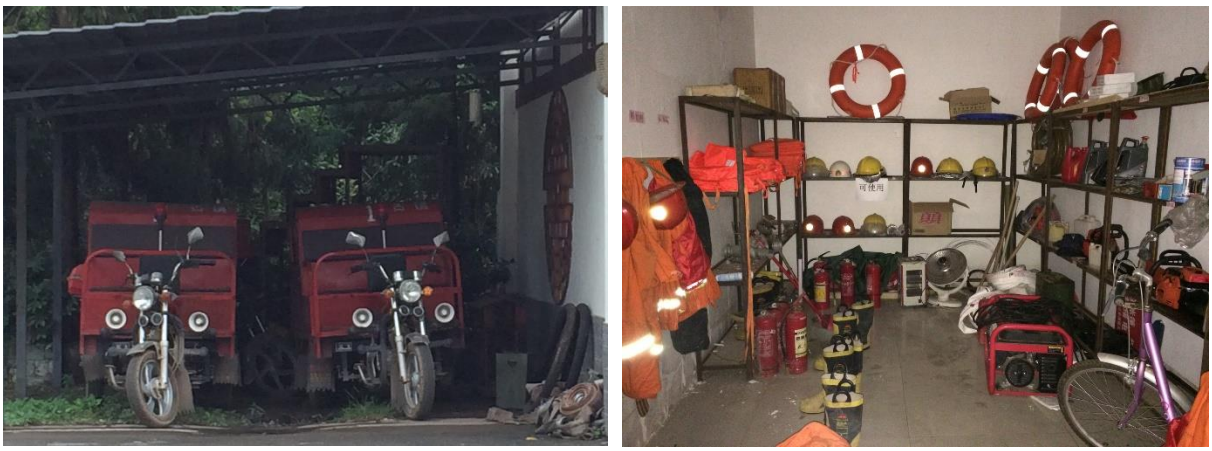
Figure 7. 7 Fire alarm only assembled in the most important heritage building in Shangli Village

7.2.3.3 Disaster response facilities equipment and maintenance

Supported by the local government, Shangli Village is equipped with three small firefighting cars (Figure 7.8(a)), which can easily run through the narrow streets. In addition, various emergency facilities are provided by local government, including one motor pumps (Figure 7.8(b)) and 52 fire extinguishers and 19 fire hydrants widely assembled in the whole village (Figure 7.9), as well as about 50 sets of power generation facilities and simple tools reserved by group leaders. However, these facilities have several problems.

First, the equipment layout of the fire extinguishers and fire hydrants are disordered. In particular, a large area of the village, where wooden buildings are crowded, cannot be covered and protected according to the 60 m protection radius of a fire hydrant. Second, the availability of the facilities cannot be ensured due to low groundwater level and bad maintenance condition. According to the interviews with village leaders, the fire hydrants cannot pump water in most cases due to low groundwater level. Therefore, when an emergency strikes, they usually use small firefighting cars to pump water from the river nearby via a movable pump. In

addition, though the village committee and volunteer firefighting troop are taking the responsibility for facilities inspection and maintenance, most of the fire hydrants are under bad maintenance condition based on field observation. Of the 19 fire hydrants, rarely two are in a good condition, six are in a common condition. However, the other 11 fire hydrants were buried to a different extent due to the road paving works did not take into account the usage of fire hydrants. Four fire hydrants were half buried, three fire hydrants were buried over outlet cop, while another four fire hydrants were totally buried (Table 7.3).



(a) Small fire engines (b) Emergency facilities in storage

Figure 7. 8 Fire engines and emergency facilities in storage in Shangli Village

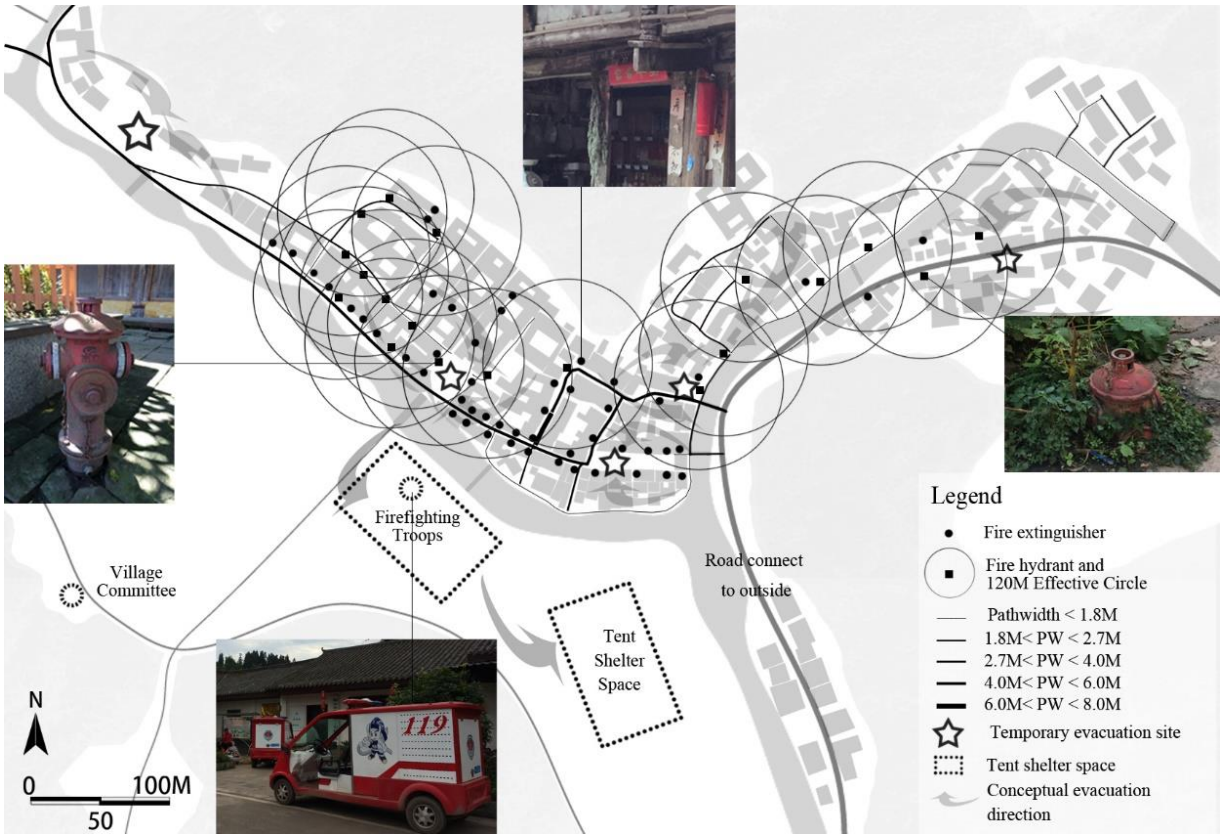
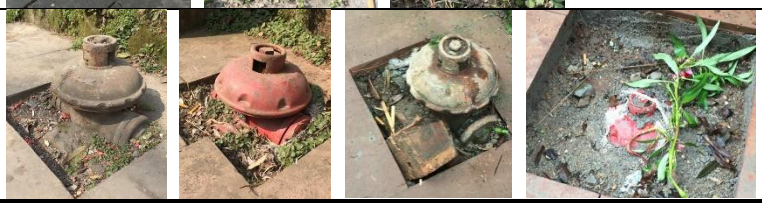


Figure 7. 9 Equipment layout of fire extinguishers and fire hydrants in Shangli Village

Table 7. 3 Maintenance condition of fire hydrants in Shangli Village

Condition	Number	Photos
Good	2	
Common	6	
Half buried	4	
Outlet cop buried	3	
Totally buried	4	

7.2.3.4 Organization of disaster training

As Table 7.2 shows, the volunteer firefighting troop conducts training mainly on firefighting facilities operation once three months, while they also participate in firefighting training held by the fire department of local government, which has no certain schedule. Shangli administrative office is taking the role of dominant organizer, the village committee, and volunteer firefighters are main implementer (Table 7.2). The main content of training includes the usage of fire extinguisher and water pump (Figure 7.10).

In summary, Shangli Village has made a great progress on disaster response plans and measures. They have developed several emergency response plans for accidental fire and flooding with detailed arrangements for response process, staffing, and contact at an accidental fire or other emergencies. However, the alarm and transmission system are not developed. In addition, though Shangli Village is equipped with various emergency facilities, the disordered layout and the poor availability due to low groundwater level

(a) Volunteer firefighters were preparing for training (b) Training of pumping water from river

Figure 7. 10 Firefighting training of the volunteer firefighting troop in Shangli Village

(Source: provided by Shangli administrative office)

and bad maintenance condition still hamper the security of village. Moreover, similar to disaster education activities, the participants in disaster training activities are usually confined to the village committee members and volunteer firefighters, the villagers are not involved.

7.2.4 Damage control and evacuation plan and measures in Shangli Village

The disaster risk reduction measures in Shangli Village are targeting pre-disaster risk reduction and disaster response to mainly accidental fire, damage control measure is not considered. However, the Shangli administrative office has developed a general plan for evacuation site and route. In the emergency response plan, they arranged one working group taking the role of evacuation guidance (Figure 7.6(b)) and roughly determined several evacuation routes. In particular, they described clear evacuation route from five heritage area, where are also tourists gathered (Figure 7.6(c)). In addition, they also planned a general location for temporary evacuation tent shelter space (Figure 7.9). Nevertheless, these evacuation measures are still at the stage of planning, there is no substantive progress for the time being.

7.2.5 Sub-conclusion of the case study in Shangli Village

The ACDCC in Shangli Village represents four obvious features. First, they have no systematic and integrated plan for disaster risk reduction measures. Second, the volunteer firefighting troop in Shangli Village has semi-professional volunteer firefighters but lacks motivation. Third, Shangli Village is laying particular stress on disaster response at emergency, far more than pre-disaster mitigation. Third, though the village faces a high risk of earthquake, their disaster countermeasures focus on accidental fire and flooding. The findings of each section are as follows.

First, Shangli Village has established a volunteer firefighting troop and is developing the primary step disaster risk reduction activities according to the local government's regulation. However, the development of the volunteer firefighting troop faces difficulties of members' lack of motivation and unstable and insufficient membership. Second, Shangli Village has developed several pre-disaster risk reduction

measures at the primary level. Their unscheduled disaster risk inspection focuses on the fire risk only. In addition, little progress has been made on disaster education. The disaster education is seldom held and the participants are mainly village committee members, while the disaster education among students is greatly enhanced in school. Third, Shangli Village has made a great progress on disaster response plans and measures. They have developed several emergency response plans for accidental fire and flooding with detailed arrangements for response process, staffing, and contact at an accidental fire or other emergencies. However, the alarm and transmission system are not developed. In addition, though Shangli Village is equipped with various emergency facilities, but the disordered layout and the poor availability due to low groundwater level and bad maintenance condition still hamper the security of village. Moreover, similar to disaster education activities, the participants in disaster training activities are usually confined to the village committee members and volunteer firefighters, the villagers are not involved. Fourth, damage control measure is not considered, while a general plan for evacuation site and the route has been developed although there has been no substantive progress.

7.3 Case study in Dali Village

In order to identify the features of Dali Village's ACDCC, this study conducted research activities to grasp the current status of community disaster mitigation organization, disaster risk reduction plans, and disaster mitigation measures in Dali Village. According to the "Fire Protection Regulations" issued by Guizhou provincial government in 2002, the rural villages are supposed to develop an integrated fire risk reduction plan. However, there is no specific fire risk reduction plan available currently based on the investigation in Dali Village. Therefore, the following sections analyze the scattered plans and measures by four steps: pre-disaster risk reduction, disaster response, damage control, and evacuation.

This study is based on the field surveys conducted in July 2015 and in February 2016 (Table 7.4), which include structured interviews with five scholars from the Dali Conservation Program Office, two village leaders, ten volunteer firefighters. The structured interviews with scholars are about conservation planning, programs, and projects. The structured interviews with village leaders are about volunteer firefighting troop, disaster risk reduction plans, disaster mitigation measures. The structured interviews with volunteer firefighters are about their participation in volunteer activities and suggestions on organization management and fire protection measures.

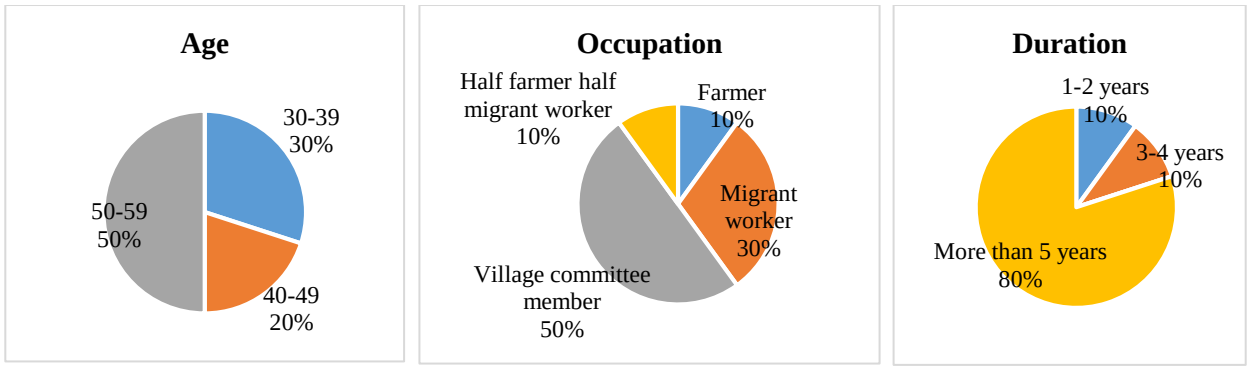
Table 7. 4 Outline of ACDCC field surveys in Dali Village

Methods	Date	Object	Total sample size	Contents
Structured Interviews	Jul. 2015 Feb. 2016	Scholars	5	Village conservation planning, programs, and projects
		Village leaders	2	Volunteer firefighting troop, disaster risk reduction plans, disaster mitigation measures
	Feb. 2016	Volunteer firefighters	10	Participation in volunteer activities; Suggestions on organization management and fire protection measures

7.3.1 Community disaster mitigation organization in Dali Village

7.3.1.1 Membership and activities

The volunteer firefighting troop in Dali Village was established in 2008 by the village committee according to the local government's regulation. The troop has 44 members in total in 2016, of them 13 are male village committee members, the other 31 are male villagers. Since a great number of local people go out for migrant works, there are averagely just 20 members available at ordinary times. Therefore, this study structured interviewed ten volunteer firefighters who were available. Of them, three are between 30 and 39 years old, two are between 40 and 49 years old, the other five are above 50 years old (Figure 7.11(a)). Refers to the occupation, rarely one of them is purely farmer, three are migrant workers, five are village committee members, and another one is a farmer who goes for migrant work every half year (Figure 7.11(b)). In addition, eight of them have worked more than five years as volunteer firefighters, one has worked for three years, another one just joined the troop for one year (Figure 7.11(c)).



N=10 (a) (b) (c)
(a) Age of the volunteer firefighters
(b) Occupation of the volunteer firefighters
(c) The volunteer firefighters' duration of work

Figure 7. 11 Basic information of volunteer firefighters in Dali Village

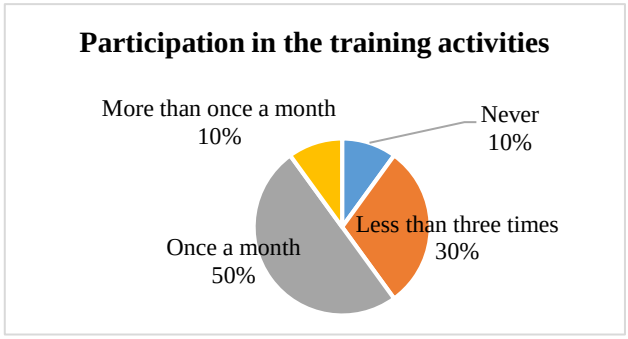
The disaster-related activities of volunteer firefighting troop in Dali Village are mainly managing by the village committee according to the local government officials' policies. Table 7.5 shows the brief situation of current disaster-related activities and roles of several implementers. The leading role of the village committee is obviously represented, while the volunteer firefighting troop plays the role of the main implementer in taking the responsibility for the village's safety (Table 7.5).

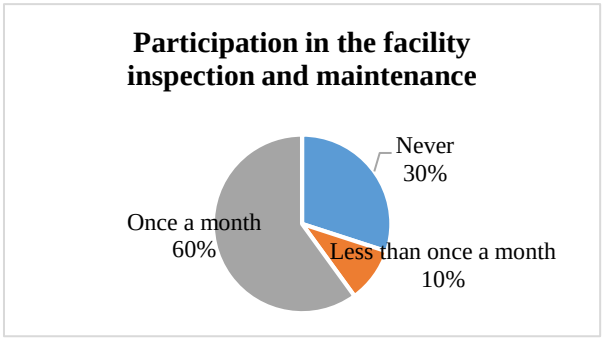
According to the survey, of the ten volunteer firefighters, rarely five participated training activities once a month in the last year, three of them joined less than three times, and even there is one never participated, who went out for migrant works. One volunteer firefighter from village committee participated in not only all the ordinary training activities once a month but also the additional training when local government visited (Figure 7.12 (a)). Similarly, six of them participated all facility inspection and maintenance activities once a month, one joined less than once a month, while three of them never joined (Figure 7.12 (b)).

Table 7. 5 Activities of the volunteer firefighting troop in Dali Village

Contents		Participation of local government	Frequency	Role of implementers			
				Local government	Village committee	Volunteer firefighters	Other villagers
Fire prevention work tracking		Yes	Once a month	△	■	○	×
		No	Once per week	×	△	■	×
Fire risk inspection		Yes	Not scheduled	△	■	○	○
		No	Not scheduled	×	△	■	○
Facilities inspection and maintenance		Yes	Once a month	△	○	■	×
		No	1-2 per week	×	△	■	×
Fire education		Yes	Not scheduled	△	■	○	×
		No	Not scheduled	×	△	■	×
Night caution	Night patrol	No	3-4 per week	×	△	■	×
	Broadcasting		3-4 per week	×	△	■	×
Firefighting training		Yes	Not scheduled	△	■	○	×
		No	Once a month	×	△	■	×
Firefighting		No	Emergency	×	△	■	○

Note: ×Not involved ○ Participant ■ Main implementer △ Dominant organizer
Source: Author, based on the structured interviews with village leaders and volunteer firefighters



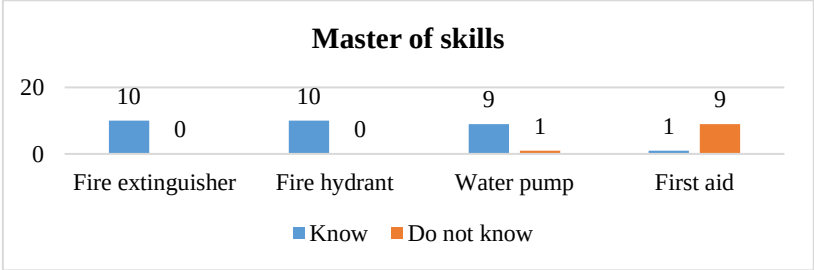


N=10 (a) (b)

(a) Volunteer firefighters' participation in the training activities

(b) Volunteer firefighters' participation in the facility inspection and maintenance

Figure 7. 12 Volunteer firefighters' participation in disaster-related activities in Dali Village



N=10

Figure 7. 13 Volunteer firefighters' mastery of basic emergency response skills in Dali Village

The volunteer firefighters' lack of training is also slightly represented by their mastery of basic emergency response skills. Though all of them know how to use a fire extinguisher and fire hydrant, still one does not know the usage of a water pump. Moreover, nine of them do not know how to do first aid, while rarely one of them know since he once learned from his migrant workplace (Figure 7.13).

7.3.1.2 Development and difficulties

In Dali Village, the volunteer firefighters have obviously high motivation. They are asked the merits and shortcomings as a volunteer firefighter, all of them feel proud of being a volunteer firefighter to protect their village and people. They also consider that the experience could bring them useful knowledge and more harmonious relationship with other villagers. Moreover, they are willing to devote themselves to protect their community without fear of danger and do not expect rewards.

However, the development of the volunteer firefighting troop still faces several difficulties. First, unstable and aging membership. Though the troop has 44 members at present, the membership is unstable since an increasing number of young people goes out to cities for work. Consequently, rarely about 20 members are available at ordinary times, which usually composed of 13 village committee members and another about seven villagers. Thus, it also causes difficulty for the village committee to perform fire protection activities without stable membership. In addition, aging is indeed a serious problem of membership of this volunteer firefighting troop, most of the available members are above 50 years old. Though all of the ten respondents believe that the members could be ensured in the future since all the villagers have high motivation for community fire protection issues, but still, the involvement of younger generation tends to be a problem for the volunteer troop's development.

Second, high disaster risk and insufficient financial support. As stated in the former chapters, the Dong Villages face particularly high fire risk because of compact wooden buildings and other reasons. The volunteer firefighters also seriously concern about the high fire risk of their village. Therefore, they forwardly concern about financial support for sufficient facility and for better maintenance. In addition, for better development of the volunteer firefighting troop in the future, they also consider that it is obviously important to involve all villagers and to improve their activity professionalized.

In summary, Dali Village has established a volunteer firefighting troop in 2008 and is developing several primary-step disaster risk reduction activities according to government regulation. The activities focus on fire risk only at the present stage and are managed by the village committee according to the local government officials' arrangement, while the volunteer firefighting troops play a role of the main implementer. The volunteer firefighters represent remarkably high motivation. However, the development of the volunteer firefighting troop faces difficulties of unstable and aging membership and insufficient financial support.

7.3.2 Pre-disaster risk reduction plans and measures in Dali Village

Pre-disaster risk reduction plans and measures are supposed to be analyzed by government's disaster-resistant building improvement, disaster risk inspection, and disaster education. Since the building improvement in Dali Village has been stated in the fourth chapter, therefore, in this section, only a summary of building improvement is presented to give a complete scenario.

7.3.2.1 Fire-resistant building improvement by the local government

As stated in the literature review section, targeting the main causes of accidental fires in Dong villages, the local government is pushing the fire-resistant building improvement projects in the rural village. In Dali Village, taking over individual building owners' responsibility, the local government conducted the fire-resistant cooking oven transformation and electrical wiring replacement projects, providing not only financial support but also materials and skilled workers.

The two improvement programs of transforming ground ovens and replacing aged electrical wiring, which have both been completed in Dali Dong Village, have effectively reduced the fire risk according to the villagers' perceptions. However, this study found that the oven transformation program was not considered to be fully effective based on the investigation. Ground oven is still being used since the transformed brick oven is too big for most families' needs since the young members usually move out of the village for work. In addition, one-third of the brick oven still surrounded by highly flammable wooden walls.

7.3.2.2 Fire risk inspection and night patrol

As stated in the section of the volunteer firefighting troop's activity, the village committee and volunteer firefighting troop are in charge of the fire risk inspection, which is conducted without a certain schedule. When fire risk is found during an inspection, the village leaders and volunteers usually call the attention and order the owner to rectify immediately.

The night patrol is a traditional fire prevention measure which was discontinued in the 1970 s and was restarted in 1994. During dry weather nights, the night patroller moves around the whole village following a fixed route, striking a gong (Figure 7.14(a)) and shouting fire-related matters needing attention, mainly

(a)

(b)

(a) The gong for night patrol around the entire village during dry weather nights

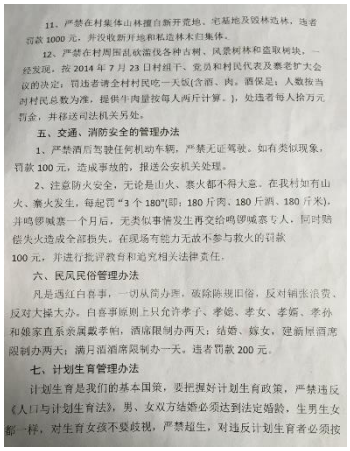
(b) The night patroller broadcasts the cautions to the villagers against fire risk during wet weather nights

Figure 7. 14 Night patrol and broadcasting volunteer and facilities

including kitchen fire and heating fire safety confirmation, cautioning children about playing with fire, garbage, and debris cleaning around the fireplace, etc. The entire patrol takes about 40 minutes. During wet weather nights, the night patroller goes to the village committee to broadcast over the public announcement system (Figure 7.14(b) similar fire-related matters to caution the villagers against fire risk, which usually lasts for 20 minutes. A veteran night patroller who is also a firefighting volunteer has been in charge of the night patrol for 22 years with a remuneration of only CNY 60 (USD 9.17) per month at present. For the future, he feels the difficulty of having no successor due to lack of a sustainable mechanism for personnel training.

7.3.2.3 Organization of disaster education

Disaster education meeting, which targets all villagers in Dali Village, is held about once a year without a fixed schedule according to the village leader. The participants are always the village committee members



(a)

(b)

(a) Village regulations written in Chinese characters issued to each family

(b) Poster for fire prevention written in Chinese characters in public space

(c)

(d)

(c) Poster for fire prevention written in Chinese characters issued to each family

(d) Slogan for fire prevention written in Chinese characters in public space

Figure 7. 15 Fire prevention education regulation and propaganda posters in Dali Village

and volunteer firefighters. Therefore, in order to regulate villagers' utilization of fire and enhance their risk awareness, the village committee has made a new conventional regulation of Dali Village. According to the regulation, the owner whose building causes a fire must compensate for the loss, conduct night patrol for one month, and provide rice, meat, and rice wine (90 kg each) to serve to the villagers who contributed to collective firefighting. In addition, those who do not participate in firefighting will also be punished (Figure 7.15(a)). Furthermore, propaganda posters also play a role in enhancing villagers' fire awareness (Figure 7.15(b), (c) and (d)).

However, since the Dong ethnic group has no written language, many elder villagers cannot understand the contents that are written in Chinese characters. Consequently, the current disaster education seems only effective to young people.

In summary, the pre-disaster risk reduction plans and measures in Dali Village represent the dominant role of local government and lack of community involvement. The local government actively carries out several pre-disaster risk reduction plans and measures, such as fire-resistant building improvement, unscheduled fire risk inspection, and disaster education in Dali Village. The fire-resistant ground oven transformation and electrical wiring replacement projects effectively reduced the fire risk according to the villagers' perceptions, but the oven transformation program was not considered to be fully effective mainly because of its low usage rate. In addition, the volunteer firefighters are in charge of unscheduled fire risk inspection and scheduled night patrol. In particular, the night patrol seems difficult to continue because of no successor due to lack of a sustainable mechanism for personnel training. Besides, the participants of the unscheduled disaster education meeting are village committee members and volunteer firefighters, while the disaster education in forms of community conventional regulation and propaganda posters plays a role in enhancing villagers' fire awareness.

7.3.3 Disaster response plan and measures in Dali Village

Disaster response plan and measures in Dali Village are analyzed by alarm and transmission system, disaster response facilities equipment and maintenance, and disaster training.

7.3.3.1 Alarm and transmission system

There has no electric alarm system assembled in Dali Village even for the important heritage buildings. The information transmission when an emergency is supposed to be broadcasted by shouting or through the village committee's broadcasting system (Figure 7.14(b)).

7.3.3.2 Firefighting facilities equipment and maintenance

Supported by the local government, Dali Village is equipped with 71 fire extinguishers, ten fire hydrants, three motor pumps, 14 firefighting water guns, four fire hooks, and fire hoses (Table 7.6, Figure 7.16). The village committee and volunteer firefighting troop are taking the responsibility for facilities maintenance.

Table 7. 6 Firefighting facilities in Dali Village

Facilities	Number	Location	Note
Fire extinguisher	71	Figure 7.16	Every four to five families share one
Fire hydrant	10	Figure 7.16	Limited coverage and insufficient water pressure
Motor pump	3	Storage	Storage house under the Drama Stage (Figure 7.17(b))
Firefighting water gun	4	Figure 7.16	Four fire hydrants nearby (Figure 7.17(a))
	10	Storage	Storage house under the Drama Stage (Figure 7.17(b))
Fire hook	4	Storage	Storage house under the Drama Stage
Fire hose	460 meters	Figure 7.16	Four fire hydrants nearby (Figure 7.17(a))
		Storage	Storage house under the Drama Stage (Figure 7.17(b))

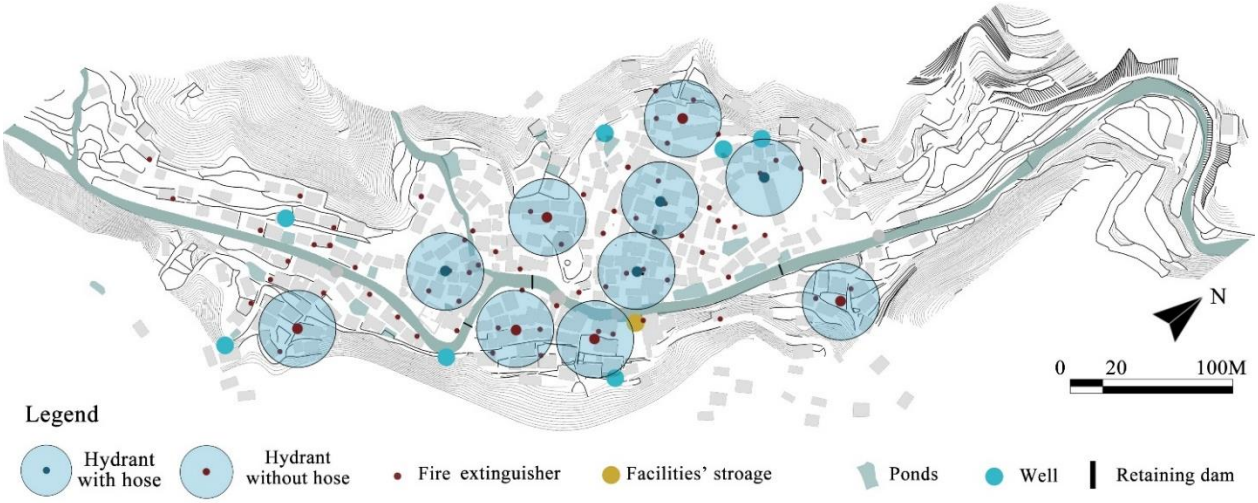


Figure 7. 16 Allocation of firefighting facilities and the firefighting water resources in Dali Village

(a)

(b)

(a) Properly stored hose and water gun close to the fire hydrant

(b) Collectively stored hoses and a firefighting volunteer is checking a motor pump

Figure 7. 17 Well-maintained firefighting facilities in Dali Village

However, these facilities have several problems. First, the current firefighting facilities are insufficient. Every four to five families share one fire extinguisher and the layout of the ten fire hydrants obviously cannot cover the whole village according to the protection radius of a fire hydrant (Figure 7.16). Second, the availability of the facilities cannot be ensured due to insufficient water resource and pressure, bad

maintenance condition, and improper storage. Since the present natural water system compose of river, ponds and wells (Figure 7.16) cannot ensure adequate volume and pressure of water for firefighting by fire hydrants (Figure 7.18(a)), local government is planning to build two common water tanks and one higher firefighting water tanks with a total storage capacity of 230 m^3 . In addition, though the firefighting facilities' inspection and maintenance are the fixed mission for volunteer firefighting troop, volunteers check and maintains the motor pumps once or twice per week (Figure 7.17(b)), but the fire hydrants' condition is not inspected and maintained (Figure 7.18(b)). Moreover, improper storage of the facilities may also affect the emergency response. Four hydrants have hoses and water guns stored nearby (Figure 7.16, Figure 7.17(a)), but six hydrants' hoses and water guns are separately stored far away (Figure 7.16, Figure 7.17(b)), possibly causing inopportune response during emergency firefighting.

(a) (b)

(a) Insufficient water pressure of fire hydrant

(b) The fire hydrant without maintenance covered by weeds

Figure 7. 18 Firefighting facilities in bad condition in Dali Village

7.3.3.3 Organization of firefighting training

As Table 7.5 shows, the volunteer firefighting troop conducts training mainly on firefighting facilities operation every month, while they also participate in firefighting training held by the fire department of local government, which has no certain schedule. The village committee is taking the role of dominant organizer, while the volunteer firefighters are the main implementer. The main content of training includes the usage of fire extinguisher and water pump. In addition, though the village committee also tried to hold usage training of fire extinguisher targeting all villagers, similar with the disaster education activities, most of the villagers are usually busying with their livelihoods and seldom participated in. The participants are still confined to the village committee members and volunteer firefighters.

In summary, the disaster response system has been largely strengthened through the firefighting facilities and equipment and technical training support provided by the local government. However, the alarm and

transmission system are not developed. In addition, though Dali Village is equipped with various emergency facilities, but the poor availability due to obviously inadequate protection scope, poor water infrastructure, and bad maintenance condition still hampers the security of village. Furthermore, similar to disaster education activities, the participants in disaster training activities are usually confined to the village committee members and volunteer firefighters, the untrained villagers present a limitation of the ACDCC of Dali Village.

7.3.4 Damage control and evacuation plan and measures in Dali Village

Except for fire-resistant building improvement, fire spread risk should be reduced through firebreak. The local government has the plan to promote the program of making firebreak in rural villages in Guizhou. However, paying careful attention to not only fire risk reduction but also to original cultural landscape conservation, the installation of firebreaks in Dali Village is still under discussion. Regarding evacuation, Dali Village has not come up with a plan yet.

7.3.5 Sub-conclusion of the case study in Dali Village

The ACDCC in Dali Village represents four obvious features. First, they have no systematic and integrated plan for disaster risk reduction measures. Second, the volunteer firefighting troop in Dali Village has an unstable membership but remarkably high motivation. Third, the disaster mitigation measures are almost relying on the local governments' support. Fourth, the security of Dali Village is greatly affected by poor infrastructure and insufficient facilities. The findings of each section are as follows.

First, Dali Village has established a volunteer firefighting troop and is developing the primary step fire risk reduction activities according to the local government's regulation. However, the development of the volunteer firefighting troop faces difficulties of unstable and aging membership and insufficient financial support. Second, with the local government's strong support, Dali Village has taken several fire prevention measures but still lacks a detailed and localized plan as well as a mechanism for personnel training and community involvement. Third, the disaster response system has been largely strengthened through the firefighting facilities and equipment and technical training support provided by the local government. However, the under-developed fire alarm and transmission system, insufficient facilities, and untrained villagers limit the ACDCC of Dali Village. Fourth, considering the balance between the fire risk reduction measures such as firebreak and original landscape conservation, the fire spread prevention measure is under discussion. Constrained by limited open spaces and narrow streets with steep stairs, evacuation planning has not been listed on the agenda at the present stage.

7.4 Comparative analysis of the ACDCC between Shangli and Dali Village

7.4.1 Comparison of community disaster mitigation organization

The community firefighting organization in two case villages has the following common features and

differences.

First, both of the two villages have established a volunteer firefighting troop and are developing the primary step disaster risk reduction activities according to government regulation. Second, the disaster risk reduction activities of volunteer firefighting troops in both of the two villages are managed by the local administration or village committee according to the local government officials' arrangement, while the volunteer firefighting troops play a role of the main implementer. Third, as a community disaster-related volunteer organization, all the activities of the volunteer firefighting troops in both of the two villages focus on fire risk only at the present stage. Other disasters should be taken into account in the future, such as earthquake countermeasures in Shangli Village. Fourth, the development of the volunteer firefighting troops in two villages face different problems. In Shangli Village, most of the members are local administration staffs from other villages, who are designated to be volunteer firefighters as additional unpaid works. Therefore, members' lack of motivation and insufficient membership hamper the troop's development. In Dali Village, all members are villagers, who have remarkably high motivation. However, the development of the volunteer firefighting troop faces difficulties of unstable and aging membership and insufficient financial support. Fifth, whole community involvement in activities and professionalization of the volunteers are obviously important for both of the two villages.

7.4.2 Comparison of pre-disaster risk reduction plans and measures

The pre-disaster risk reduction plans and measures in two case villages have the following common features and differences.

First, the pre-disaster risk reduction plans and measures in both of the two villages focus on fire risk only and represent the dominant role of local government or local administrative office and the lack of community involvement. Second, these two villages have different emphases on pre-disaster risk reduction plans and measures. Shangli Village pays more attention to fire risk inspection and they have developed a disaster risk inspection plan with a general operation process but without a certain schedule. Dali Village pays more attention to buildings' fire safety and the local government actively carries out fire-resistant ground oven transformation and electrical wiring replacement projects. In addition, the scheduled night patrol in Dali Village plays an important role in fire prevention. However, the night patrol seems difficult to continue because of no successor due to lack of a sustainable mechanism for personnel training. Third, in both of the two villages, the disaster education is seldom held and the participants are always village committee members and volunteer firefighters. However, Dali Village develops disaster education in forms of community conventional regulation and propaganda posters, which play an important role in enhancing villagers' fire awareness.

7.4.3 Comparison of disaster response plan and measures

The disaster response plan and measures in two case villages have the following common features and

differences.

First, the disaster response system of both two villages targets fire risk only and has been largely strengthened through the firefighting facilities and equipment and technical training support provided by the local government. Second, Shangli Village seems active in developing emergency response plans with detailed arrangements for response process, staffing, and contact at an accidental fire or other emergencies. Dali Village has no progress on response plan-making. Third, though the two villages are equipped with various emergency facilities, the emergency response may still be hampered by several problems. For instance, the alarm and transmission system are not developed in both of the two villages. In addition, the current facilities' inadequate protection scope and poor availability still threaten the security of village. In Shangli Village, it is because of the disordered layout and the poor availability due to low groundwater level and bad maintenance condition. In Dali Village, it is because of the poor availability due to obviously inadequate protection scope, poor water infrastructure, and bad maintenance condition. It can be seen that the insufficient water resource and facilities' maintenance are a common problem for these historical villages in the remote mountainous areas. Fourth, the disaster training activities in two villages are usually confined to the village committee members and volunteer firefighters, the untrained villagers may hamper the emergency response in these villages.

7.4.4 Comparison of damage control and evacuation plan and measures

The damage control and evacuation plan and measures in two case villages have totally different development.

In Shangli Village, damage control measure is not considered. But the Shangli administrative office has developed a general plan for evacuation site and route but without substantive progress for the time being. In Dali Village, evacuation measure is not considered. But the local government has the plan to promote the program of making firebreak to reduce fire spread risk in rural villages in Guizhou. However, paying careful attention to not only fire risk reduction but also to original cultural landscape conservation, the installation of firebreaks in Dali Village is still under discussion.

7.5 Conclusion of the chapter

In this chapter, Actual community disaster coping capacity (ACDCC) in Shangli Village and Dali Village are examined based on community disaster mitigation organization, disaster risk reduction plans and disaster mitigation measures. The conclusions are as follows.

In Shangli Village, the local government has established a volunteer firefighting troop and is developing the primary step disaster risk reduction activities. However, the development of the volunteer firefighting troop faces difficulties of members' lack of motivation and unstable and insufficient membership. In addition, Shangli Village has developed several pre-disaster risk reduction measures focus on fire risk at the primary

level, such as unscheduled disaster risk inspection and disaster education. However, disaster education is seldom held and the participants are mainly village committee members. Furthermore, Shangli Village has made a great progress on disaster response plans and measures, such as several emergency response plans for accidental fire and flooding with detailed arrangements for response process, staffing, and contact at an accidental fire or other emergencies. However, though Shangli Village is equipped with various emergency facilities, undeveloped alarm, and transmission system, the facilities' disordered layout and the poor availability due to low groundwater level and bad maintenance condition still hamper the security of village. Moreover, the disaster training activities are usually confined to the village committee members and volunteer firefighters without the villager involvement. In addition, damage control measure is not considered, while a general plan for evacuation site and the route has been developed although there has been no substantive progress.

In Dali Village, a volunteer firefighting troop has been established and primary step fire risk reduction activities have been developed according to the local government's regulation. However, the development of the volunteer firefighting troop faces difficulties of unstable and aging membership and insufficient financial support. In addition, Dali Village has taken several pre-disaster risk reduction measures under the local government's strong support, such as the fire-resistant ground oven transformation and electrical wiring replacement, unscheduled fire risk inspection, and disaster education. However, the fire-resistant ground oven transformation was not considered to be fully effective mainly because of its low usage rate. The night patrol seems difficult to continue because of no successor due to lack of a sustainable mechanism for personnel training. The disaster education meeting is usually confined to the village committee members and volunteer firefighters without the villager involvement, while the disaster education in forms of community conventional regulation and propaganda posters plays a role in enhancing villagers' fire awareness. Furthermore, the disaster response system has been largely strengthened through the firefighting facilities and equipment and technical training support provided by the local government. However, the under-developed fire alarm and transmission system, insufficient facilities, and untrained villagers limit the ACDCC of Dali Village. Besides, considering the balance between the fire risk reduction measures such as firebreak and original landscape conservation, the fire spread prevention measure is under discussion. Constrained by limited open spaces and narrow streets with steep stairs, evacuation planning has not been listed on the agenda at the present stage.

In summary, the ACDCC in two case villages has the following common feature and difference.

First, both of the two villages have established a volunteer firefighting troop. Their disaster risk reduction activities focus on fire risk only at the present stage that is managed by the local administration according to the local government officials' arrangement, while the volunteer firefighting troops play the role of the main implementer. However, the development of the volunteer firefighting troops in the two villages face problems. Members' lack of motivation and insufficient membership hamper the troop's development in

Shangli Village. In Dali Village, members have high motivation, but the troop's development is hampered by unstable and aging membership and insufficient financial support. In addition, whole community involvement in activities and professionalization of the volunteers are obviously important for both of the two villages.

Second, the pre-disaster risk reduction plans and measures in both of the two villages focus on fire risk only and represent the dominant role of the local government or local administrative office and the lack of community involvement. For instance, disaster education in both of the two villages is seldom held and the participants are always village committee members and volunteer firefighters. In addition, these two villages have different emphases on pre-disaster risk reduction plans and measures. Dali Village pays more attention to buildings' fire safety. In addition, the scheduled night patrol in Dali Village plays an important role in fire prevention. However, the night patrol seems difficult to continue because of no successor due to lack of a sustainable mechanism for personnel training.

Third, the disaster response system of both two villages targets fire risk only and has been largely strengthened through the firefighting facilities and equipment and technical training support provided by the local government. Though the two villages are equipped with various emergency facilities, the lack of alarm and transmission system and the current facilities' inadequate protection scope and poor availability may hamper the emergency response. The insufficient water resource and facilities' maintenance are a common problem for these historical villages in the remote mountainous areas. In addition, the disaster training activities in two villages are usually confined to the village committee members and volunteer firefighters. The untrained villagers may hamper the emergency response in these villages.

Fourth, the two case villages are not yet concerned with damage control and evacuation plan and measures. Shangli Village has developed a general plan for evacuation site and route but without substantive progress for the time being. Dali Village has the plan to promote the program of making firebreak to reduce fire spread risk. However, paying careful attention to not only fire risk reduction but also to original cultural landscape conservation, the installation of firebreaks is still under discussion.

On the whole, the ACDCC of these two villages represents five obvious features: lack of systematic and integrated plan caused insufficient disaster risk reduction measures; the dominant role of local government or local administrative office and the lack of community involvement; the target of fire risk and ignorance of other risks such as the earthquake in Shangli Village; disaster risk reduction measures laying particular stress on disaster response during emergencies, far more than pre-disaster mitigation; and lack of technical support for the better disaster-resistance of historical villages, while considering the conservation.

CHAPTER 8. POTENTIAL COMMUNITY DISASTER COPING CAPACITY (PCDCC)

This chapter presents a detailed analysis of PCDCC in the two case historical villages through three components: community asset, community connection, and community participation in disaster-related activities. Then, a comparative discussion on the features of PCDCC between the two case historical villages is presented.

8.1 Outline of the chapter

In this chapter, PCDCC, which is defined as the inherent potential capacity rooted in community cohesion that might empower the community cooperation for coping with disaster during an emergency, is examined by community asset, community connection, and community participation in disaster-related activities.

The component of community asset includes community organizations and their management, community events and collaboration work. This component is the start point to understand these basic elements that support a functioning community. Community connection, which can be reflected by social capital, is examined by six sections: groups and networks, trust and solidarity, collective action and cooperation, information and communication, social cohesion and inclusion, and empowerment and political action. This component and its sub-components manifest a community's basis of developing community-based activities. Community participation in disaster-related activities is going to be analyzed by investigating people's participation in disaster education and training, and their participation willingness for disaster-related activities. The following sections elaborate on each component and sub-components of the ACDCC in the two case villages.

8.2 Case study in Shangli Village

In order to identify the features of Shangli Village's PCDCC, this study conducted research activities to grasp the current status of community asset, community connection, and community participation in disaster-related activities in Shangli Village. This study is based on the field surveys conducted in October 2014, in August 2015, and in February 2016 (Table 8.1). In October 2014, three village leaders were structured interviewed about the village's basic property of community permanent residents, organizations, events, and collaboration. In August 2015, questionnaires were distributed to all 280 families. Of those questionnaires, 214 were collected, of which 133 were valid. The questionnaire includes people's participation in community common activities and disaster-related activities. Besides, their willingness to join in these activities and their perception of the leading role of these activities. In February 2016, in order to investigate the social capital in Shangli Village, a questionnaire survey was conducted with 100 households. The 100 samples were selected by spatially uniform sampling, a systematic sampling strategy through which the samples are regularly distributed in a given spatial context. The selected samples were adjusted minutely according to the

Table 8. 1 Outline of PCDCC field surveys in Shangli Village

Methods	Date	Object	Total sample size			Contents
Structured Interview	Oct. 2014	Village leaders	3			Community permanent residents, organizations, events, and collaboration.
Questionnaire Survey	Aug. 2015	Villagers	Delivered	Collected	Valid	Participation in community activities
			280	214	133	
	Feb. 2016	Villagers	100	97	81	Social capital

owners' willingness to cooperate. The question includes six broad sections: groups and networks, trust and solidarity, collective action and cooperation, information and communication, social cohesion and inclusion, and empowerment and political action.

8.2.1 Community asset of Shangli Village

8.2.1.1 Community permanent residents and organizations

In Shangli Village, 90% of the villagers are permanent residents. The organization in this community includes Shangli administrative office, the village committee, a volunteer firefighting troop, an association for the elderly, and a basketball team. Of these organizations, Shangli administrative office, and the village committee are governing bodies, while the association for the elderly and the basketball team are community entertainment groups but were also found by Shangli administrative office. In addition, detailed information about the volunteer firefighting troop in Shangli Village has been explained in chapter 6 (Table 8.2).

In Shangli village, the key process of decision-making is dominated by Shangli administrative office and the village committee in principle at present and the top-down approach is being applied (Figure 8.1).

Table 8. 2 Community organizations in Shangli Village

Name	Founded	Type	Number	Members	Activity Frequency
Shangli administrative office	2004	Governance	1	>30	All the year around
Village committee	1949		1	13	
Volunteer firefighting troop	2008	Volunteer	1	10	
Association for the elderly	—	Entertainment	1	>10	Unscheduled and inactive
Basketball team	—		1	10	

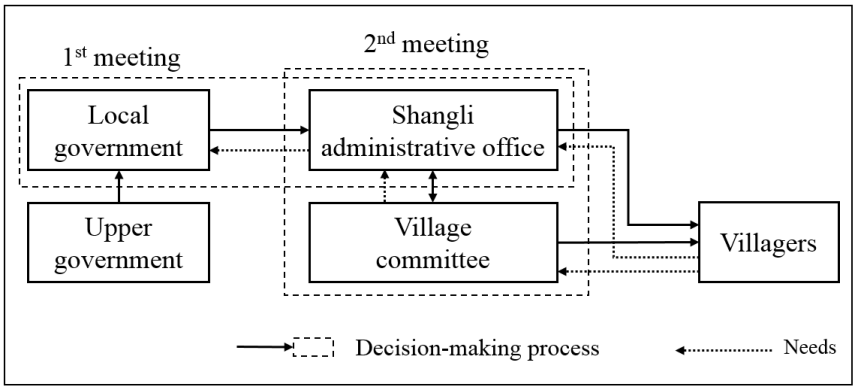


Figure 8. 1 Decision-making process of public affairs in Shangli Village

8.2.1.2 Community events and operation

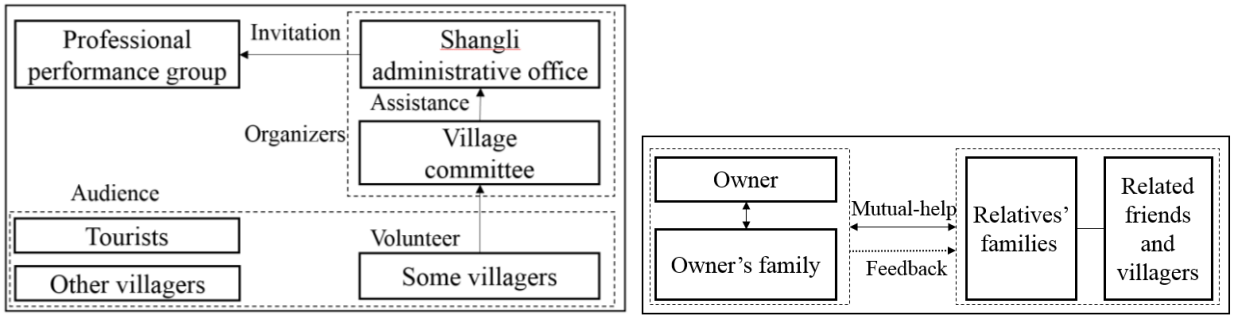
The community events in Shangli Village can be categorized into three types: festivals, weddings, and funerals, and building constructions. The festivals have certain regularity according to the lunar calendar. “Nianzhu festival” is a traditional New Year’s sacrifice ceremony before the Spring festival comes, while the Spring Festival is a private holiday within the household. The weddings, funerals and building constructions are quite occasionally (Table 8.3).

In order to understand the operation mechanism of community events, this study investigated its process and objectives separately. During the organization of Nianzhujie, the Shangli administrative office is taking a leading role in inviting the professional performance group and in organizing the community cooperation. Except for a few of villagers are asked to help during the preparation, most villagers are audience together with tourists (Figure 8.2(a)). During a private event, such as a wedding, the owner’s family is playing a leading role. Their relatives and related friends and other villages provide a mutual-help while getting feedback from the owner’ s family (Figure 8.2(b)). It can be seen that the traditional multi-help custom during a private event, and the leading role of governing bodies during the public event, which lacks community involvement.

In summary, Shangli Village is a consanguineous community that has no active traditional community organization. The community asset represents the leading role of governing bodies during the public event, which lacks community involvement, and the traditional multi-help custom during a private event.

Table 8. 3 Community events in Shangli Village

Type	Name	Lunar calendar date	Times (per year)	Private/Public	Leading role
Festivals	Nianzhujie	December	1	Public	Shangli administrative office
	Spring festival	1-Jan	1	Private	Family
Weddings and funerals		Occasionally	—	Private	Family
Building constructions			—	Private	Family



(a) Operation of a public event of Nianzhujie (b) Operation of the private event

Figure 8. 2 Organization of community events in Shangli Village

(Source: Author, based on structured interviews with the village leaders)

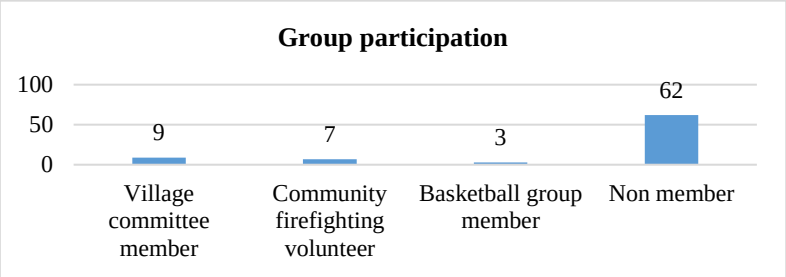
8.2.2 Community connection of Shangli Village

Community connection, which can be reflected by social capital, is examined by six sections: groups and networks, trust and solidarity, collective action and cooperation, information and communication, social cohesion and inclusion, and empowerment and political action. This component and its sub-components manifest a community's basis of developing community-based activities.

8.2.2.1 Groups and networks

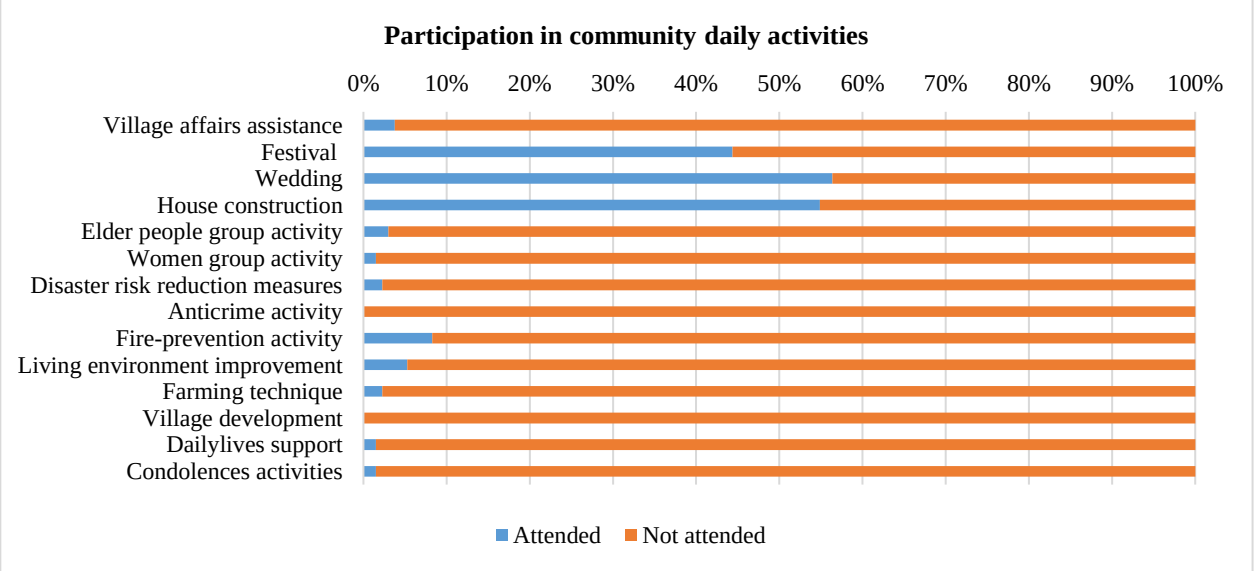
At the level of households, the density of membership is measured by the average number of memberships of each household in existing organizations and people's participation in community activities. In addition, groups with linkages often have better access to resources, especially from outside the community, such as from government or NGOs.

Of the 81 respondent households, nine memberships are village committee members, seven are community firefighting volunteers, three are basketball group members (Figure 8.3). In the rest 62 respondent households, no membership belongs to any of the community groups. Averagely, there are 0.23



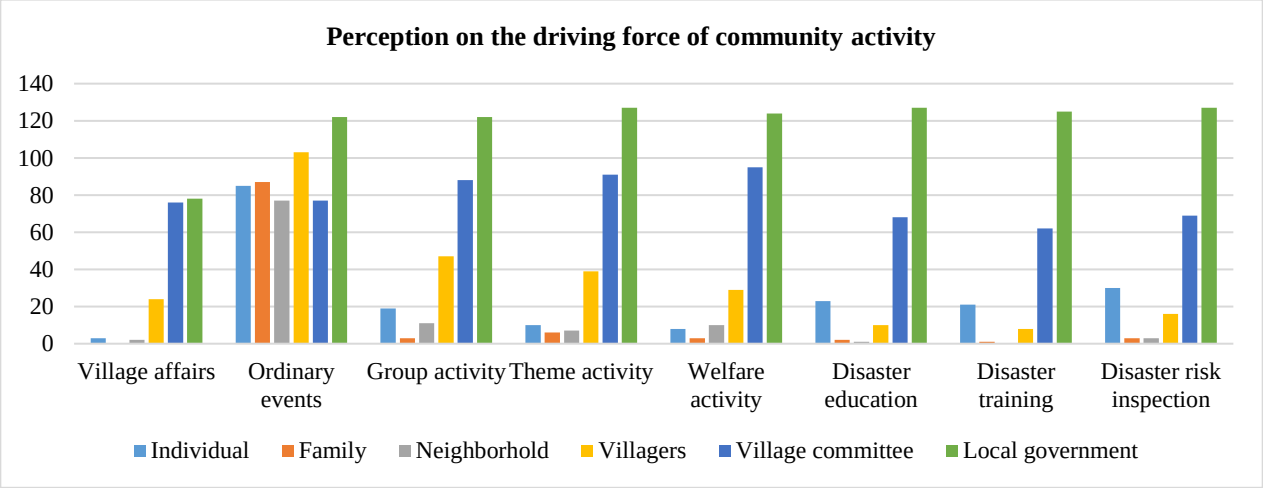
N=81 Multichoice

Figure 8. 3 People's participation in community groups in Shangli Village



N=133

Figure 8. 4 People's participation in community daily activities in Shangli Village



N=133

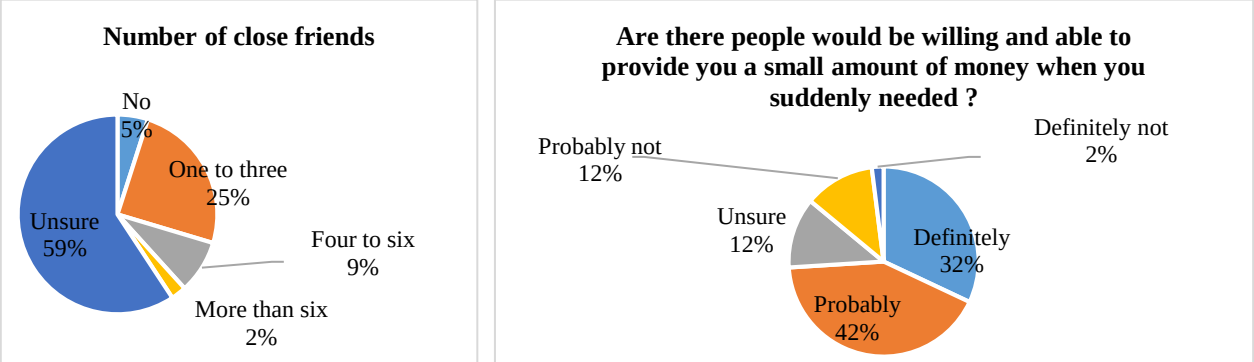
Figure 8. 5 People's perception of the driving force of community activities in Shangli Village

memberships of each household belong to some of the three community organizations in Shangli Village. In addition, these groups are occasionally working with or interact with groups outside the village.

People's participation in community activities has three features. First, all of the regular activities are the basic needs of a traditional community, involving mutual-help, such as festivals, weddings, and building construction. Second, the local people are not involved in the activities regarding village governance and development (Figure 8.4). Third, the local government and the village committee are most expected to be the driving force of community activities (Figure 8.5).

Regarding external networks, most of the rural villages mainly connect the local government through the village committee. In Shangli Village, Shangli administrative office is a management office of the local government in the village, which contacts the village committee for policy transmission and execution. The needs of villagers are reported by the village committee or directly by Shangli administrative office to the local government. It can be seen that Shangli administrative office is the key point connecting the local government and the local community. Regarding internal networks, based on SC-IQ, this study provides two items of information: the size of the network and the extent to which it would provide assistance in case of need. Because "network" is a difficult concept to define concretely in the context of a household survey, a pragmatic approach has been taken: a network is seen as a circle of "close friends", that is people one feels at ease with, can talk to about private matters, or call upon for help. The size of the network then is captured by the number of such close friends. The usefulness of the network is assessed by asking the respondents whether they could turn to the network in a series of hypothetical emergency situations. The answers to these questions can be aggregated to yield a "mutual support score" for the network.

In Shangli Village, the investigation on the size and the usefulness of the network were proved as the following figures show. 5% of the respondents have no close friend at all. 25% have one to three close friends, 9% have four to six close friends, and 2% have more than six close friends, while 59% are unsure



N=81 (a) N=50 (b)

(a) Number of people's close friends in Shangli Village

(b) People's perception on the possibility of obtaining financial help in Shangli Village

Figure 8. 6 People's internal networks in Shangli Village

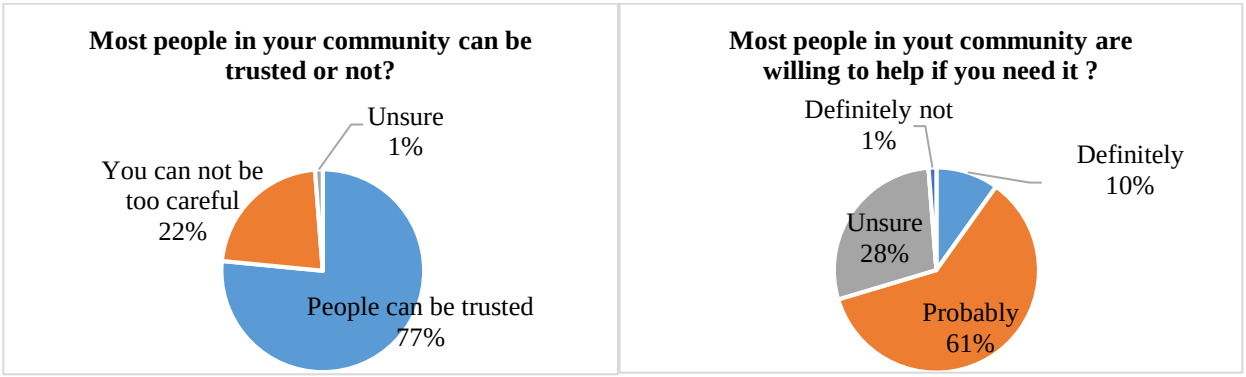
about how many close friends they have that they could feel at ease with and can talk to about private matters, or call upon for help (Figure 8.6(a)).

The usefulness of the network is assessed by asking the respondents the question of "If you suddenly needed to borrow a small amount of money (enough to pay for expenses for your household for one week), are there people beyond your immediate household and close relatives to whom you could turn and who would be willing and able to provide this money?". 32% of the respondents believe that definitely there will be people in the community are willing to help, while 42% think that probably people are willing to help, and other 14% doubt that people will probably not or definitely not be willing to provide money. The rest of 12% are unsure (Figure 8.6(b)).

8.2.2.3 Trust and solidarity

Measurement of cognitive social capital in this section is organized around the themes of trust and solidarity. Trust is an abstract concept that is difficult to measure in the context of a household questionnaire because it may mean different things to different people. Therefore, this study focuses both on generalized trust (the extent to which one trusts people overall) and on the extent of multi-help among the community members based on their trust of each other. In addition, trust is also viewed from different dimensions of trust: trust in local government officials and central government officials. Moreover, the solidarity is being proved by the extent of people's willingness to contribute time or money to the community project, which does not directly benefit one but has benefits for other community members.

The respondents are firstly asked whether they trust most people in their community, 77% of them generally trust people in their community, while 22% of them are not (Figure 8.7(a)). In addition, the respondents are asked their perception on the possibility of obtaining help in their community. 10% of them greatly believe that definitely possible, 61% think that probably possible, while 1% believe that definitely

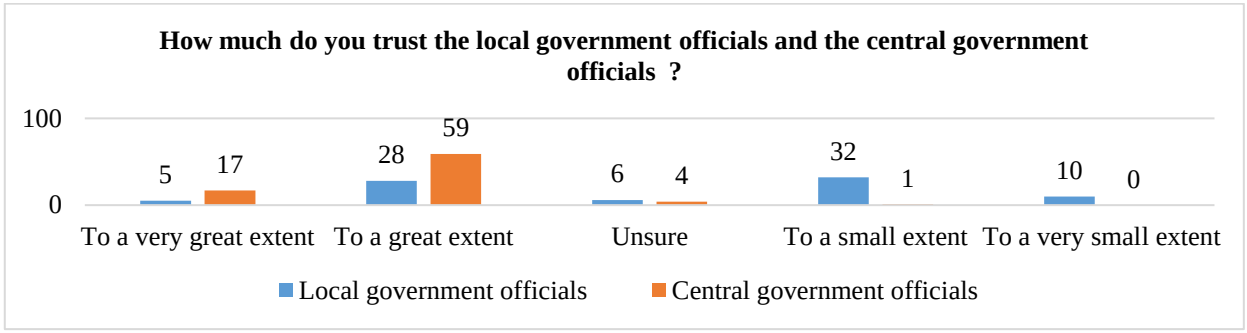


N=81 (a) N=81 (b)

(a) Generalized trust of people in community of Shangli Village

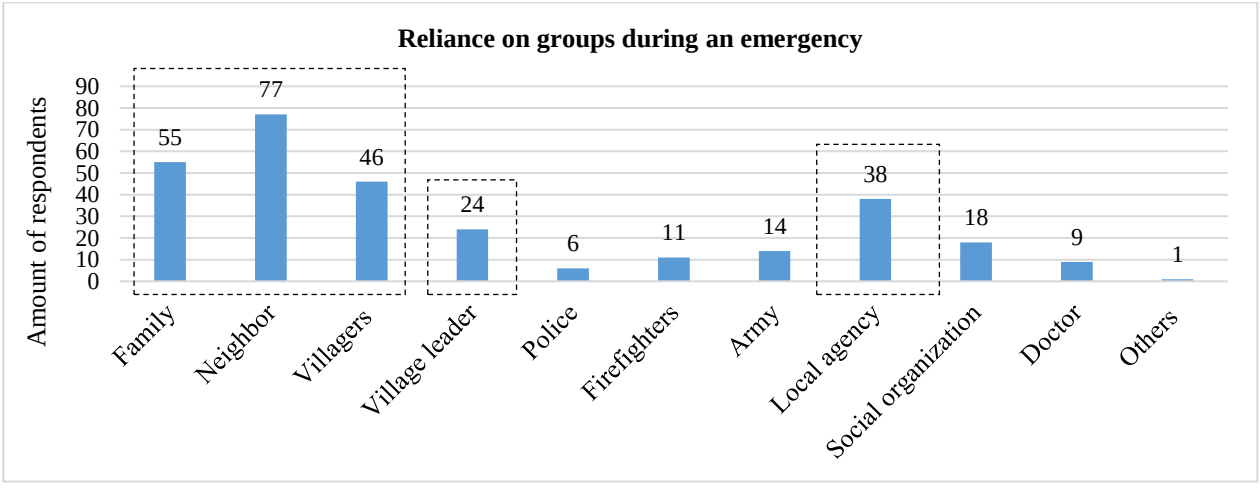
(b) People's perception on the possibility of obtaining help in Shangli Village

Figure 8. 7 Trust of people in community of Shangli Village



N=81

Figure 8. 8 People's trust in the local and the central government officials in Shangli Village



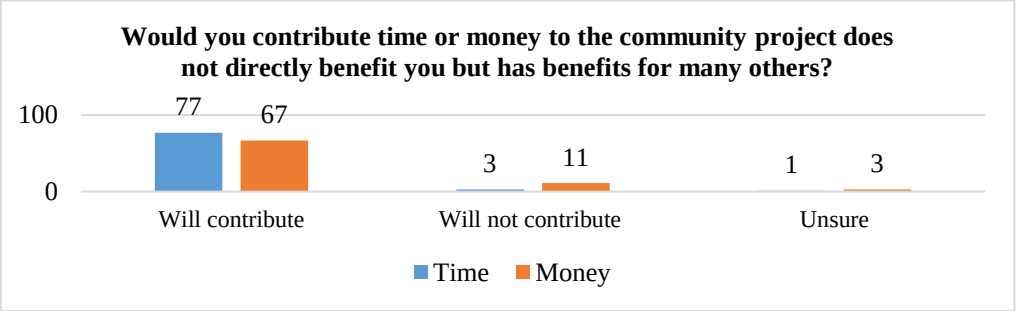
N=112 Multichoice

Figure 8. 9 People's perception of reliable groups during an emergency in Shangli Village

impossible, and 28% are unsure about that (Figure 8.7(b)). Trust is also viewed from different dimensions of trust: trust in local government officials and central government officials. The result indicates the differences of the trust between local government officials and central government officials. Of the 81 respondents, 32 of them trust in local government officials to a small extent, while 28 of them trust in to a

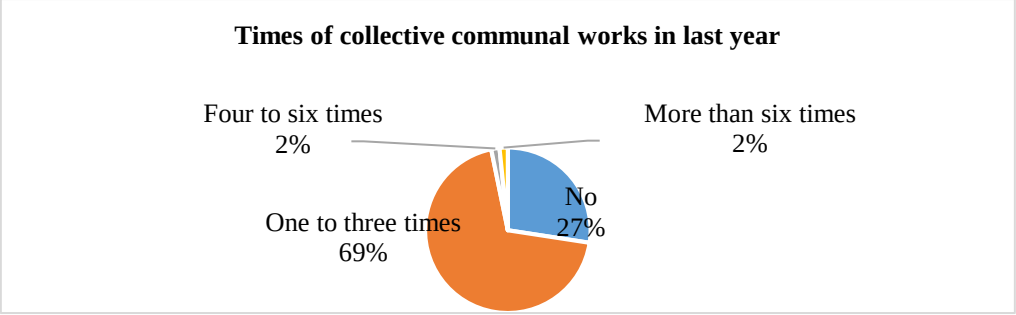
great extent. On the other hand, 59 of the respondents trust in the central government officials to a great extent (Figure 8.8). The local government officials are less trusted in comparing to the central government.

This study investigated the people's perception on reliable groups during an emergency. It was found that the family, neighbors, villagers, in other words, their own community members, are the most dependable sources of support for the local people. in addition, local agency and village leader are also expected (Figure 8.9). It can be seen that the local people tend to rely on three aspects of power when an emergency strike: community power (neighbor, family, and villagers), public power (local agency), and coordinating power (village leader). It presents a basis for disaster coping at the community level. The respondents are also asked whether they are willing to contribute time or money to the to the community project, which does not directly benefit one but has benefits for many others. It shows that most of them are willing to contribute time, while still a contribution of money is slightly discreetly considered (Figure 8.10).



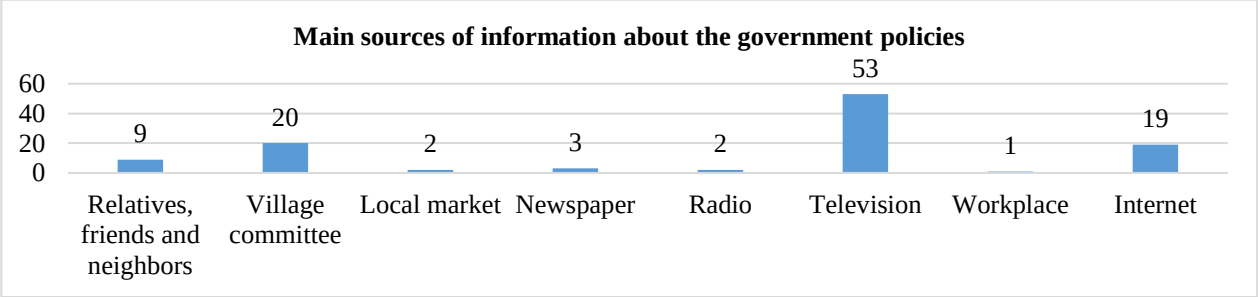
N=81

Figure 8. 10 People's willingness to contribute to the community projects in Shangli Village



N=62

Figure 8. 11 People's participation in collective communal works in last year in Shangli Village



N=81 Multichoice

Figure 8. 12 People's main sources of information about the government policies in Shangli Village

8.2.2.4 Collective action and cooperation

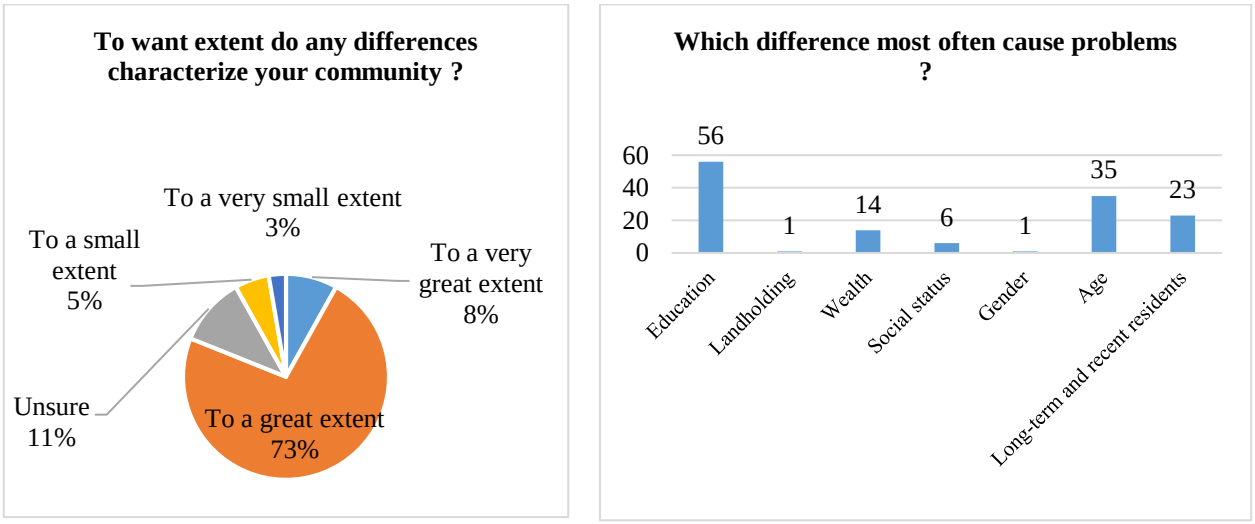
Collective action is the third basic type of proxy indicator for measuring social capital, which is possible only if a significant amount of social capital is available in the community. The collective action section of the social capital utilized one item of information: the extent of a collective action. Of the 62 respondents in Shangli Village, 27% never participated in collective action in last year, while 69% participated one to three times, and 2% participated four to six times and more than six times (Figure 8.11). According to the information from interview accompanying with the questionnaire surveys, at the most occasion, people are not involved in to organize a collective action. Because of that like the urban area, infrastructure and public facilities in Shangli Village is being managed by some certain professional management companies.

8.2.2.5 Information and communication

Information and communication have a simple structure: it is a list of sources of information and means of communication. It makes possible an assessment of the relative importance of groups and networks as sources for important information compared to "impersonal" sources such as newspapers or television. However, the most important source of information about the government policies in Shangli Village is proved to be television. Village committee and the internet are also the important sources (Figure 8.12).

8.2.2.6 Social cohesion and inclusion

Item of social cohesion and inclusion brings together three related topics: inclusion, sociability, and conflict and violence. The respondent is first asked whether there are any divisions in the community and, if so, do these differences cause problems and what characteristics most often cause it?



N=74 (a) N=71 Multichoice (b)

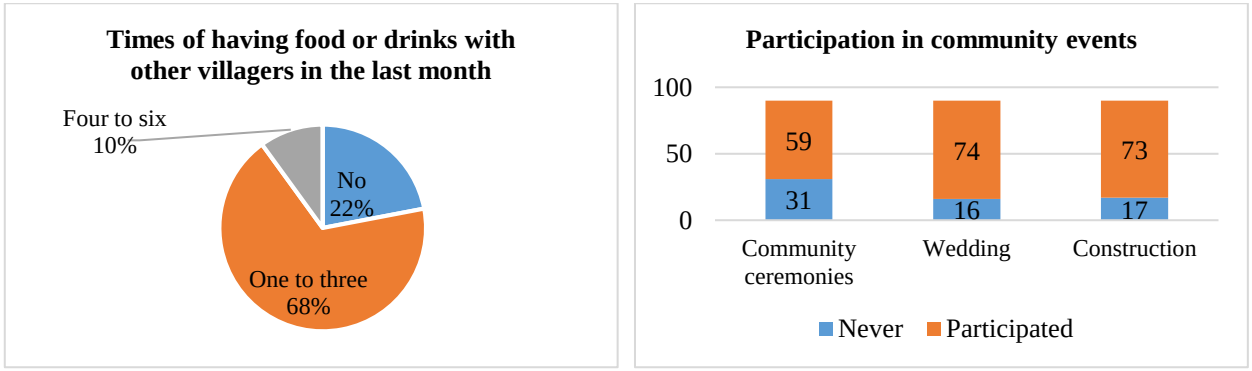
(a) People's perception on the extent of divisions in the community

(b) People's perception on the cause characteristic of problems in the community

Figure 8. 13 Community inclusion in Shangli Village

8% of the respondents view that to a very great extent their community with differences in characteristics between people, and 73% of them consider that to a great extent people are different, while 5% and 3% believe that to a small extent and to a very small extent the people are different (Figure 8.13(a)). Moreover, 67% of the respondents think that these differences cause problems. Differences in education, differences between younger and older generations, and differences between long-term and recent residents most often cause problems (Figure 8.13(b)).

One of the positive manifestations of a high level of social capital in the community is the occurrence of frequent everyday social interactions. This "sociability" can take the form of meeting with people in public places, visits to other people's homes or visits from others into one's own home, and participation in the community events such as sports or ceremonies. In Shangli Village, of the 50 respondents, 68% have ever had food or drinks with other villagers one to three times in the last month (January 2016), and 10% have four to six times, while 22% never went to other villagers for a meal or drink (Figure 8.14(a)). In addition, most of the respondents participated in community events such as ceremonies, wedding, and construction works (Figure 8.14(b)).

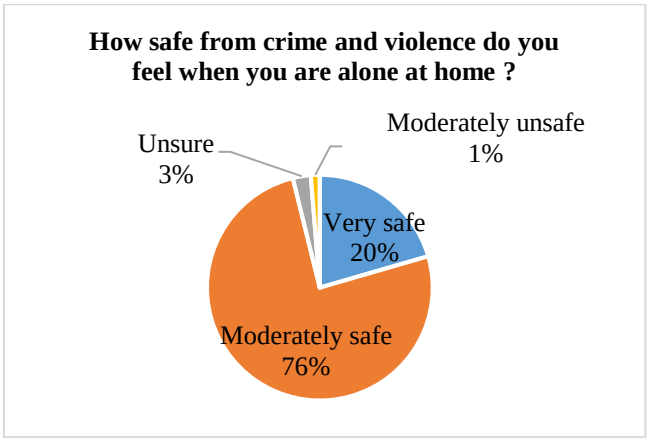


N=50 (a) N=90 (b)

(a) Times of having food or drinks with other villagers in the last month

(b) People's participation in community events

Figure 8. 14 Community sociability in Shangli Village



N=78

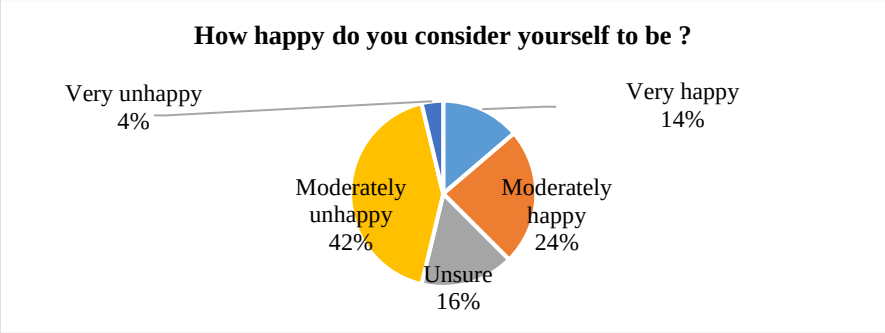
Figure 8. 15 People's perception of security in Shangli Village

The presence of conflict in a community or in a larger area is often an indicator of the lack of trust or the lack of appropriate structural social capital to resolve conflicts or both. This study brings together three important items of information on conflict and violence: the extent of violence, the contribution made by internal divisiveness in the community, and the feelings of insecurity stemming from fear of crime and violence. In Shangli Village, 20% of the respondents feel very safe from crime and violence when they are alone at home, and 76% of them feel moderately safe, while rarely 1% feel moderately unsafe (Figure 8.15).

8.2.2.7 Empowerment and political action

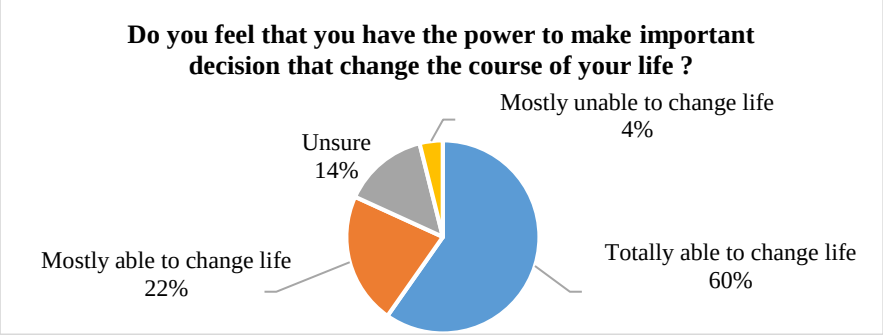
The final section takes a broad view that transcends social capital. Empowerment refers to the expansion of assets and capabilities of people to participate in, negotiate with, influence, control, and hold accountable institutions that affect their lives (The World Bank, 2003). Empowerment is brought about by a wide range of actions, in the context of social capital at the household level, empowerment is defined more narrowly as the ability to make decisions that affect everyday activities and may change the course of one's life. In addition, this study also considers political activities such as filing petitions and voting in elections.

Of the 80 respondents in Shangli Village, 14% consider that they are very happy, and 24% are moderately happy, while 42% of them feel that they are moderately unhappy, and 4% feel very unhappy (Figure 8.16). In other words, approximately half of the respondents feel unhappy to their general lives, more than one-third of them feel happy, and 16% are unsure about their sense of happiness.



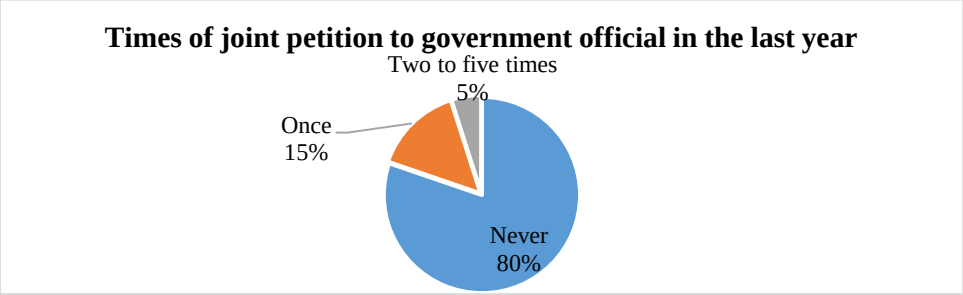
N=80

Figure 8. 16 People's perception of happiness in Shangli Village



N=77

Figure 8. 17 People's perception of self-empowerment in Shangli Village



N=81

Figure 8. 18 People's participation in joint petition in Shangli Village

In order to explore household members' sense of personal efficacy, the respondent is asked that "do you feel that you have the power to make an important decision that changes the course of your life?". 60% of them believe that they are totally able to change their lives, and 22% consider that they are mostly able to change, while 4% feel that they are mostly unable to change their lives (Figure 8.17). That is to say that 82% of the respondents feel positive about their personal efficacy.

In order to understand household members' sense of their capacities to influence local political events, this study investigated their political activities such as filing petitions and voting in elections. In Shangli Village, though all the adult villagers vote in elections of the village committee, 80% of the respondents never participated in a joint petition, 15% of them participated in once, while rarely 5% of them experienced two to five times (Figure 8.18). In addition, the local people could be said have a weak voice in matters affecting their well-being based on the example, which was stated in chapter three that Mr. Wen was filing a petition for more than two years for a construction license to rebuild his destroyed house.

In summary, the social capital in Shangli Village is analyzed by six sections: groups and networks, trust and solidarity, collective action and cooperation, information and communication, social cohesion and inclusion, and empowerment and political action.

First, the groups and networks are analyzed by the density of group membership, people's participation in community activities, and the network's size and usefulness. Averagely, 0.23 person per household belongs to a community group. In addition, these groups are occasionally working with or interact with groups outside the village. Refers to the network, most of the people have one to three close friend, and most of them believe the usefulness of the network.

Second, trust is analyzed by the generalized trust and multi-help among the community members and the trust in local and central government officials. Most of them generally trust people in their community and they believe that they can obtain help from their community. On another dimension, most of the local people trust in the central government officials, while the local government officials are less trusted in. In addition, the solidarity is proved by the extent of people's willingness to contribute to the community project. Most of the local people are willing to contribute, while still contribution of money is slightly discreetly

considered rather than time contribution.

Third, collective action and cooperation are analyzed by the extent of a collective action. At the most occasion, people are not involved in to organize a collective action, since the infrastructure and public facilities in Shangli Village are being managed by some certain professional management companies. More than half of the respondents participated in collective action one to three times.

Fourth, information and communication are analyzed by a list of sources of information. The most important source of information about the government policies in Shangli Village is television. Village committee and the internet are also the important sources for the local people. It represents the inactive communication within the community.

Fifth, social cohesion and inclusion are analyzed by inclusion, sociability, and conflict and violence. Most of the respondents consider that to a great extent people are different in their community. Differences in education, differences between younger and older generations, and differences between long-term and recent residents most often cause problems. In addition, the "sociability", which takes the form of visits to other people's homes or visits from others into one's own home. More than half of the people have ever had food or drinks with other villagers one to three times in the last month. Additionally, almost of the people feel safe from crime and violence when they are alone at home.

Sixth, empowerment, and political action are analyzed by the ability to make decisions that affect everyday activities and may change the course of one's life, and participation in petitions and vote in elections. Approximately half of the local people feel that they are unhappy with their general lives. However, most of them believe that they are able to change their lives. In addition, though all the adult villagers vote in elections of the village committee, almost of them never participated in a joint petition.

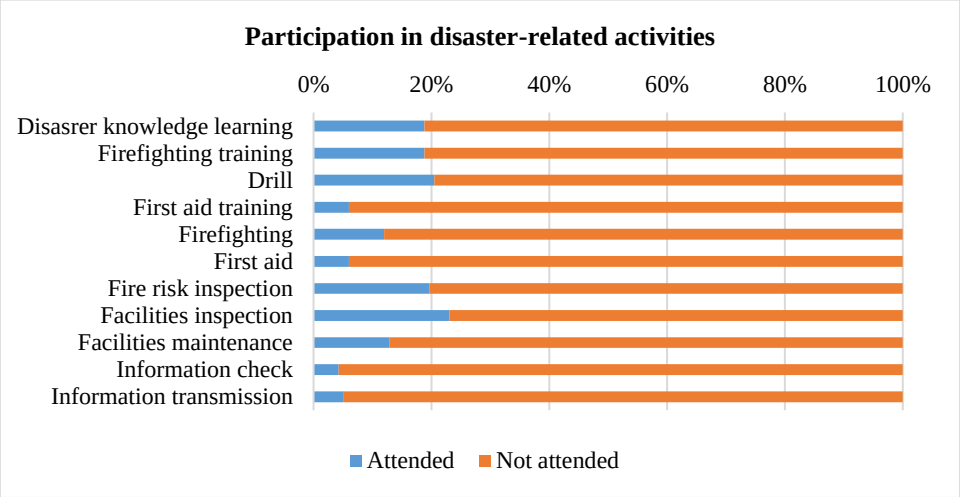
8.2.3 Community participation in disaster-related activities of Shangli Village

8.2.3.1 People's participation in disaster-related activities

In Shangli Village, most of the villagers were busy with their livelihoods and seldom participated in disaster-related activities (Figure 8.19). The participants of disaster response training activities are also confined to the village committee members and volunteer firefighters.

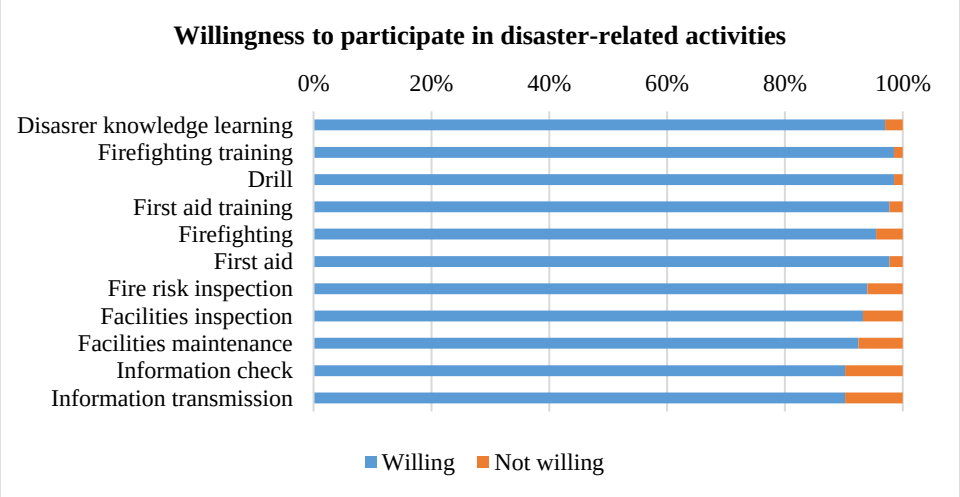
8.2.3.2 People's participation willingness for disaster-related activities

The local people's attention to the disaster-related issues can represent their awareness (Wakabayashi, 1998), therefore, the extent that the local people are willing to participate in the disaster-related activities can reveal a community's potential responding ability. Considering the high disaster risk of the whole village, most of the villagers are willing to enhance their ability and contribute to their community through a number of activities (Figure 8.20). According to the analysis, actual participation and willingness to participate in



N=117

Figure 8. 19 People's participation in disaster-related activities in Shangli Village



N=133

Figure 8. 20 People's willingness to participate in disaster-related activities in Shangli Village

disaster-related activities show remarkable contrast. It can be concluded that the Shangli community possesses an ample potential ability for responding to disasters.

In summary, the community participation in disaster-related activities of Shangli Village is analyzed by people's participation and their willingness for participation in disaster-related activities. Almost of the villagers are not involved in the disaster-related activities. However, almost of them are willing to enhance their ability and contribute to their community through a number of activities. It can be concluded that Shangli community possesses an ample potential ability for responding to disasters.

8.2.4 Sub-conclusion of the case study in Shangli Village

The PCDCC in Shangli Village is examined based on community asset, community connection, and community participation in disaster-related activities. The conclusions are as follows.

First, Shangli Village is a consanguineous community that has no active traditional community organization. The community asset represents the leading role of governing bodies during the public event, which lacks community and involvement, and the traditional multi-help and collaboration custom during a private event.

Second, the community external connection in Shangli Village represents the key role of Shangli administrative office between the local community and the local government. The community internal connection is only reflected in activities of basic needs of a traditional consanguineous community since not only the inactive group activities but also local people are not involved in the activities regarding village governance and development. The social capital in Shangli Village has features of inactive group activities, the limited scope of the network, few collective action, and cooperation, limited source of information and inactive communication within the community, low-inclusion of people even cause problems, low-sociability, and lack of empowerment and political action. On the other hand, local people generally trust other community members, and they are willing to contribute money and time to community projects. It also reflected by that most reliable groups of them during an emergency are their neighbors, family, and other villagers, which presents a potential basis for disaster coping at the community level.

Third, Shangli community possesses an ample potential ability for responding to disasters, which can be seen from the remarkable contrast between the obviously limited participation and the very willingness for disaster-related activities.

8.3 Case study in Dali Village

In order to identify the features of Dali Village's PCDCC, this study conducted research activities to grasp the current status of community asset, community connection, and community participation in disaster-related activities in Dali Village. This study is based on the field surveys conducted in July 2015, and in February 2016 (Table 8.4). In July 2015, the village leader was structured interviewed about the village's basic property of community permanent residents, organizations, events, and collaboration. In addition, 115 households were structured interviewed and 112 are valid, in which, the questions include people's participation and their willingness for participating in community common activities and disaster-related activities. In February 2016, in order to investigate this village's social capital, a structured interview was conducted again to 115 households and 108 are valid. The questions include six broad sections: groups and networks, trust and solidarity, collective action and cooperation, information and communication, social

Table 8. 4 Outline of PCDCC field surveys in Dali Village

Methods	Date	Object	Total sample size		Contents
Structured Interview	July 2015	Village leaders	1		Community permanent residents, organizations, events, and collaboration.
	July 2015	Villagers	Structured-interviewed	Valid	Participation in community activities
			115	112	
	Feb. 2016	Villagers	115	108	Social Capital

cohesion and inclusion, and empowerment and political action. In these two structured interviews, the 115 samples were selected by spatially uniform sampling, a systematic sampling strategy through which the samples are regularly distributed in a given spatial context. The selected samples were adjusted minutely according to the owners' willingness to cooperate.

8.3.1 Community asset of Dali Village

8.3.1.1 Community permanent residents and organizations

In Dali Village, all villagers are permanent residents living in small kinship circles. Traditional organizations, such as the Zhailao group and Dong drama troupe, are spontaneously and informally-organized without certain regulations for membership management and for the schedule of activities (Figure 8.21). On the other hand, modern organizations, such as the village committee and volunteer firefighting troop, are organized with certain activities (Table 8.5). The Zhailao group, which is used to organize the community events, and make decisions related to internal and external community affairs before the village committee was established in 1949, has become a subsidiary. The key process of decision-making is dominated by the village committee in principle at present and the top-down approach is being applied (Figure 8.22).

Table 8. 5 Community organizations in Dali Village

Name	Founded	Type	Number	Members	Activity Frequency
Village committee	1949	Community Governance	1	14	All the year around
Zhailao group	Long existed		1	Men (>70 years old)	Occasionally
Volunteer firefighting troop	2008	Volunteer	1	44	Every month
Grand Song team of adults	Long existed	Entertainment	>2	>30	Nearly every day
Grand Song team of children	2008		1	>50	Every week
Dong drama troupe	Long existed		1	>40	Nearly every new year

(a) (b)

(a) The Dali Dong drama troupe received a memorial flag from a neighboring village for their performance during the Spring Festival

(b) The Dali Grand Song adults' team is performing within the community during the Spring Festival

Figure 8. 21 Typical community organizations in Dali Village

(Source: (a) by Author; (b) by Dali Conservation Committee)

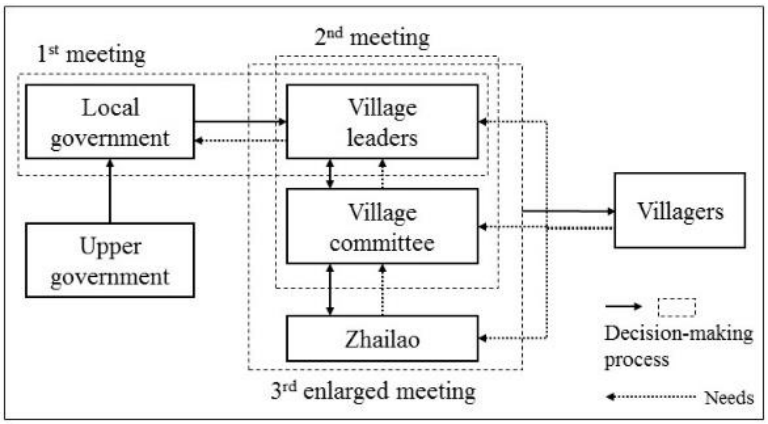


Figure 8. 22 Decision-making process of public affairs in Dali Village
(Source: Author, based on interviews and referenced on (Tang, 2003))

8.3.1.2 Community events and operation

The community events in Dali Village can be categorized into four types: festivals, weddings, and funerals, building constructions, and fire prevention. The festivals have certain regularity according to the lunar calendar, which determines in which day the local people will celebrate in the traditional way. Among them, the Spring Festival and the Harvest Festival are the most solemn. The weddings, funerals and building constructions are occasional and take place more than ten times a year on the average. In these occasions, part or most of the village become busy for several days. The fire prevention event is a traditional sacrifice activity performed to avert fire accidents from happening (Table 8.6).

Table 8. 6 Community events in Dali Village

Type	Name	Lunar calendar date	Times (per year)	Private/Public	Leading role
Festivals	Spring festival	1-Jan	1	Private Public	Village committee, Zhailao, Family
	Harvest Festival	After harvest			
	Er yue er, San yue san	2-Feb, 3-Mar			
	Liu yue liu, Ba yue ba	6-Jun, 8-Aug			
Weddings and funerals		Occasionally	>10	Private	Zhailao, Family
Building constructions			>10	Private	
Fire prevention	Tuihuoyang jie		Uncertain	Public	Village committee, Zhailao

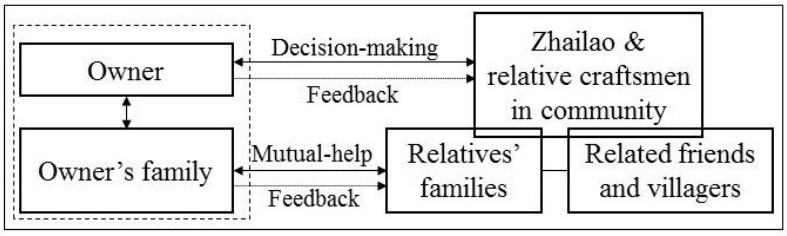


Figure 8. 23 Operation of private events in Dali Village

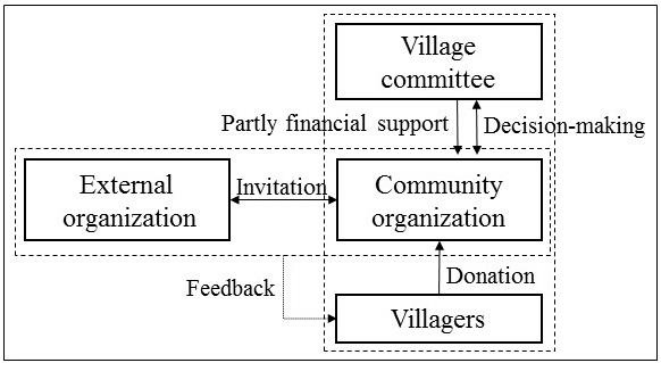


Figure 8. 24 Operation of public events in Dali Village

In order to understand the operation of the community events, this study investigated its process and objectives separately. As Figure 8.23 shows, the Zhailao group and related traditional craftsmen are playing an important role during private events, revealing a mutual-help and feedback connection among the building owners, relatives' families, and related friends and villagers. Comparatively, during the public events, the village committee is taking a leading role in supporting the community organization with financial resources to supplement the villagers' donations (Figure 8.24). Dali Village builds the basis for mutual help within the community and with external communities through the public.

In summary, Dali Village is a consanguineous community that has active traditional community organizations or informal groups and therefore various group activities and community events. The community asset represents the leading role of the village committee and a subsidiary role of the traditional Zhailao group. The traditional Zhailao group and mutual-help custom are playing an important role during private events, while the village committee is taking a leading role in supporting the public events.

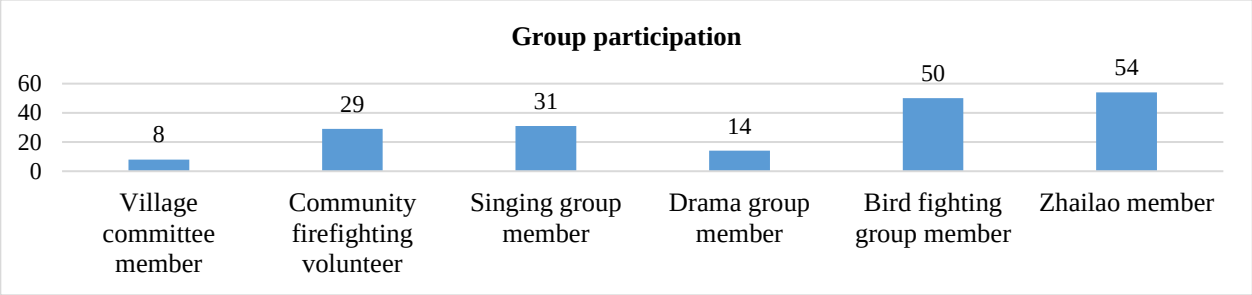
8.3.2 Community connection of Dali Village

8.3.2.1 Community connection and Social Capital at the household level

Community connection in Dali Village is also examined by six sections of social capital: groups and networks, trust and solidarity, collective action and cooperation, information and communication, social cohesion and inclusion, and empowerment and political action.

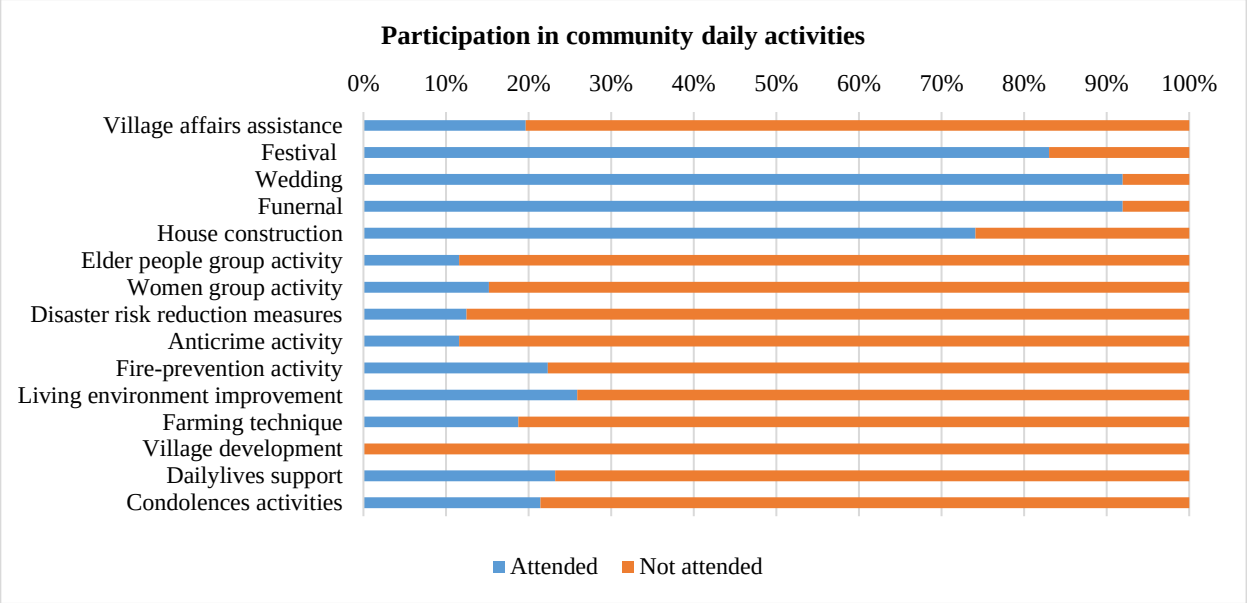
8.3.2.2 Groups and networks

Of the 108 respondent households, eight memberships are village committee members, 29 are community firefighting volunteers, 31 are singing group members, 14 are drama group members, 50 are bird fighting group members, and 54 elders are Zhailao members (Figure 8.25). Averagely, there are 1.72 memberships belong to some of the community organizations or informal groups in Dali Village. In addition, most of these groups are occasionally work with or interact with groups outside the village. In particular, the singing group and the drama group frequently have communication performances interacting with groups in other



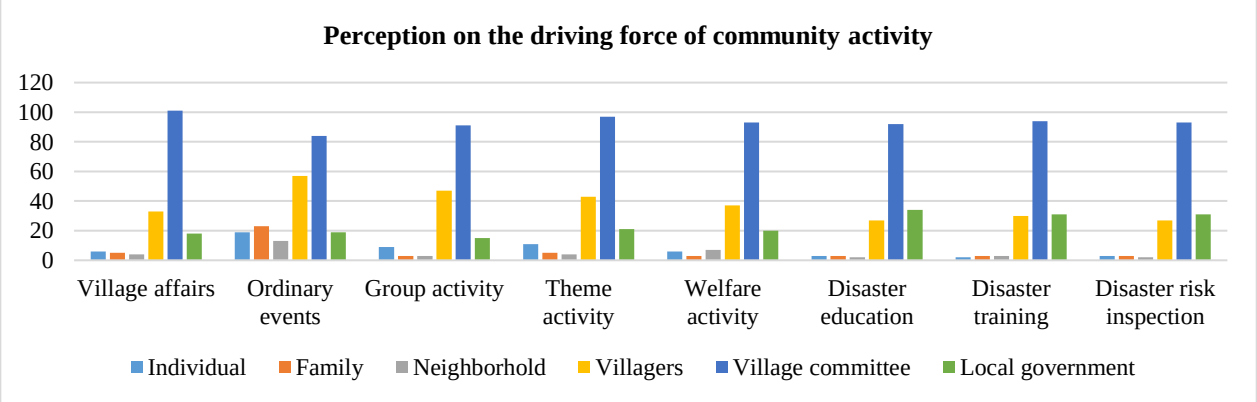
N=108 Multichoice

Figure 8. 25 People's participation in community groups in Dali Village



N=112

Figure 8. 26 People's participation in community daily activities in Dali Village



N=112

Figure 8. 27 People's perception of the driving force of community activities in Dali Village

villages and even have the opportunity to go upon the stage at the national level.

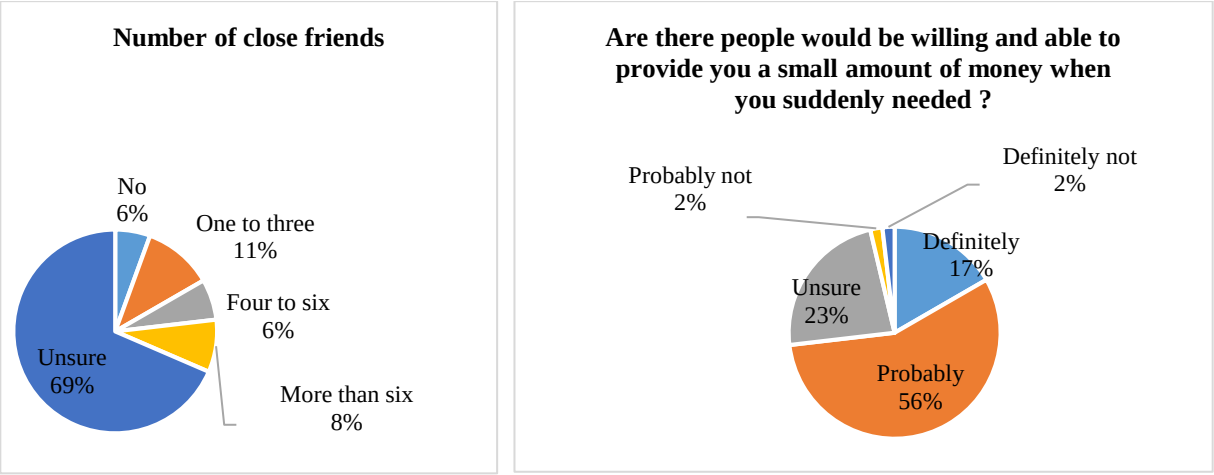
People's participation in community activities has two features. Firstly, most of the local people actively

participate in the ordinary activities of a traditional community, involving mutual-help and reward custom, such as festivals, weddings, funerals, and building construction. Secondly, the local people are not involved in the activities regarding village governance and development (Figure 8.26). Third, the village committee and villagers themselves are most expected to be the driving force of community activities (Figure 8.27).

Regarding external networks, as in most of the rural villages, Dali village mainly connects to the local government through the village committee. The local government contacts the village committee for policy transmission and execution. The village situation and the needs of the people are reported to the local government by the village committee. It can be seen that the village committee is the key point connecting the local government and the local community.

Regarding internal networks, the investigation on the size and the usefulness of the network in Dali Village are showing by the following figures. 6% of the respondents have no close friend at all. 11% have one to three close friends, 6% have four to six close friends, and 8% have more than six close friends that they could feel at ease with and can talk to about private matters, or call upon for help. Similar to Shangli Village, most of the respondents could not clearly count an exact number of close friends (Figure 8.28(a)).

Then, the respondent in Dali Village is asked the question of "If you suddenly needed to borrow a small amount of money (enough to pay for expenses for your household for one week), are there people beyond your immediate household and close relatives to whom you could turn and who would be willing and able to provide this money?". 17% of the respondents believe that definitely there will be people in the community are willing to help, while 56% think that probably people are willing to help, and other 4% doubt that people will probably not or definitely not be willing to provide money. The rest of 23% are unsure (Figure 8.28(b)). In total, 73% of the respondents consider that they will obtain financial help when emergency situation.



N=108 (a) (b)

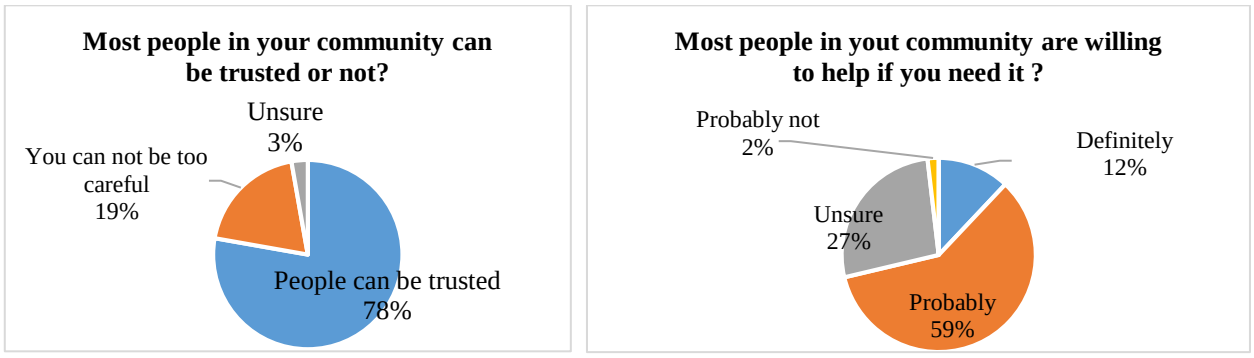
(a) People's close friends in Dali Village

(b) People's perception on the possibility of obtaining financial help in Dali Village

Figure 8. 28 People's close friends in Dali Village

8.3.2.3 Trust and solidarity

The respondents are first asked whether they trust most people in their community in general, 78% of them generally trust people in their community, while 19% of them are not (Figure 8.29(a)). In addition, the respondents are asked their perception on the possibility of obtaining help in their community. 12% of them greatly believe that definitely possible, 59% think that probably possible, while 2% believe that probably impossible, and 27% are unsure about that (Figure 8.29(b)).

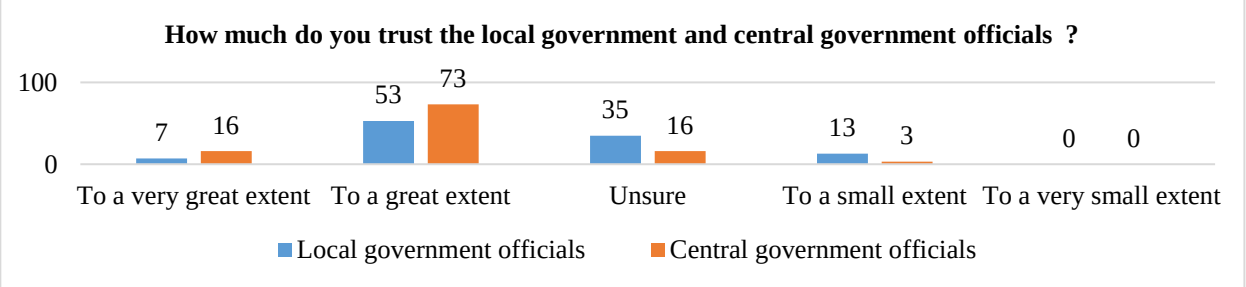


N=108 (a) (b)

(a) Generalized trust of people in community of Dali Village

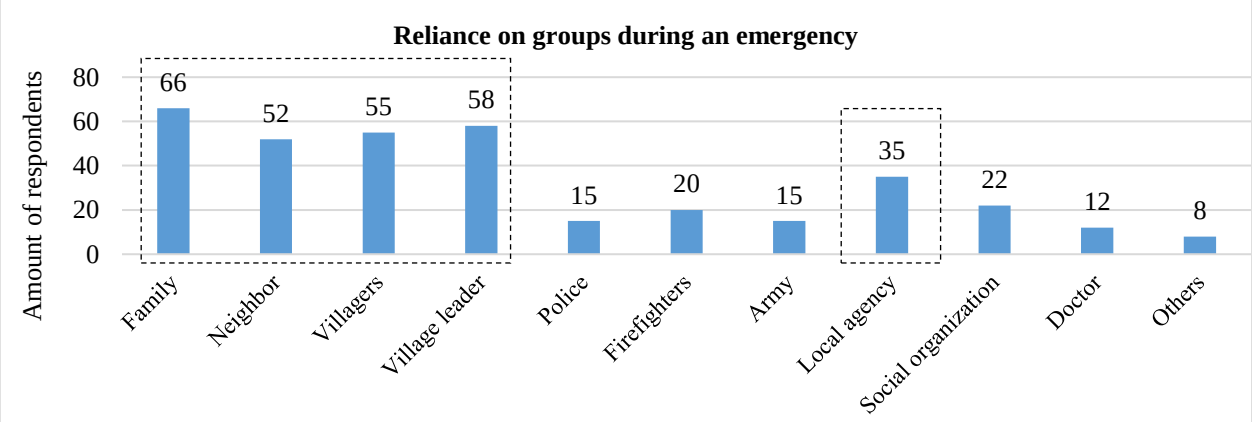
(b) People's perception on the possibility of multi-help in Dali Village

Figure 8. 29 Trust of people in community of Dali Village



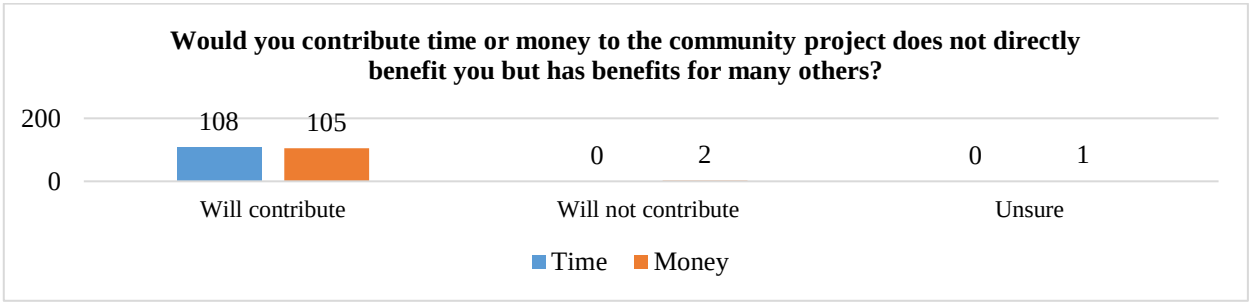
N=108

Figure 8. 30 People's trust in the local and the central government officials in Dali Village



N=112 Multichoice

Figure 8. 31 People's perception of reliable groups during an emergency in Dali Village



N=108

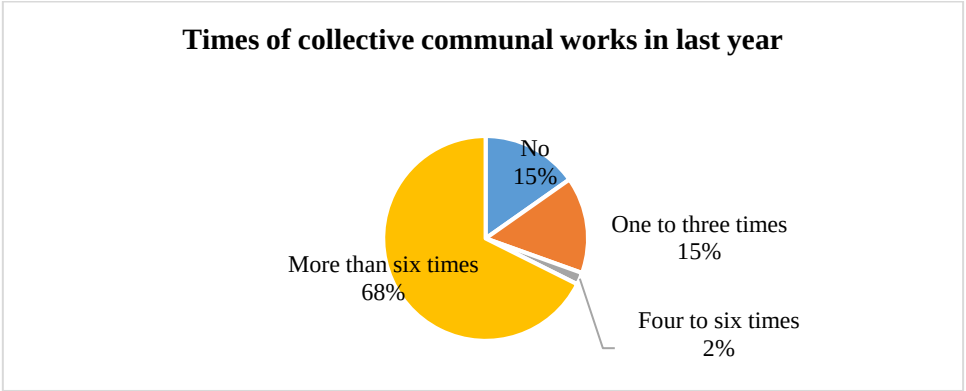
Figure 8. 32 People's willingness to contribute to the community projects in Dali Village

Trust is also viewed from different dimensions of trust: trust in local government officials and central government officials. The result indicates the difference of trust between local government officials and central government officials. Of the 81 respondents, 32 of them trust in local government officials to a small extent, while 28 of them trust in to a great extent. On the other hand, 59 of the respondents trust in the central government officials to a great extent (Figure 8.30). This study also investigated the reliance to groups by the local people at the emergency situation. It was found that the family, neighbors, other villagers, and village leader, in other words, their own community members, are the most dependable sources of support for the local people (Figure 8.31). The respondents are also asked whether they are willing to contribute time or money to the to the community project, which does not directly benefit one but has benefits for many others. The result shows that most of them are willing to contribute, while still a contribution of money is slightly discreetly considered rather than time contribution (Figure 8.32).

8.3.2.4 Collective action and cooperation

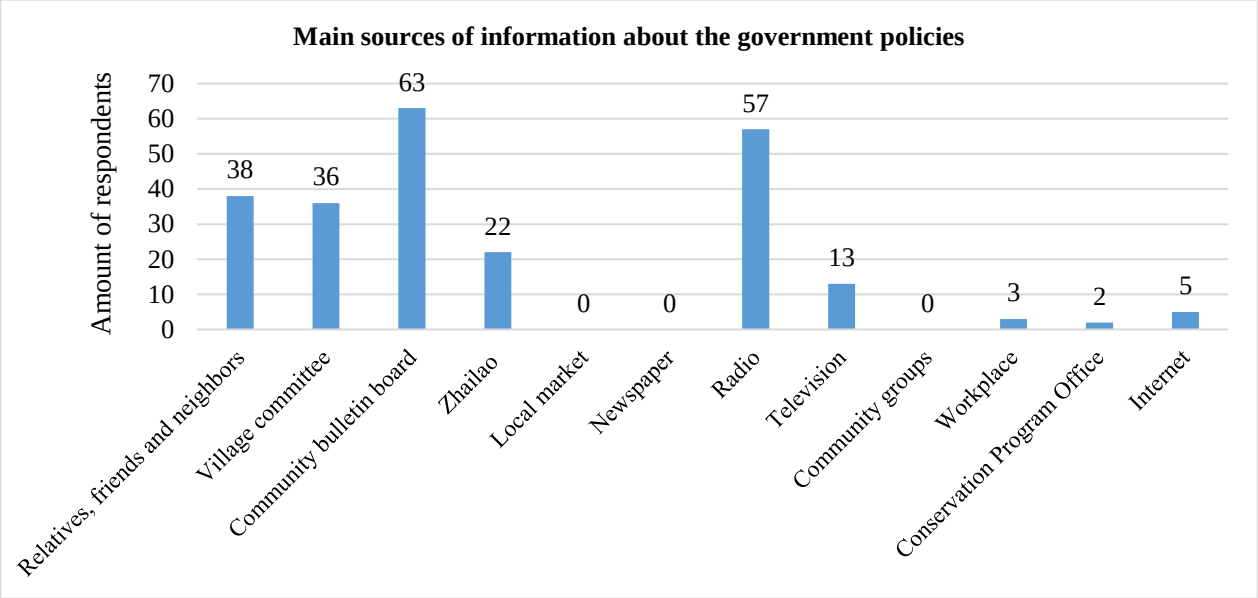
Of the 105 respondents in Shangli Village, 15% never participated in collective action in last year, 15% participated one to three times, and 2% participated four to six times and more than six times, while 68% participated more than six times (Figure 8.33).

8.3.2.5 Information and communication



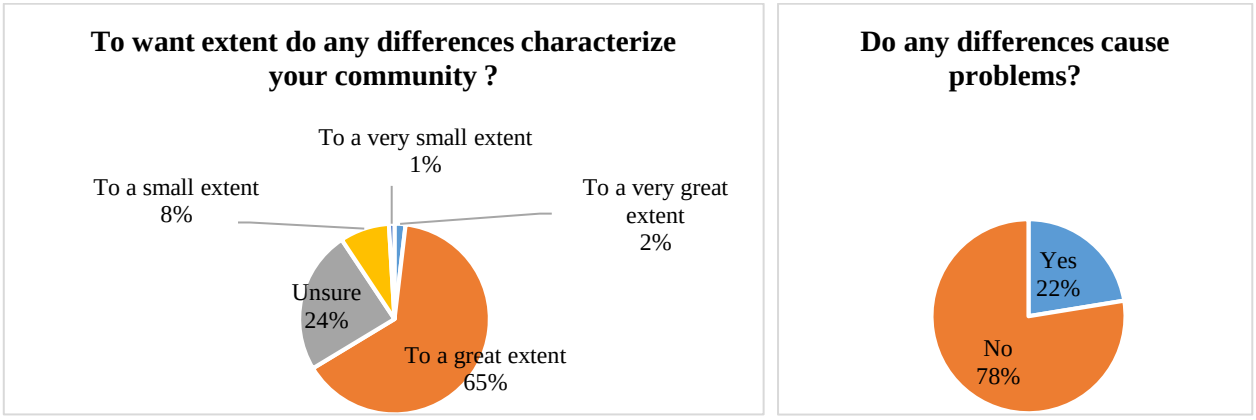
N=105

Figure 8. 33 People's participation in collective actions in last year in Dali Village



N=108 Multichoice

Figure 8. 34 People's main sources of information about the government policies in Dali Village



N=107 (a) (b)

(a) People's perception on the extent of divisions in the community

(b) People's perception on the influence of different characteristic in the community

Figure 8. 35 Community inclusion in Dali Village

In Dali Village, the most important source of information about the government policies is proved to be community bulletin board. In addition, various sources of information are playing an important role in people's communication lives. Information from radio, relatives, friends and neighbors, village committee leaders, and Zhailao members are remarkably influential rather than television or the internet (Figure 8.34).

8.3.2.6 Social cohesion and inclusion

In Dali Village, 2% of the respondents consider that to a very great extent their community with differences in characteristics between people, and 65% of them consider that to a great extent people are different, while 8% and 1% believe that to a small extent and to a very small extent the people are different (Figure 8.35(a)).

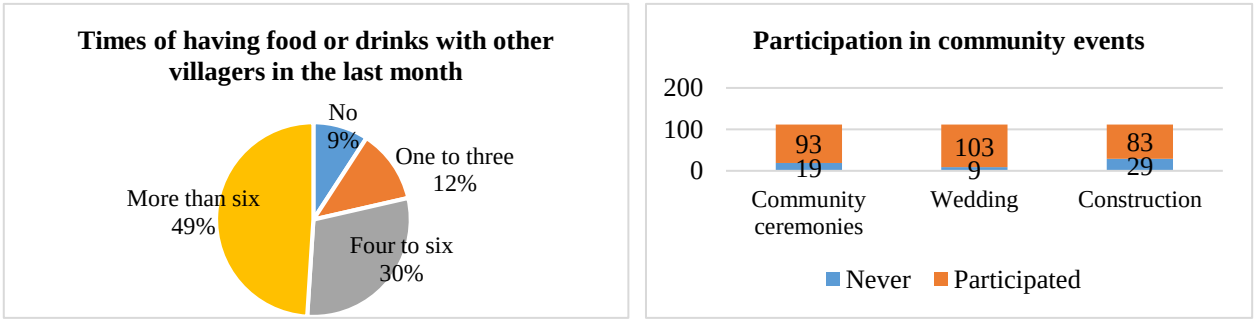
According to interviews, differences between younger and older generations and differences in wealth tend to be a characteristic of Dali Village. Nevertheless, 78% of the respondents think that these differences did not cause problems (Figure 8.35(b)).

In Dali Village, of the 50 respondents, 68% have ever had food or drinks with other villagers one to three times in the last month (January 2016), and 10% have four to six times, while 22% never went to other villagers for a meal or drink (Figure 8.36(a)). In addition, most of the respondents participated in community events such as ceremonies, wedding, and construction works (Figure 8.36(b)).

In Dali Village, 10% of the respondents feel very safe from crime and violence when they are alone at home, and 65% of them feel moderately safe, while rarely 10% feel moderately unsafe, and 1% feel very unsafe (Figure 8.37).

8.3.2.7 Empowerment and political action

Of the 108 respondents in Dali Village, 2% consider that they are very happy, and 47% are moderately happy, while 13% of them feel that they are moderately unhappy, and 2% feel very unhappy (Figure 8.38). In other words, approximately half of the respondents feel happy to their general lives, 15% of them feel happy, and 36% are unsure about their sense of happiness.

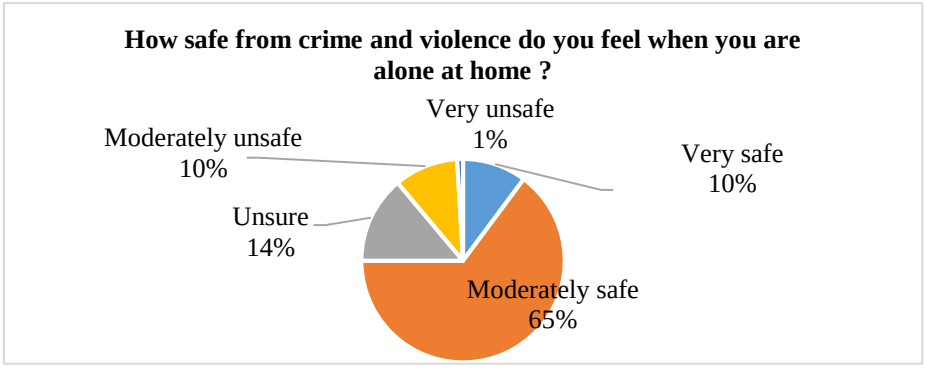


N=98 (a) N=112 (b)

(a) Times of having food or drinks with other villagers in the last month

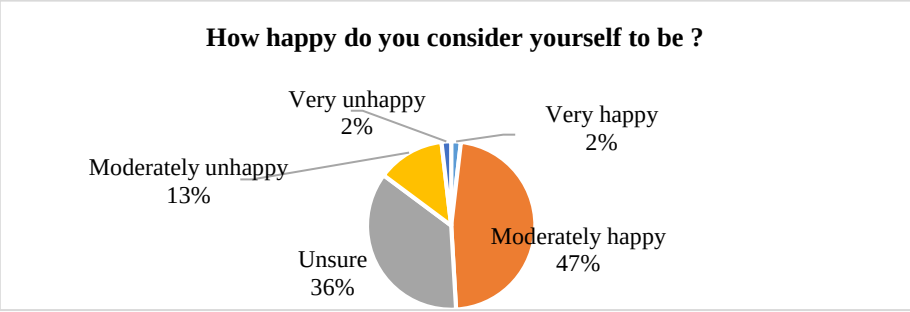
(b) People's participation in community events

Figure 8. 36 Community sociability in Dali Village



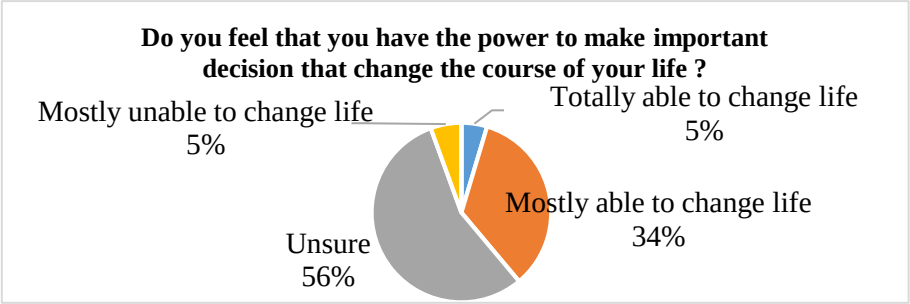
N=108

Figure 8. 37 People's perception of security in Dali Village



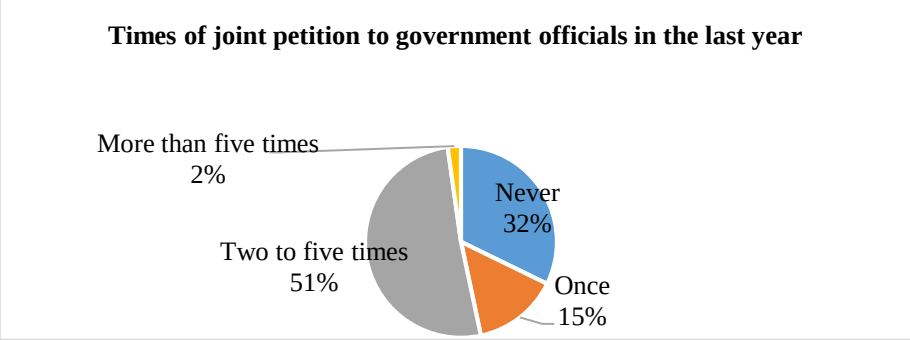
N=108

Figure 8. 38 People's perception of happiness in Dali Village



N=108

Figure 8. 39 People's perception of self-empowerment in Dali Village



N=90

Figure 8. 40 People's participation in joint petition in Dali Village

In order to explore household members' sense of personal efficacy, the respondent is asked that "do you feel that you have the power to make an important decision that changes the course of your life?". Rarely 5% of them believe that they are totally able to change their lives, and 34% consider that they are mostly able to change, while 5% feel that they are mostly unable to change their lives. However, 56% of them are unsure about their personal efficacy. (Figure 8.39).

In order to understand household members' sense of their capacities to influence local political events, this study investigated their political activities such as filing petitions and voting in elections. In Dali Village, though all the adult villagers vote in elections of the village committee, 32% of the respondents never participated a joint petition, 15% of them participated once, while 51% of them experienced two to five times, and even 2% of them participated more than five times (Figure 8.40).

In summary, the social capital in Dali Village is analyzed by groups and networks, trust and solidarity, collective action and cooperation, information and communication, social cohesion and inclusion, and empowerment and political action.

First, averagely 1.72 person per household belongs to a community group or informal groups in Dali Village. In addition, these groups are active and frequently have communication interacting with groups in other villages and even go upon the stage at the national level. Refers to the network, most of the local people have too many close friends, and most of them believe the usefulness of the network.

Second, Most of them generally trust people in their community and they believe that they can obtain help from their community. On another dimension, most of the local people trust in the government officials at both the central and local level. In addition, most of the local people are willing to contribute money and time to community projects.

Third, collective action and cooperation in Dali Village are obviously active. Most of the local people participated in collective action more than six times in the last year.

Fourth, various sources of information play important role in people's communication lives in Dali Village, such as community bulletin board, radio, relatives, friends and neighbors, village committee leaders, and Zhailao members. It represents very active community communication within Dali Village.

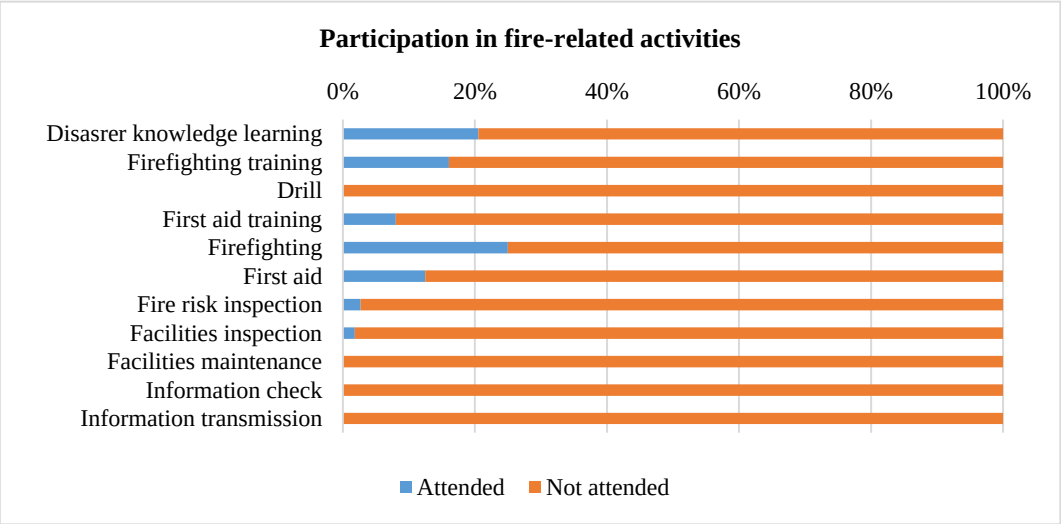
Fifth, the social cohesion in Dali Village tend to the features of low-inclusion, high-sociability, and no risk of conflict and violence. Low-inclusion is reflected by that two third of the respondents consider that to a great extent people are different in their community, while the most obvious are differences between younger and older generations and differences in wealth. However, these differences did not cause problems. In addition, high-sociability is reflected by that almost of the local people have ever had food or drinks with other villagers more than four times in the last month. Additionally, almost of the people feel safe from crime and violence when they are alone at home.

Sixth, empowerment and political action in Dali Village have features of low-level empowerment and active petition activity. Half of the local people feel happy to their general lives. However, less than half of them believe that they are able to change their lives. In addition, all the adult villagers vote in elections of the village committee, and most of them participated in a joint petition two to five times.

8.3.3 Community participation in disaster-related activities of Dali Village

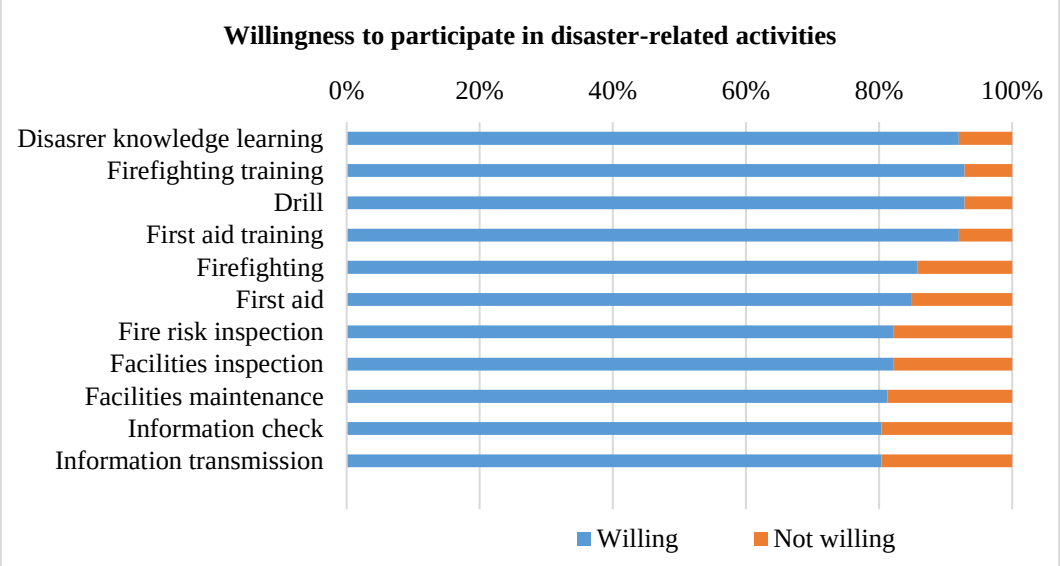
8.3.3.1 People's participation in disaster education and training

In Dali Village, most of the villagers were busy with their livelihoods and seldom participated in disaster-related activities (Figure 8.41). The participants are also confined to the village committee members and volunteer firefighter.



N=112

Figure 8. 41 People's participation in fire-related activities in Dali Village



N=112

Figure 8. 42 Willingness to participate in fire-related activities in Dali Village

8.3.3.2 People's participation willingness for disaster-related activities

The local people's attention to the disaster-related issues can represent their awareness (Wakabayashi, 1998), therefore, the extent that the local people are willing to participate in the disaster-related activities can reveal a community's potential responding ability. According to the analysis, actual participation and willingness to participate in fire-related activities show remarkable contrast. Most of the villagers were not actively involved (Figure 8.41) due to lack of access and due to their busy schedule with home affairs and farm work. On the other hand, considering the high fire risk of the whole village, most of the villagers are willing to enhance their ability and contribute to their community through a number of activities (Figure 8.42). It can be concluded that the Dali community possesses an ample potential ability for responding to a fire accident.

In summary, the community participation in disaster-related activities of Dali Village is analyzed by people's participation and their willingness for participation in disaster-related activities. Almost of the villagers are not involved in the disaster-related activities. However, almost of them are willing to enhance their ability and contribute to their community through a number of activities. It can be concluded that the Dali community possesses an ample potential ability for responding to disasters.

8.3.4 Sub-conclusion of the case study in Dali Village

The PCDCC in Dali Village is examined based on community asset, community connection, and community participation in disaster-related activities. The conclusions are as follows.

First, Dali Village is a consanguineous community that has active traditional community organizations or informal groups and therefore various group activities and community events. The community asset represents the leading role of the village committee and a subsidiary role of the traditional Zhailao group. The traditional Zhailao group and mutual-help custom are playing an important role during private events, while the village committee is taking a leading role in supporting the public events. Most of the private and public events involve collaboration.

Second, the community external connection in Dali Village represents the key role of the village committee between the local community and the local government. The community internal connection is reflected in active basic community activities and several traditional group activities. However, the local people are not involved in the activities regarding village governance and development. The social capital in Dali Village has features of active group activities and network, a great extent of trust in their community and government, frequent collective action and cooperation, various sources of information and communication within the community, and high sociability. On the other hand, even low-inclusion of people is a feature but almost never cause a problem. In addition, though the people in Dali Village lack of empowerment, but most of them are active in political action. All of these features show a potential basis for disaster coping at the community level.

Third, Dali community possesses an ample potential ability for responding to disasters, which can be seen from the remarkable contrast between the obviously limited participation and the very willingness for disaster-related activities.

8.4 Comparative analysis of the PCDCC between Shangli and Dali Village

8.4.1 Comparison of community asset

The community asset in two villages has the following common features and differences (Table 8.7). First, both of these two villages are a consanguineous community that with most of the villagers are permanent residents. Second, the governing body includes the governmental office at the local level and the village committee in Shangli Village, which are taking the leading role in the public event, lacking community

Table 8. 7 Comparison of community asset in Shangli and Dali Village

Case village	Permanent residents (%)	Organizations (Activity Frequency)			Community events (Leading role)		Community involvement
		Governance	Volunteer	Entertainment	Public	Private	
Shangli	Consanguineous 90%	2 Frequent	1 Frequent	2 Inactive	1 (Administration)	— (Family)	No
Dali	Consanguineous 100%	2 (Zhailao) Frequent	1 Frequent	3 Frequent	5 (Committee and Zhailao)	— (Zhailao and family)	Yes

Table 8. 8 Comparison of community groups and activities in Shangli and Dali Village

Case village	Density of group membership	Frequency of group activities			Participation rate of community activities		
		Governance	Volunteer	Entertainment	Ordinary*[1]	Others*[1]	Total
Shangli	0.23	Frequent	Frequent	Rarely	38.91%	2.67%	13.21%
Dali	1.72	Frequent	Frequent	Frequent	68.21%	16.56%	34.88%

*[1] The ordinary community activities refers to festival, wedding, funeral, and house construction activities, which supporting the basic functioning of a traditional community. Others refer to various additional activities of village affairs assistance, elder people group, women group, disaster risk reduction measures, anticrime, fire-prevention, living environment improvement, farming technique communication, village development, daily lives support, and condolences.

involvement. Comparatively, Dali Village, which is an ethnic minority group, has the active traditional governing body of Zhailao. It takes a subsidiary role to the village committee's governance during the public event that the community is involved. Third, Shangli Village has no active traditional community organization, therefore, inactive activities. Comparatively, Dali Village has various informal groups, therefore, various group activities and community events. Fourth, the family itself plays a leading role in the private event, which also presents traditional multi-help custom. Comparatively, the traditional Zhailao group and mutual-help custom are playing an important role during private events.

8.4.2 Comparison of community connection

The community connection in two case villages has the following common features and differences.

First, the groups and networks are analyzed by the density of group membership, people's participation in community activities, and the network's size and usefulness. Dali Village has a higher density of group membership and more frequent activities, as well as more frequent communication with the outside. In addition, people's participation in community activities is completely more active than Shangli village (Table 8.8). Accordingly, the size of the network in Dali tends to be larger than in Shangli, even though the usefulness of the work seems to have no difference between two villages.

Second, trust is analyzed by the generalized trust and multi-help among the community members, the trust in local and central government officials, and the reliable groups at an emergency situation. Both of the people in two villages generally trust in their community members, and they believe that they can obtain

help from their community. However, the local government officials are less trusted in than the central government officials among the people in Shangli Village, while the local people in Dali Village trust in the central and local government officials to the same extent. In addition, the solidarity is proved by the extent of people's willingness to contribute to the community project. Most of the people in both of the two villages are willing to contribute money and time to community projects.

Third, collective action and cooperation are analyzed by the extent of the collective action. The local people's involvement in collective action in Dali Village is obviously more active than in Shangli Village. It represents that community with a higher density of group memberships displays higher levels of collective action. On the other hand, the opportunity of collective action in Shangli Village has been reduced by the involvement of professional management companies.

Fourth, information and communication are analyzed by a list of sources of information, which reveals a great difference in the two villages. Television is the most important source of information about the government policies in Shangli Village, while various sources of information play important role in people's communication lives in Dali Village, such as community bulletin board, radio, relatives, friends and neighbors, village committee leaders, and Zhailao members. It can be seen that Dali Village has better access to information and communication because of active community communication.

Fifth, social cohesion and inclusion are analyzed by inclusion, sociability, and conflict and violence. Both of the two villages tend to be low-inclusion, people in Shangli Village mainly have the differences in education, perception between younger and older generations, and perception between long-term and recent residents. These differences often cause problems. In Dali Village, people mainly have the differences between younger and older generations and differences in wealth. However, these differences did not cause problems. In addition, the "sociability", which takes the form of visits to other people's homes or visits from others into one's own home. Visit among villagers are extremely frequent in Dali Village, which presents a higher sociability than Shangli Village. Additionally, both the two villages present a low risk of conflict and violence.

Sixth, empowerment, and political action are analyzed by the ability to make decisions that affect everyday activities and may change the course of one's life, and participation in petitions and vote in elections. People in Shangli Village appears less sense of happiness to their general lives than in Dali Village. However, they seem more confident in changing their lives than people in Dali Village. In addition, though all the people in both villages vote in elections of the village committee, people in Dali Village have more experience in joint petitions than in Shangli Village.

On the whole, the community connection in Shangli Village represents the features of inactive group activities, the limited scope of the network, few collective action, and cooperation, limited source of information and inactive communication within the community, low-inclusion of people even cause

problems, low-sociability, and lack of empowerment and political action. Oppositely, the community connection in Dali Village represents the features of active group activities and a larger network, a great extent of trust in their community and government, frequent collective action and cooperation, various sources of information and communication within the community, and high sociability. On the other hand, local people in Shangli Village generally trust and rely on their community members, and they are willing to contribute money and time to community projects. In addition, though the people in Dali Village lack of empowerment, but most of them are active in political action. All of these features show a potential basis for disaster coping at the community level in both of the two villages.

8.4.3 Comparison of community participation in disaster-related activities

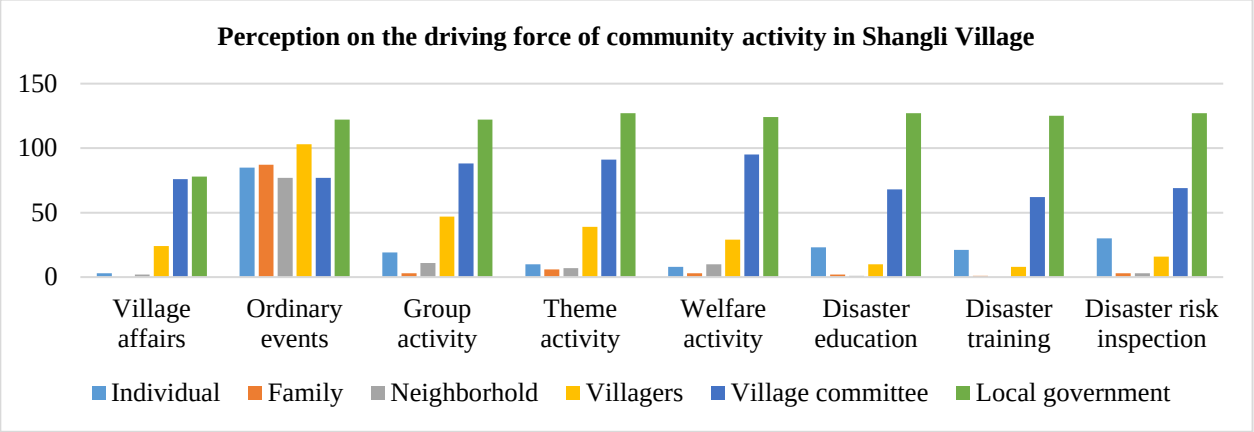
The community participation in disaster-related activities in two case villages represents completely similar features. Almost of the villagers in both villages are not involved in the disaster-related activities. However, almost of them are willing to enhance their ability and contribute to their community through a number of activities. It can be concluded that both of the villages possess an ample potential ability for responding to disasters.

8.4.4 Comparison of the PCDCC in Shangli and Dali Village

The most obvious differences between the PCDCC of Shangli and Dali Village could be seen as the activity of the community. Shangli Village appears the features of less community group and inactive community activities. Consequently, people in this community also tend to have a limited scope of the network, few collective action, and cooperation, limited source of information and inactive communication within the community, low-sociability. Oppositely, Dali Village represents the feature of various community groups and active group activities. Consequently, people in Dali community also have a larger network, frequent collective action, and cooperation, various sources of information and active communication within the community, and high sociability.

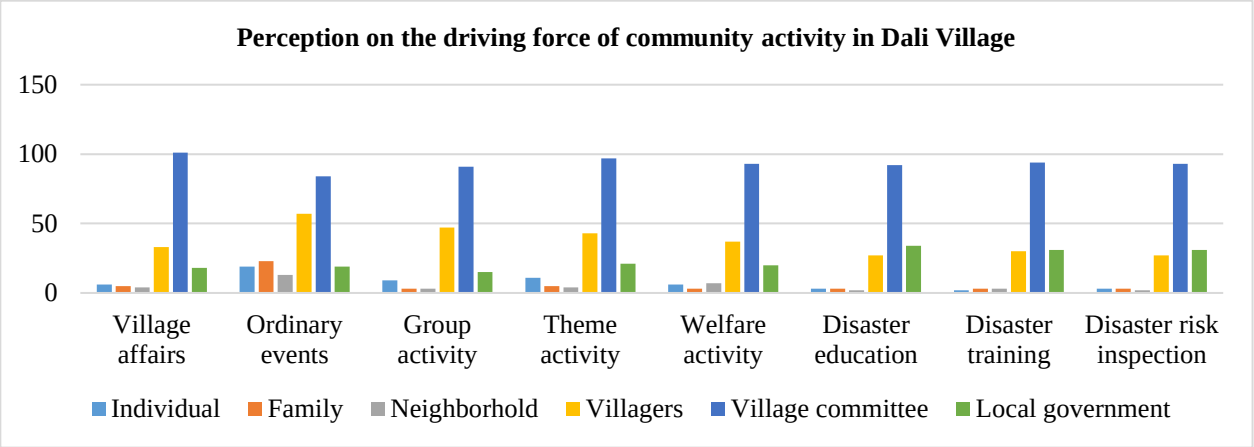
As the basis of the community, people's motivation greatly affects the development of community activities. Thus, this study investigated the local people's perception on the driving force of community activity in each case village. In Shangli Village, the result shows that local people obviously rely on the local government in terms of their own community activities. The village committee is less expected, which the other community members, which includes from individual to villagers are almost not expected (Figure 8.43). Comparatively, in Dali Village, the village committee and villagers are most expected to be the driving force of community activity according to the people's perception (Figure 8.44). It represents that the people in Dali Village have an active motivation to develop their own community by themselves.

This study defined PCDCC as an inherent potential capacity rooted in community cohesion that might empower the community cooperation for coping with disaster during an emergency. Therefore, according



N=133 Multichoice

Figure 8. 43 People's perception of the driving force of community activity in Shangli Village



N=108 Multichoice

Figure 8. 44 People's perception of the driving force of community activity in Dali Village

to the analyses stated above, it can be said that PCDCC in Dali Village is higher than in Shangli Village.

8.5 Conclusion of the chapter

In this chapter, Potential community disaster coping capacity (PCDCC) in Shangli and Dali Village are examined based on community asset, community connection, and community participation in disaster-related activities. The conclusions are as follows.

Shangli Village is a consanguineous community that has no active traditional community organization. The community asset represents the leading role of governing bodies during the public event, which lacks community and involvement, and the traditional multi-help and collaboration custom during a private event. Second, the community external connection in Shangli Village represents the key role of Shangli administrative office between the local community and the local government. The community internal connection is only reflected in activities of basic needs of a traditional consanguineous community since not only the inactive group activities but also local people are not involved in the activities regarding village

governance and development. The social capital in Shangli Village has features of inactive group activities, the limited scope of the network, few collective action, and cooperation, limited source of information and inactive communication within the community, low-inclusion of people even cause problems, low-sociability, and lack of empowerment and political action. On the other hand, local people generally trust other community members, and they are willing to contribute money and time to community projects. It also reflected by that most reliable groups of them during an emergency are their neighbors, family, and other villagers, which presents a potential basis for disaster coping at the community level. Third, Shangli community possesses an ample potential ability for responding to disasters, which can be seen from the remarkable contrast between the obviously limited participation and the very willingness for disaster-related activities.

Dali Village is a consanguineous community that has active traditional community organizations or informal groups and therefore various group activities and community events. The community asset represents the leading role of the village committee and a subsidiary role of the traditional Zhailao group. The traditional Zhailao group and mutual-help custom are playing an important role during private events, while the village committee is taking a leading role in supporting the public events. Most of the private and public events involve collaboration. Second, the community external connection in Dali Village represents the key role of the village committee between the local community and the local government. The community internal connection is reflected in active basic community activities and several traditional group activities. However, the local people are not involved in the activities regarding village governance and development. The social capital in Dali Village has features of active group activities and network, a great extent of trust in their community and government, frequent collective action and cooperation, various sources of information and communication within the community, and high sociability. On the other hand, even low-inclusion of people is a feature but almost never cause a problem. In addition, though the people in Dali Village lack of empowerment, but most of them are active in political action. All of these features show a potential basis for disaster coping at the community level. Third, Dali community possesses an ample potential ability for responding to disasters, which can be seen from the remarkable contrast between the obviously limited participation and the very willingness for disaster-related activities.

In summary, the PCDCC in two case villages has the following common feature and difference.

First, these two villages are a consanguineous community, meaning that most of the villagers are permanent residents. The governing body includes the governmental office at the local level and the village committee in Shangli Village, which are taking the leading role in the public event, lacking community involvement. Comparatively, Dali Village, which is an ethnic minority group, has the active traditional governing body of Zhailao. It takes a subsidiary role to the village committee's governance during the public event that the community is involved. In addition, Shangli Village has no active traditional community organization, therefore, there are few or no activities. Comparatively, Dali Village has various informal

groups, therefore, there are various group activities and community events. During the private events, the mutual-help custom could be seen in both villages. The family itself plays a leading role in Shangli Village, while the traditional Zhailao group plays an important role in Dali Village.

Second, the community connection in Shangli Village represents the features of inactive group activities, the limited scope of the network, few collective action and cooperation, limited source of information and inactive communication within the community, low-inclusion of people which even cause problems, low-sociability, and lack of empowerment and political action. Oppositely, the community connection in Dali Village represents the features of active group activities and a larger network, a great extent of trust in their community and government, frequent collective action and cooperation, various sources of information and communication within the community, and high sociability. On the other hand, local people in Shangli Village generally trust and rely on their community members, who are willing to contribute money and time to community projects. In addition, though the people in Dali Village lack empowerment, most of them are active in political action. All of these features show a potential basis for disaster coping at the community level in both of the two villages.

Third, the community participation in disaster-related activities in two case villages represents completely similar features. Most of the villagers in both villages are not involved in disaster-related activities. However, most of them are willing to enhance their ability and contribute to their community through a number of activities. It can be concluded that both of the villages possess an ample potential ability for responding to disasters.

On the whole, benefitting from various community groups and active group activities in Dali Village, the people there have a larger network, frequent collective action, and cooperation, various sources of information and active communication within the community, and high sociability. Consequently, they also have an active motivation to develop their own community by themselves. PCDCC in Dali Village is higher than in Shangli Village.

CHAPTER 9. CONCLUSION AND RECOMMENDATION

This chapter summarizes all the findings of each chapter. In particular, a summary of the common features and differences of community disaster coping capacity (CDCC) in two case historical villages are presented. Based on the findings, this chapter provides recommendations for establishing specific measures of CDCC enhancement in historical villages.

9.1 Summary of research findings

This doctoral thesis analyzed and clarified the features of the current status of community disaster coping capacity (CDCC) in historical villages in mountainous Southwest China with two cases, in order to contribute to developing specifically targeted measures for CDCC enhancement. The two case historical villages are Shangli Village, which is a Han ethnic village in Sichuan Province, and Dali Village, which is a typical Dong ethnic minority village. First, this study focused on the local people's disaster-resistant building improvement response and explored the impediments that affected their activities in these two villages, since the residential buildings in rural areas are the major risk-bearing bodies. Second, this study investigated the current status of CDCC in these two villages based on the proposed CDCC framework and clarified the common features and differences of CDCC between these two case villages. The findings based on analyses in previous chapters are summarized and these form the rationale behind the recommendations for the CDCC enhancement in historical villages in mountainous Southwest China in the present context, which will be mentioned in this chapter.

Chapter 1 and 2

In Southwest China dwell most of the ethnic minorities population in China. Various ethnic minorities population in Southwest China have preserved colorful cultural landscape of traditional human settlements, which account for approximately half of the Chinese Traditional Villages in the whole country. However, China is one of the countries that are most prone to natural disasters in the world. In particular, the mountainous Southwest China is frequently affected by serious geological disasters and fires. Moreover, the multi-hazard risk and vulnerability extremely threaten the safety of rural areas in Southwest China where a major portion of buildings are with poor disaster-resistance due to problematic design and construction. Therefore, comprehensive conservation approach for these historical villages in the rural mountainous area in Southwest China, which could take into account the multi-hazard risk reduction, is urgently needed.

The institutional system of disaster risk management in China has been basically shaped in the early 2000s and has three features. First, China does not have a very specific disaster risk management ministry at the national level. The organizational system of disaster risk management tends to be a mixed system, which is a vertical hierarchy in normal times of disaster risk management, and a horizontal hierarchy in

disaster relief during an emergency. Therefore, the disaster risk reduction measures at the national level usually lack integration. Second, a basic act, which can standardize the activities covering the whole cycle of disaster mitigation, disaster preparedness, disaster response, and disaster recovery is missing at the national level. Consequently, the current disaster risk management plans and measures are without a comprehensive perspective, focusing mainly on emergency response, paying less attention to long-term disaster mitigation. Moreover, disaster mitigation strategies at present are running at the structural solution-dominated stage, with the non-structural solution lagging behind but increasingly being emphasized. Third, the institutional gap of disaster risk management between urban and rural areas is also presented. Existing disaster-related laws and regulations in China mainly focus on urban areas. Few special provisions are made targeting rural areas. Since there is no complete and in-depth disaster mitigation planning system in urban and rural planning, rural areas lack practicable construction standards for disaster mitigation. Therefore, the rural areas not only have structural vulnerability of undeveloped infrastructure and buildings with insufficient disaster-resistance but also non-structural vulnerability of institutional ignorance. Additionally, the community-based disaster mitigation is being increasingly emphasized in China. However, it is far from well-developed, particularly in the case of rural areas.

On the whole, numerous historical villages in the remote mountainous areas of Southwest China have a particularly high risk of multi-hazard. It is necessary for local communities of these villages to protect not only their people but also cultural heritages by themselves. However, they are under an unbalanced and undeveloped institutional background of disaster risk management. Therefore, to analyze and clarify the current status of community disaster coping capacity (CDCC) of these historical villages is essential and significant for developing specific measures for these historical villages' safety and conservation.

Chapter 3

This chapter focused on the people's building repair and retrofit activities in Shangli Village and identified the factors that hamper the people's disaster-resistance improvement response.

The people's repair activities were inactive and incomplete, though they are unsatisfied with their buildings' limited disaster-resistance after experiencing the earthquakes and floods in recent years. In particular, the older buildings built before 1981, the traditional wooden and wooden-brick buildings, and the severely damaged buildings were repaired less. In addition, their disaster-resistant retrofit activities have not really been taken seriously yet. The actual factors to the people's limited repair and retrofit activities could be attributed to limited access to building technology, administrative licensing problem and impediments on decision-making due to property right subdivision.

First, most of the local people have never received any technical support since there is no effective mechanism for giving local people access to technical support from professionals or institutes. Second, the complicated procedures of application for building permit resulted in many owners leaving their buildings

without repair and retrofit. In particular, the repair activities on the buildings built before 1981 were particularly impeded by the administrative licensing problem. Third, the property rights subdivisions have really impeded the decision-making for repair and retrofit. However, the reason from the perspective of local people, insufficient financial capacity, could not be considered as an actual impediment, given the economic situation of local people and the subsidy payments. It appears that the real reason behind the insufficient financial capacity was the lack of supervision of the subsidy usage.

Chapter 4

This chapter investigated the local government and the people's building improvement responses to multi-hazard risk in Dali Village and identified the factors that hamper the people's activities.

The local government's building improvement response has two features. First, the fire risk is the main concern of the regulations and programs at both the national and the provincial levels. The technical guidelines on fire-resistant building improvement at both the national and the provincial levels suggest that the local people should use non-combustible materials or fire-retardant materials when renewing the wooden buildings, but the methods for improving the fire resistance of a large number of existing wooden buildings remain unclear. Second, a consideration of changing family size was missing during the local government's two disaster-resistance improvement programs. Ground oven transformation and aged electrical wiring replacement, which have been completed in Dali Village, have effectively reduced the fire risk according to the villagers' perceptions. Yet, ground ovens are still being used, since the transformed brick oven is too big for most families' needs as the young members usually move out of the village for work. One-third of the brick oven are still surrounded by highly flammable wooden walls. Third, a gap has been observed between the disaster-resistance improvement and the cultural heritage conservation of a historical village. The Dali Village conservation plan, which is still in the process of being developed, proposes measures targeting multi-hazard risk but only focuses on heritage buildings. The conservation projects that have been completed focused on heritage restoration and with no disaster-resistant building improvement activity conducted.

The local people's fire-resistant building improvement activities tended to be limited and not executed properly without detailed technical rules and guidelines. Insufficient financial capacity, limited access to disaster-resistant building technology, lack of flatland resource, and restrictions on heritages' improvement are the main factors that hampered people's activities. First, nearly one-third of the investigated households replaced the first storey of wooden buildings with brick or concrete to reduce fire risk. However, all of the non-transformed buildings and the upper storey of the transformed buildings still retain wooden facades without a fire-resistant coating. These transformations can be considered to enhance fire-resistance to some extent while simultaneously dramatically affecting the buildings' original architectural characteristics. Insufficient financial capacity and limited access to fire-resistant building technology have affected the people's activities. Second, the majority of the 39 affected households did not respond to landslide risk due to insufficient financial capacity and the lack of flatland resource. Third, of the 64 flood-inundated buildings

along the riverbank, a half have been elevated or raised on stilts and another half have no countermeasures. Of the 29 buildings without countermeasures, 14 owners did not consider it necessary to protect their buildings against flood risk and 13 owners attributed to insufficient financial capacity. In addition, the other two buildings are heritage buildings, whose conservation issues are entirely managed by the government, resulting in the imposition of restrictions on the owners' activities that may lead to alteration of the heritage.

Chapter 5

This chapter explained the definition of community disaster coping capacity (CDCC) in this study and proposed a CDCC assessment framework for the case studies in two historical villages. In this study, CDCC is analyzed in terms of three components: individual disaster coping capacity (IDCC), actual community disaster coping capacity (ACDCC), and potential community disaster coping capacity (PCDCC).

IDCC is defined as the individuals' comprehensive capacity of coping with disaster. It can be examined based on risk awareness, disaster preparedness, and potential responding ability of individuals. ACDCC is defined as the visible capacity represented by actual community disaster risk reduction measures. It can be examined based on disaster risk reduction planning, community disaster mitigation organization, and disaster mitigation measures. PCDCC is defined as the inherent potential capacity rooted in community cohesion that might empower the community cooperation for coping with disaster during an emergency. It can be examined based on community asset, community connection, and community participation in disaster-related activities.

Chapter 6

This chapter examined the individual disaster coping capacity (IDCC) in Shangli Village and Dali Village by the components of individuals' risk awareness, disaster preparedness, and potential responding ability. Based on the comparative study, the common features and differences of IDCC between two case villages are clarified.

First, the local people' individual disaster coping capacity in both villages represent a gap between high disaster awareness and poor preparedness and limited potential responding ability. Second, the local people in both of the two case villages tend to have a high-risk awareness, which is based on the fresh memory of disaster experience in Shangli Village and based on clear understanding of hazard in Dali Village. Third, the local people's disaster preparedness in both villages is limited. The limited disaster-resistant building improvement activity in Shangli Village is mainly due to limited access to building technology, administrative licensing problem, and impediments on decision-making due to property right subdivision. In Dali Village, it is due to insufficient financial capacity and limited access to fire-resistant building technology. It can be seen that limited access to disaster-resistant building technology is a common impediment. Lack of clear guidelines and technical support at the local level leads to not only limitation of disaster-resistant improvement of the traditional buildings in these historical villages but also the difficulty

of developing rational and effective strategies for better disaster-resistance of the traditional buildings and historical villages. In addition, local people's other disaster preparedness seems active in both villages. Fourth, the local people's potential responding ability in both Shangli Village and Dali Village tend to be limited and have dissimilar features. The local people in Shangli Village are skilled in the location and usage of emergency facilities, but their emergency action is based on intuition and experience. In Dali Village, though people are familiar with the emergency action of an accidental fire, they lack the knowledge of modern firefighting facilities usage. Both of the situation reflects the lack of disaster education and training.

Chapter 7

This chapter examined the actual community disaster coping capacity (ACDCC) in Shangli Village and Dali Village through the components of community disaster mitigation organization, disaster risk reduction plans, and disaster mitigation measures. Based on the comparative study, the common features and differences of ACDCC between two case villages are clarified.

First, both of the two villages have established a volunteer firefighting troop. Their disaster risk reduction activities focus on fire risk only at the present stage that is managed by the local administration according to the local government officials' arrangement, while the volunteer firefighting troops play the role of the main implementer. However, the development of the volunteer firefighting troops in the two villages face problems. Members' lack of motivation and insufficient membership hamper the troop's development in Shangli Village. In Dali Village, members have high motivation, but the troop's development is hampered by unstable and aging membership and insufficient financial support. In addition, whole community involvement in activities and professionalization of the volunteers are obviously important for both of the two villages.

Second, the pre-disaster risk reduction plans and measures in both of the two villages focus on fire risk only and represent the dominant role of the local government or local administrative office and the lack of community involvement. For instance, disaster education in both of the two villages is seldom held and the participants are always village committee members and volunteer firefighters. In addition, these two villages have different emphases on pre-disaster risk reduction plans and measures. Dali Village pays more attention to buildings' fire safety. In addition, the scheduled night patrol in Dali Village plays an important role in fire prevention. However, the night patrol seems difficult to continue because of no successor due to lack of a sustainable mechanism for personnel training.

Third, the disaster response system of both two villages targets fire risk only and has been largely strengthened through the firefighting facilities and equipment and technical training support provided by the local government. Though the two villages are equipped with various emergency facilities, the lack of alarm and transmission system and the current facilities' inadequate protection scope and poor availability may hamper the emergency response. The insufficient water resource and facilities' maintenance are a common

problem for these historical villages in the remote mountainous areas. In addition, the disaster training activities in two villages are usually confined to the village committee members and volunteer firefighters. The untrained villagers may hamper the emergency response in these villages.

Fourth, the two case villages are not yet concerned with damage control and evacuation plan and measures. Shangli Village has developed a general plan for evacuation site and route but without substantive progress for the time being. Dali Village has the plan to promote the program of making firebreak to reduce fire spread risk. However, paying careful attention to not only fire risk reduction but also to original cultural landscape conservation, the installation of firebreaks is still under discussion.

On the whole, the ACDCC of these two villages represents five obvious features: lack of systematic and integrated plan caused insufficient disaster risk reduction measures; the dominant role of local government or local administrative office and the lack of community involvement; the target of fire risk and ignorance of other risks such as the earthquake in Shangli Village; disaster risk reduction measures laying particular stress on disaster response during emergencies, far more than pre-disaster mitigation; and lack of technical support for the better disaster-resistance of historical villages, while considering the conservation.

Chapter 8

This chapter examined the potential community disaster coping capacity (PCDCC) in Shangli Village and Dali Village through the components of community asset, community connection, and community participation in disaster-related activities. Based on the comparative study, the common features and differences of PCDCC between two case villages are clarified.

First, these two villages are a consanguineous community, meaning that most of the villagers are permanent residents. The governing body includes the governmental office at the local level and the village committee in Shangli Village, which are taking the leading role in the public event, lacking community involvement. Comparatively, Dali Village, which is an ethnic minority group, has the active traditional governing body of Zhailao. It takes a subsidiary role to the village committee's governance during the public event that the community is involved. In addition, Shangli Village has no active traditional community organization, therefore, there are few or no activities. Comparatively, Dali Village has various informal groups, therefore, there are various group activities and community events. During the private events, the mutual-help custom could be seen in both villages. The family itself plays a leading role in Shangli Village, while the traditional Zhailao group plays an important role in Dali Village.

Second, the community connection in Shangli Village represents the features of inactive group activities, the limited scope of the network, few collective action and cooperation, limited source of information and inactive communication within the community, low-inclusion of people which even cause problems, low-sociability, and lack of empowerment and political action. Oppositely, the community connection in Dali Village represents the features of active group activities and a larger network, a great extent of trust in their

community and government, frequent collective action and cooperation, various sources of information and communication within the community, and high sociability. On the other hand, local people in Shangli Village generally trust and rely on their community members, who are willing to contribute money and time to community projects. In addition, though the people in Dali Village lack empowerment, most of them are active in political action. All of these features show a potential basis for disaster coping at the community level in both of the two villages.

Third, the community participation in disaster-related activities in two case villages represents completely similar features. Most of the villagers in both villages are not involved in disaster-related activities. However, most of them are willing to enhance their ability and contribute to their community through a number of activities. It can be concluded that both of the villages possess an ample potential ability for responding to disasters.

On the whole, benefitting from various community groups and active group activities in Dali Village, the people there have a larger network, frequent collective action, and cooperation, various sources of information and active communication within the community, and high sociability. Consequently, they also have an active motivation to develop their own community by themselves. PCDCC in Dali Village is higher than in Shangli Village.

9.2 Recommendation for the CDCC enhancement in historical villages

A historical village is a particular type of cultural heritage, in which the local community co-exists with the surrounding natural environment while preserving their culture. Its conservation needs to focus attention on the subsistence, originality, and integrity of the whole community. Generally speaking, governments at the national, provincial, and local level should introduce a specialized conservation system with institutional, financial, and technical regulations. These regulations should fully address multi-hazard risk, instead of only tackling the major risk, and must also make provision for the whole community, instead of only focusing on the heritage building conservation. Of course, decision-making on the investment and distribution of resources could be arranged according to a priority classification.

Based on the research findings, this study proposes the following detailed recommendations for CDCC enhancement of historical villages in Southwest China in the context of cultural heritage. Since the residential buildings in rural areas are the major risk-bearing bodies, the recommendations for disaster-resistant building improvement are separately described before the recommendations for IDCC, ACDCC, and PCDCC enhancement.

9.2.1 Promoting local people's disaster-resistant building improvement in historical villages

To promote the disaster-resistant building improvement in historical villages, this study strongly advocates

a multi-hazard risk targeted policy, detailed regulation at the local level, development of new materials and technology targeting historical buildings and villages, multiple channels of financial support, and a technical support platform for historical villages. Specifically speaking, recommendations for the governments and local communities are as follows.

First, it is necessary to specialize the process of construction license application for disaster-resistance improvement and provide comprehensive institutional reward and support to encourage people's building improvement activity. In particular, it is necessary to prepare a simplified licensing operation plan for repair and retrofit works after a disaster emergency.

Second, regarding the local people's difficulty of insufficient financial capacity, the availability of various forms of financial support is essential to break a vicious cycle of "low resistance-disaster-damage-insufficient financial capacity-limited response-low resistance". In order to share the risk that people are bearing, various risk sharing partners need to be involved, for instance, disaster insurance. The whole community needs to engage in insuring the buildings to thereby share the multi-hazard risk facing the whole village. In addition, low-interest or interest-free loans and subsidies should be provided to local people to motivate them to engage in effective disaster-resistant improvement activities. Moreover, the insurance rate and the proportion of subsidies can be linked to the building's safety condition and the real situation of household's financial capacity. In addition, the usage of the subsidy should be strictly supervised for effective implementation of the disaster-resistant building improvement.

Thirdly, regarding the local people's difficulty of limited access to building technology, a technical support platform for historical villages should be established in cooperation with local agencies, professionals, institutes, social organizations, and volunteers to enable local people to have an easy access to technical support. Based on this platform, various resources could fully play their role and can be effectively used through flexible combination and cooperation. For instance, in a certain historical village, which needs detailed and specifically targeted technical guidelines, a sensible practical approach is supposed to involve social organizations and certified volunteers in providing long-term professional technical support within this community, in developing targeted strategies, and in guiding the whole process of implementation. In addition, the government should encourage the development of materials and technology targeting disaster-resistant improvement of the historical buildings and historical villages. It could be also integrated into the technical support platform, by which, the integration of various resources is conducive to the direct application of research results.

Additionally, with these supports from government and various organizations, the local community should create a database of historical buildings and continually update it in order to grasp their safety and conservation condition. The database can be used as evidence for various risk sharing partners to conduct appropriate conservation assistance and to determine the insurance rate or subsidy proportion. In addition, historical buildings, which are registered as cultural heritage, are worth a priority in all the recommended

measures stated above. Their safety and conservation should be given the highest priority.

9.2.2 Enhancing the IDCC in historical villages

To enhance the IDCC in historical villages, this study strongly suggests a local community-based education and training system and a leading role for schools in the disaster education and training events within communities. Specifically speaking, recommendations for the governments and local communities are as follows.

First, it is necessary for the local government to support the local community to develop a school-led disaster education and training system to improve people's inactive participation in disaster education and training activities. The present government-led activities have made little progress in disaster education among adults because most of the villagers are busy with their livelihoods and seldom participated in the education lecture. Nevertheless, the disaster education among students is greatly enhanced in school since the local governments are required to include disaster education into the curriculum system according to the national regulation after the Wenchuan earthquake. Thus, this study strongly suggests a new approach through which the disaster education and training in school could be transferred between children and their family members and even neighbors in a variety of flexible ways. For instance, social practice homework for students or community game which involves child-family-neighborhoods with the theme of disaster education and training.

Second, it is necessary for the local communities to adjust the emphasis of education and training activities according to their specific shortcomings. For instance, regarding the local people's limited potential responding ability in both Shangli village and Dali Village, training on the emergency action in Shangli Village and training on modern firefighting facilities usage in Dali Village should be emphasized. The local people in Shangli Village are skilled in the location and usage of emergency facilities, but their emergency action is based on intuition and experience. In Dali Village, though people are familiar with the emergency action of an accidental fire, they lack the knowledge of how to use modern firefighting facilities.

9.2.3 Enhancing the ACDCC in historical villages

To enhance the ACDCC in historical villages, this study strongly recommends a systematic and integrated plan for each historical village. Specifically speaking, recommendations for the governments and local communities are as follows.

First, the most important recommendation to local government is to establish a systematic and integrated plan for disaster risk reduction in every historical village adapting to their own conditions. The most obvious feature of the ACDCC in these two villages is the lack of a systematic and integrated plan, which caused

insufficient disaster risk reduction measures. The plan should cover all stages of disaster risk management, comparing to the current measures that lay stress on disaster response during emergencies, far more than on pre-disaster mitigation. Further, the disaster risk reduction activities of these villages focus on fire risk only at the present stage. The target scope of disaster risk management should be widened to all the multi-hazard risks in each village in the next step.

Second, the key recommendation to the local communities is to improve the availability of infrastructure and facilities. Though the two villages are equipped with various emergency facilities, the lack of alarm and transmission system and the current facilities' inadequate protection scope and poor availability are common problems for these historical villages in the remote mountainous areas, which may hamper the emergency response. In particular, the poor condition of infrastructure such as insufficient water resource for firefighting remarkably threatens the safety of Dali Village. All of these problems need improvement, which must be strongly financially supported by the government. In addition, the facilities' maintenance in historical villages should be emphasized because the bad maintenance condition of facilities is the main reason of their poor availability. Therefore, community involvement and professional technical guidance should be integrated to improve this situation.

Third, it is also remarkably important for the local communities to develop the professionalism and community involvement of volunteer firefighting troops in both two villages. Since their disaster risk reduction activities focus on fire risk only at the present stage and few volunteer firefighters in both villages can do the first aid, professionalization is obviously important for the volunteer firefighting troops' development. In addition, the volunteer firefighting troops in both villages face the problem of unstable membership. Members' lack of motivation hampers the troop's development in Shangli Village. In Dali Village, though members have high motivation, the unstable and aging membership are still problems. Therefore, it is necessary to motivate the community involvement for the volunteer firefighting troops' development since it could not only motivate the villagers' ability but also be conducive to the personnel training and supplement.

Fourth, this study provides different recommendations to the local communities of two case villages for the damage control and evacuation plan and measures. Shangli Village has developed a general plan for evacuation site and route but without substantive progress for the time being. In addition, the village should inform the arrangement on evacuation site and route to the villagers by means of disaster training or the disaster imagination game (DIG). Dali Village has the plan to promote the program of making firebreak to reduce fire spread risk. However, paying careful attention to not only fire risk reduction but also to original cultural landscape conservation, the installation of firebreaks is still under discussion. Therefore, the technical support platform stated above could help to develop detailed and specifically targeted technical guidelines, while providing long-term professional technical support within the community and guiding the whole process of implementation.

9.2.4 Enhancing the PCDCC in historical villages

Benefitting from various community groups and active group activities in Dali Village, the people there have a larger network, frequent collective action and cooperation, various sources of information and active communication within the community, and high sociability. Consequently, they also have an active motivation to develop their own community by themselves. PCDCC in Dali Village is higher than in Shangli Village. Comparatively, Shangli Village has inactive group activities, people have a limited scope of the network, few collective action and cooperation, limited source of information and inactive communication within the community, low-sociability, and lack of empowerment and political action. Therefore, it can be seen that various community groups and active group activities are the key issues for higher PCDCC.

To enhance the PCDCC in historical villages, this study strongly suggests various community groups and activities' organization in historical villages. Specifically speaking, recommendation for the governments is to provide institutional and financial support to encourage the local communities' groups and activities. On the other hand, recommendation for the local communities is to revive and promote the foundation of various community groups and develop active group activities, which could involve more villagers to improve the community connection and to enhance the PCDCC. Additionally, the village committee and the volunteer firefighting troop are supposed to take the leading roles in community activities. Simultaneously, the involvement of traditional organizations and villagers in the decision-making process should be encouraged.

9.3 Recommendation for future research

This study proposed a qualitative and quantitative assessment framework that targets the community itself, which is supposed to be flexibly used for different communities under various social and organizational situations. In this framework, the community disaster coping capacity (CDCC) is explained by individual disaster coping capacity (IDCC), actual community disaster coping capacity (ACDCC), and potential community disaster coping capacity (PCDCC). It was applied to identify the features of CDCC in two case historical villages in Southwest China. Based on the qualitative and quantitative assessment, this study gave several recommendations at the qualitative level, which can be a useful reference not only for policy-making and local practice but also for further and more detailed research in CDCC of historical villages.

However, this research has several limitations. First, though this study emphasized multi-hazard risk in historical villages, as a primary attempt to evaluate disaster coping capacity at the community level, this study merely developed a CDCC assessment framework which targeting only a major hazard in a certain village. For the future study, this methodology could be developed as a comprehensive CDCC assessment system with a series of frameworks targeting various hazards and their interactions. Second, though this study contains a comparative section between two case villages, the comparison is mainly based on a qualitative approach, with only a few of components are quantitatively evaluated. Thus, the comparative results could represent a few of different features at a qualitative level, which cannot support further studies

in terms of wide comparisons. Therefore, for the future study, this methodology of CDCC assessment framework could be developed as a quantitative from the academic viewpoint. In the case of practical concern, it is also necessary to establish practicable CDCC enhancement plans for historical villages based on a quantitative assessment. Third, the CDCC assessment framework, which was developed based on the literature review and was adapted to the condition of only two case villages, could not be seen as an universal CDCC assessment framework for a historical village in anywhere. For the future study, it should be adjusted according to the real conditions of the targeted villages.

To end this chapter, the author hopes the research result can contribute to the community disaster coping capacity enhancement and further conservation of historical villages in the remote mountainous areas in the context of cultural heritage at the present stage.

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APPENDICES

Appendix 1: Questionnaires in Shangli Village

Appendix 2: Summary of structured interviews in Shangli Village

Appendix 3: Structured interviews in Dali Village

Appendix 4: General information of 27 surveyed traditional residential buildings in Dali Village

APPENDIX 1: QUESTIONNAIRES IN SHANGLI VILLAGE

QUESTIONNAIRE 1 (For Shangli villager – Living environment and disaster experience)

The main purpose of the questionnaire is to investigate the people's disaster experience and their perception on living environment in Shangli Village. In addition, a pre-survey on disaster awareness and disaster activities are also implemented.

1. GENERAL INFORMATION

1.1 Age……1.2 Sex……..……1.3 Occupation…….

1.4 Education……1.5 Household population……1.6 Duration of residence…….

2. PERCEPTION ON LIVING ENVIRONMENT

Type	Content	Very satisfied	Satisfied	Common	Unsatisfied	Very satisfied	Unsure
Spiritual	Culture						
	Identity						
Natural	Natural environment						
Infrastructure	Water supply						
	Sewerage						
	Road						
	Manure management						
	Garbage management						
Facility	Street						
	Play ground						
	Meeting						
	Disaster facility						
	Welfare						
	Communication facilities						
Building	Appearance						
	Area						
	Sunshine						
	Ventilation						
	Earthquake-resistance						
	Flood-resistance						
	Fire-resistance						
	Style and features						
Safety	Disaster countermeasure						
	Anti-crime measure						
	Risk						
	Noise						
	sanitation						
Daily life	Family life						
	Neighbors communication						
	Neighborhood mutual-help						

3. DISASTER EXPERIENCE

3.1 Do you have disaster knowledge before and after Lushan Earthquake happened ?

☐I know very well ……..☐ I know a little…...☐ I don't know ……..……

3.2 What emergency measures did you prepare before and after Lushan Earthquake happened ?

☐Prepared emergency food and water…...… ☐Packaged the important goods for emgency evacuation….

☐Checked safe place for emgency evacuation..☐Discussed an emgency contact with family……...

☐Joined the disaster insurance……..☐Prepared emergency tools……..…….

☐Joined disaster training ……..☐Others……..

3.3 What did you do when Lushan Earthquake happened ?

☐Hid under a table or near a column …… ☐Open the window or door …… ☐Hold the furniture……..

☐Help the weak……. ☐ Stand to prevent failling.……. ☐ Cut off the power……..

☐Fly outdoors…… ☐ I did nothing…… ☐ Others……...

3.4 Why did you do that ?

☐Taught by…….before…… ☐Follow others ……... ☐ Personal experience…..

☐Intuition……..…… ☐Others……...……..…….

3.5 Who do you think is reliable during the emergency rescue after Lushan Earthquake?

☐Family……...…. ☐ Neighbors……☐Villagers…….. ☐Village committee and leaders……..

☐Police……...….. ☐ Firefighting agency… ☐ Army……... ☐ Local governmen……...…….....

☐Family……...…. ☐ Neighbors……☐Villagers…….. ☐Village committee and leaders……..

☐Social organization and volunteers…….. ☐ Doctor……. ☐ Others…….....……

3.6 To what extent do the disaster experiences have a influence on your life in the future ?

☐To a very great extent, I will prepare to avoid loss…. ☐To a great extent, It may be help next time…..…

☐To a small extent, I will not care …… ☐To a very small extent, I will forget it soon…… ☐ Unsure...

4. DISASTER AWARENESS

4.1 Do you know that Sichuan is a earthquake-prone region before Wenchuan Earthquake?

☐Yes, I know…...…. ☐ I know a little….…… ☐No, I don't know……..……☐ Unsure……..

4.2 To what extent does a large earthquake (>M 6.0) may happen in your region in the future 10 years ?

☐Definitely…….…… ☐ May …… ☐ May not……. ☐ Definitely not……☐Unsure

4.3 To what extent does you building be affected by a possible large earthquake (>M 6.0) ?

☐Definitely…….…… ☐ May …… ☐ May not……. ☐ Definitely not……☐Unsure

4.4 Do you clearly know the safe place for emergency evacuation when a earthquake happens ?

☐I clealy know…..…..… ☐I know ……..… ☐ I know but not clearly… ☐ I don' t know… ☐ Unsure

4.5 To what extent do the village's disaster risk reduction measures are sufficient ?

☐To a very great extent ☐To a great extent ☐To a small extent ☐To a very small extent ☐Unsure

5. DISASTER AWARENESS

5.1 How many times do your join in the public activity such as a festival ceremony every year ?.....

5.2 How many times do your join in disaster education activity every year?.....

5.3 How many times do your join in disaster training activity every year ?.....

Brief result of the questionnaire 1

(For Shangli villager – Living environment and disaster experience)

1. GENERAL INFORMATION

1.1 Age

	Number	Percentage
20-29	6	4.2
30-39	29	20.3
40-49	47	32.9
50-59	34	23.8
60-69	17	11.9
>69	10	7.0
Total	143	100.0
No data	73	-
Total	216	-

1.2 Sex

	Number	Percentage
Male	89	73.6
Female	32	26.4
Total	121	100.0
No data	95	-
Total	216	-

1.3 Occupation

	Number	Percentage
Agriculture	85	63.0
Self-employed	27	20.0
Migrant labors	10	7.4
Civil servant	2	1.5
Freelance	8	5.9
Others	3	2.2
Total	135	100.0
No data	81	-
Total	216	-

1.4 Education

	Number	Percentage
No	2	1.5
Primary school	45	32.8
Junior high school	70	51.1
Senior high school	16	11.7
College and above	4	2.9
Total	137	100.0
No data	79	-
Total	216	-

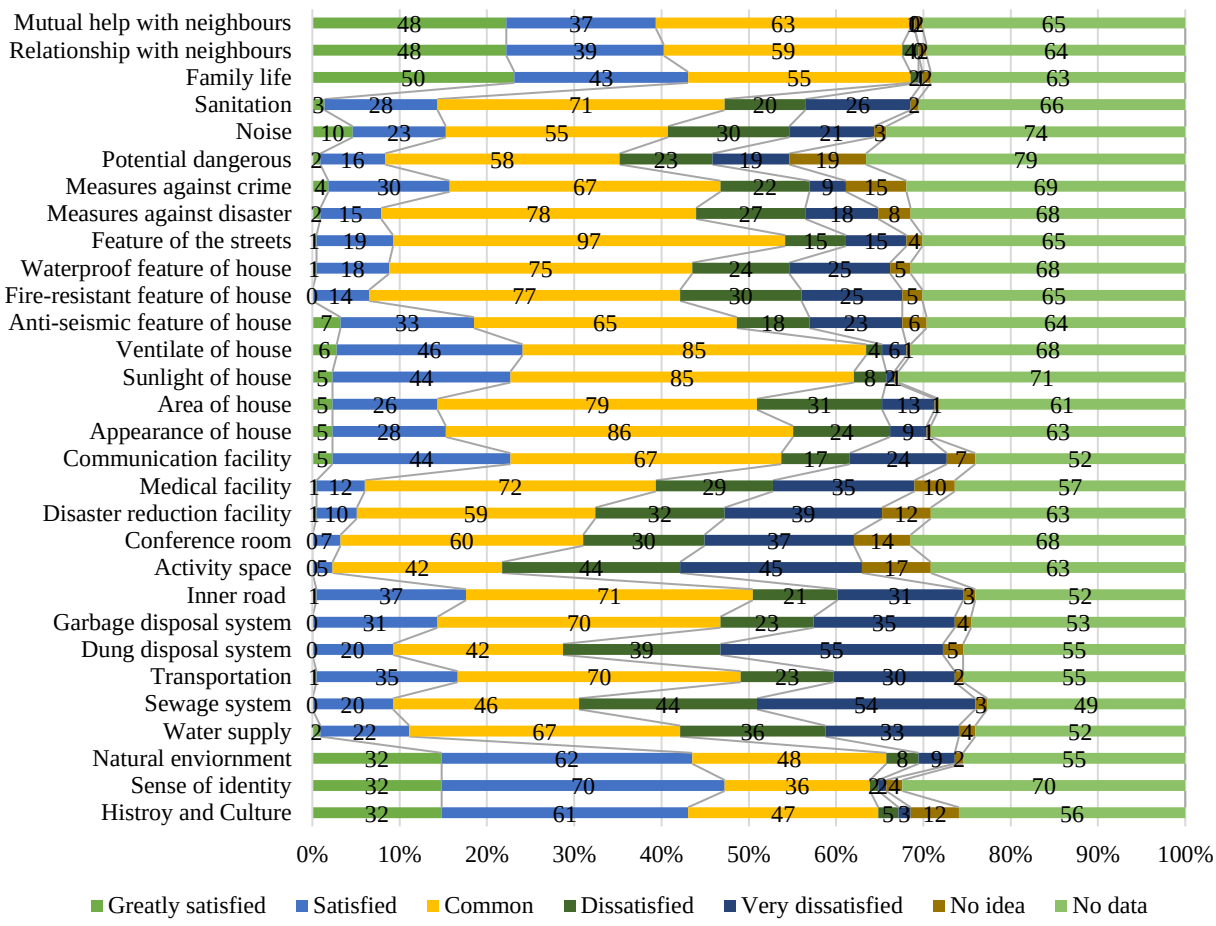
1.5 Household population

	Number	Percentage
1	9	5.1
2	8	4.5
3	34	19.1
4	50	28.1
5	46	25.8
6	20	11.2
7	9	5.1
10	2	1.1
Total	178	100.0
No data	38	-
Total	216	-

1.6 Duration of residence

	Number	Percentage
1-3years	4	3.1
4-6years	1	0.8
16-20years	1	0.8
>20years	123	95.3
Total	129	100.0
No data	87	-
Total	216	-

2. PERCEPTION ON LIVING ENVIRONMENT



3. DISASTER EXPERIENCE

3.1 Disaster knowledge before and after earthquake

		Disaster knowledge after earthquake			Total
		I don't know	I know a little	I know very well	
Disaster knowledge before earthquake	I don't know	5	42	3	50
	I know a little	2	54	15	71
	I know very well	1	1	8	10
Total		8	97	26	131

3.2 Emergency measures before and after Lushan Earthquake

Measures	Before	Percentage	After	Percentage
Prepared emergency food and water	16	48.5%	49	51.0%
Packaged the important goods for emgency evacuation	12	36.4%	43	44.8%
Checked safe place for emgency evacuation	14	42.4%	54	56.3%
Discussed an emgency contact with family	12	36.4%	35	36.5%
Joined the disaster insurance	2	6.1%	13	13.5%
Prepared emergency tools	7	21.2%	31	32.3%
Joined disaster training	11	33.3%	10	10.4%
Total	74	224.2%	235	244.8%

3.3 Emergency action in Lushan Earthquake

Action	Number	Percentage (%)
Hid under a table or near a column	22	17.3
Open the window or door	12	9.4
Hold the furniture	10	7.9
Help the weak	48	37.8
Stand to prevent failling	25	19.7
Cut off the power	34	26.8
Fly outdoors	84	66.1
I did nothing	7	5.5
Others	1	0.8
Total	243	191.3

3.4 Reason of the action

Reason	Number	Percentage (%)
Taught by someone	18	15.4
Follow others	18	15.4
Personal experience	27	23.1
Intuition	70	59.8
Total	133	113.7

3.5 Reliable group during Lushan Earthquake

Groups	Number	Percentage (%)
Family	55	37.
Neighbors	77	52.7%
Villagers	46	31.5
Village committee and leaders	24	16.4
Police	18	12.3
Firefighting agency	11	7.5
Army	6	4.1
Local government	14	9.6
Social organization and volunteers	9	6.2
Doctor	38	26.0
Others	1	0.7
Total	299	204.8

3.6 Influence of the disaster experiences

Influence	Number	Percentage (%)
To a very great extent, I will prepare to avoid loss	84	75.0%
To a great extent, It may be help next time	25	22.3%
To a small extent, I will not care	1	0.9%
To a very small extent, I will forget it soon	2	1.8%
Total	112	100.0

4. DISASTER AWARENESS

4.1 Influence of the disaster experiences

Influence	Number	Percentage (%)
Yes, I know	18	14.9
I know a little	54	44.6
No, I don’t know	38	31.4
Unsure	11	9.1
Total	121	100.0

4.2-4.3 Possibility of a large earthquake (>M 6.0) and building damage

Possibility	A large earthquake (>M 6.0)		Building damage	
	Number	Percentage (%)	Number	Percentage (%)
Definitely	6	5.1	33	27.3
May	44	37.3	56	46.3
May not	19	16.1	15	12.4
Definitely not	5	4.2	4	3.3
Unsure	44	37.3	13	10.7
Total	118	100	121	100.0

4.4 Knowledge of emergency evacuation site

	Number	Percentage (%)
I clealy know	11	9.7
I know	62	54.9
I know but not clearly	29	25.7
I don't know	5	4.4
Unsure	6	5.3
Total	113	100.0

4.5 Sufficiency of disaster risk reduction measures sufficiency

	Number	Percentage (%)
To a very great extent	3	2.7
To a great extent	46	41.8
To a small extent	23	20.9
To a very small extent	29	26.4
Unsure	9	8.2
Total	110	100.0

5. DISASTER AWARENESS

5.1-5.3 Participation in festival ceremony, disaster education activity, and disaster training activity every year

Possibility	Festival ceremony		Disaster education activity		disaster training activity	
	Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)
Never	10	8.4	39	32.8	46	41.4
1-2 times	59	49.6	26	21.8	16	14.4
3-5 times	24	20.2	11	9.2	12	10.8
More than 5 times	8	6.7	4	3.4	5	4.5
Unsure	18	15.1	39	32.8	32	28.8
Total	119	100.0	119	100.0	111	100.0

QUESTIONNAIRE 2 (For Shangli villager – Disaster experience and response)

The main purpose of the questionnaire is to investigate the building damages caused by disasters and people's response in Shangli Village. Since one household in Shangli Village may have more than one building, the following questions are asked to every builidng in one household seperately.

1. GENERAL INFORMATION OF RESIDENTIAL BUILDINGS

1.1 Number of buildings……1.2 Construction year……1.3 Function……

1.4 Structure type…… ☐ Wooden…... ☐ Wooden-brick……☐Confined brick……☐Reinforce-concrete

2. BUILDING DAMAGE CAUSED BY DISASTERS

2.1 Damage caused by Lushan Earthquake in 2013…….☐ Mildly ……☐Moderately……☐Severely

2.2 Inundated situation caused by floods in 2013 ……

☐ Unsure…… ☐ Did not affected…… ☐ Scarely inundated…… ☐ Inundated less than one meter

☐ Inundated more than one meter but less than two meters…… ☐ Inundated more than two meters

3. BUILDING REPAIR ACTIVITY

3.1 Have you entirely repaired your buildings ? ……

☐ Yes, I entirely repaired……. ☐ No, it was mostly repaired…….. ☐ No, it was partly repaired…….

☐ No, I did not repair……

3.2 Why didn't you entirely repaired your buildings ? ……

☐ Insufficient financial capacity…….. ☐ Limited access to building technoly……☐ Lack of labor.

☐ Administrative licensing problem…… ☐ No necessity…….. ☐ Others……...

3.3 Have you ever gotten any support for building technology ? ……..

☐ No……..…....…… ☐ Yes, from local government…… ☐ Yes, from professionals in institutions

☐ Yes, from other organization or individuals…….…….. ……

4. BUILDING IMPROVEMENT ACTIVITY

4.1 Have you retrofitted your buildings for better earthquake-resistance ? ……

☐ No retrofit, no plan ☐ No retrofit, but plan ☐ Retrofitted by myself ☐ Retrofitted by craftsmen

4.2 Have you retrofitted your buildings for better flood-resistance ? ……

☐ No retrofit, no plan ☐ No retrofit, but plan ☐ Retrofitted by myself ☐ Retrofitted by craftsmen

4.3 Why didn't you retrofitted your buildings ? ……

☐ Insufficient financial capacity…….. ☐ Limited access to building technoly……☐ Lack of labor.

☐ Administrative licensing problem…… ☐ No necessity…….. ☐ Others……...

Brief result of the questionnaire 2 (For Shangli villager – Disaster experience and response)

1. GENERAL INFORMATION OF RESIDENTIAL BUILDINGS

1.1 Number of buildings

	All buildings		Old building (Before 1981)		New building (After 1980)	
	Number	Percentage(%)	Number	Percentage(%)	Number	Percentage(%)
Don't have	0	0	116	71.6	28	17.3
Have one building	139	85.8	46	28.4	130	80.2
Have two buildings	23	14.2	0	0	4	2.5
Total	162	100.0	162	100.0	162	100.0

1.2 Construction year of the buildings

Old buildings (Before 1981)			New buildings (After 1980)		
Year of built	Number	Percentage (%)	Year of built	Number	Percentage (%)
1815	1	2.2	1982	2	1.4
1838	3	6.5	1984	1	0.7
1876	2	4.3	1985	1	0.7
1886	2	4.3	1986	2	1.4
1896	1	2.2	1987	1	0.7
1910	1	2.2	1988	2	1.4
1917	1	2.2	1989	8	5.8
1930	3	6.5	1990	2	1.4
1945	1	2.2	1991	1	0.7
1950	1	2.2	1992	7	5.1
1955	1	2.2	1993	1	0.7
1958	1	2.2	1994	1	0.7
1970	3	6.5	1995	4	2.9
1973	1	2.2	1996	2	1.4
1975	2	4.3	1998	3	2.2
1976	1	2.2	1999	2	1.4
1978	1	2.2	2000	2	1.4
1980	3	6.5	2001	4	2.9
Unsure but before 1900	2	4.3	2002	4	2.9
Unsure but before 1949	1	2.2	2003	2	1.4
Unsure but before 1921	1	2.2	2005	14	10.1
Unsure	13	28.3	2006	5	3.6
Total	46	100	2007	7	5.1
			2008	10	7.2
			2009	13	9.4
			2010	7	5.1
			2011	6	4.3
			2012	7	5.1
			2013	5	3.6
			2014	5	3.6
			2015	4	2.9
			Total	138	100

1.3 Function

Old buildings (Before 1981)			New buildings (After 1980)		
Function	Number	Percentage (%)	Function	Number	Percentage (%)
Residential house	36	81.8	Residential house	68	51.5
Family inn	4	9.1	Family inn	52	39.4
Rent house	4	9.1	Rent house	13	9.8
Shop	4	9.1	Shop	15	11.4
Total	48	109.1	Total	148	112.1

1.4 Building structure

Old buildings (Before 1981)			New buildings (After 1980)		
Function	Number	Percentage (%)	Function	Number	Percentage (%)
Wooden	33	12.2	Wooden	23	16.7
Wooden-brick	10	3.7	Wooden-brick	8	5.8
Confined brick	3	1.1	Confined brick	88	63.8
Reinforce-concrete	0	0	Reinforce-concrete	14	10.1
No data	0	0	No data	5	3.6
Total	46	100	Total	138	100

2. BUILDING DAMAGE CAUSED BY DISASTERS

2.1 Damage caused by Lushan Earthquake in 2013 (Provided by Shangli Town government)

Building Typology	Total	Damage level		
		Mild	Moderate	Severe
Total	280 (100%)	6(2%)	183(65%)	91(33%)
(W) Wooden buildings	73 (26%)	4(5%)	59(81%)	10(14%)
(WB) Wooden-Brick buildings	24 (9%)	0(0%)	19 (79%)	5(21%)
(CB) Confined Brick buildings	163 (58%)	1(1%)	91(56%)	71(43%)
(RC) Reinforced-Concrete buildings	20 (7%)	1(5%)	14(70%)	5(25%)

2.2 Inundated situation caused by floods in 2013

Old buildings (Before 1981)			New buildings (After 1980)		
Inundated situation	Number	Percentage (%)	Inundated situation	Number	Percentage (%)
Unsure	1	2.2	Unsure	5	3.6
Did not affected	8	17.4	Did not affected	6	4.3
Scarely inundated	9	19.6	Scarely inundated	19	13.8
Less than one meter	14	30.4	Less than one meter	38	27.5
more than one meter, less than two meters	7	15.2	more than one meter, less than two meters	31	22.5
more than two meters	1	2.2	more than two meters	7	5.1
No data	6	13.0	No data	32	23.2
Total	46	100	Total	138	100

3. BUILDING REPAIR ACTIVITY

3.1-3.2 Repair situation and reasons

Repair situation					Reasons				
Repair situation	Number			Percentage (%)	Reasons	Old		New	
	Old	New	Total			Num.	(%)	Num.	(%)
Entirely repaired	0	3	3	1.8%	Insufficient financial capacity	24	53.3	63	58.9
Mostly repaired	9	28	37	22.4	Limited acess to building technology	13	28.9	45	42.1
Partly repaired	18	67	85	51.5	Lack of labor	1	2.2	8	7.5
Did not repair	18	22	40	24.2	Administrative licensing problem	14	31.1	11	10.3
					No necessity	5	11.1	10	9.3
Total	45	120	165	100	Total	57	126.7	137	128.0

3.3 Technical support for building repair and retrofit

Repair			Retrofit		
Support	Number	Percentage (%)	Support	Number	Percentage (%)
No	30	81.1	No	70	67.3
Local government	4	10.8	Local government	24	23.1
Institute	0	0	Institute	4	3.8
Others	6	16.2	Others	26	25.0
Total	40	108.1	Total	124	119.2

4. BUILDING IMPROVEMENT ACTIVITY

4.1-4.2 Retrofit situation

Earthquake-resistance					Flood-resistance				
Retrofit situation	Old		New		Retrofit situation	Old		New	
	Num.	(%)	Num.	(%)		Num.	(%)	Num.	(%)
No retrofit, no plan	14	29.8	16	12.1	No retrofit, no plan	22	46.8	27	20.8
No retrofit, but plan	9	19.1	19	14.4	No retrofit, but plan	9	19.1	15	11.5
Retrofitted by myself	22	46.8	90	68.2	Retrofitted by myself	14	29.8	85	65.4
Retrofitted by craftsmen	2	4.3	7	5.3	Retrofitted by craftsmen	2	4.3	3	2.3
Total	47	100.0	132	100.0	Total	47	100.0	130	100.0

4.3 Reason

Reason	Old buildings (Before 1981)		New buildings (After 1980)	
	Number	Percentage (%)	Number	Percentage (%)
Insufficient financial capacity	23	50.0	68	58.1
Limited acess to building technology	17	37.0	45	38.5
Lack of labor	2	4.3	6	5.1
Administrative licensing problem	15	32.6	11	9.4
No necessity	6	13.0	15	12.8
Others	0	0	1	0.9
Total	63	137.0	146	124.8

QUESTIONNAIRE 3 (For Shangli villager – Risk awareness)

The main purpose of the questionnaire is to investigate the local people's disaster risk awareness, preparedness, disaster responding measures, and participation in disaster education and training activities.

1. RISK AWARENESS

1.1 In you opinion, to what extent does a large earthquake (>M 7.0) may happen in your region in the future 30 years ?

☐Definitely…… ☐ May …… ☐ May not…… ☐ Definitely not……☐Unsure

1.2 To what extent does you building be affected by a possible large earthquake (>M 7.0) ?

☐Definitely…… ☐ May …… ☐ May not…… ☐ Definitely not……☐Unsure

1.3 In you opinion, to what extent does a flood (same with in 2013) may happen again in the future 30 years ?

☐Definitely…… ☐ May …… ☐ May not…… ☐ Definitely not……☐Unsure

1.4 To what extent does you building be affected by a possible flood ?

☐Definitely…… ☐ May …… ☐ May not…… ☐ Definitely not……☐Unsure

1.5 In you opinion, to what extent does your village has a fire risk ?

☐Definitely…… ☐ May …… ☐ May not…… ☐ Definitely not……☐Unsure

1.6 To what extent does you building be affected by a fire ?

☐Definitely…… ☐ May …… ☐ May not…… ☐ Definitely not……☐Unsure

2. DISASTER PREPAREDNESS

2.1 Did you consider to prepare for a emergency situation caused by disasters ?

☐Yes, well considered… ☐ Yes, considered.. ☐Unsure… ☐ I almost didn't consider ☐ I never consider

2.2 What emergency goods did you prepare ?

☐Emergency food…. ☐ Emergency drinking water….☐Simply first aid bag…. ☐ Commonly used drugs

☐Radio and battery…☐ Emergency tools…… ☐ Personal goods…….. ☐ Others……..

2.3 What emergency measures did you consider ?

☐Packaged the important goods for emgency evacuation… ☐Checked safe place for emgency evacuation..

☐Considered an evacuation route……. ☐Discussed an emgency contact with family...

☐Discussed an emergency rescue method with neighbors.. ☐Others……

3. DISASTER RESPONDING

3.1 What will do when a earthquake happens ?

☐Hid under a table or near a column ……☐Open the window or door …… ☐Hold the furniture……..

☐Help the weak……. ☐ Stand to prevent failling……. ☐ Cut off the power……..

☐Fly outdoors…… ☐ Others…….

3.2 Do you clear know the safe place for emergency evacuation when a earthquake happens ?

☐Yes, I know ……..…… ☐No, I don't know…….. ☐Unsure…….……..

3.3 Do you clear know the location of emergency tools for rescue when a earthquake happens ?

☐Yes, I know ……..…… ☐No, I don't know…….. ☐Unsure…….……..

3.4 What will do when a fire happens ?

☐Shout to notice……...……. ☐ Rescue elder and children…….☐ Firefighting…..……..

☐Run out……..……. ☐Close the fire room door.……. ☐ Call 119…….……..

☐Ask for help…… ☐ Others…….

3.5 Do you clear know the location of the nearest fire extinguisher when a fire happens ?

☐Yes, I know ……..……☐ No, I don't know……. ☐ Unsure…….……..

3.6 Are you able to use a fire extinguisher when emergency firefighting ?

☐Yes, I am able to ……..……..☐ No, I am unable to…….. ☐ Unsure…….……..

3.7 Do you clear know the safe place for emergency evacuation when a flood happens ?

☐Yes, I know ……..…… ☐No, I don't know…….. ☐Unsure…….……..

3.8 Do you clear know a safe evacuation route when a flood happens ?

☐Yes, I know ……..…… ☐No, I don't know…….. ☐Unsure…….……..

4. PARTICIPATION IN DISASTER EDUCATION AND TRAINING

4.1 Have you ever partcipated in disaster education activities ?

☐Yes, more than 3 times…. ☐ Yes, 3 times… ☐Yes, 2 times…. ☐Yes, once… ☐No, I never……...

4.2 Have you ever partcipated in disaster training activities ?

☐Yes, more than 3 times…. ☐ Yes, 3 times… ☐Yes, 2 times…. ☐Yes, once… ☐No, I never……...

5. RELIABLE GROUP WHEN EMERGENCY

5.1 Who do you think is reliable when emergency ?

☐Family……...…. ☐ Neighbors……☐Villagers…….. ☐Village committee and leaders……..

☐Police……...….. ☐Firefighting agency… ☐ Army……... ☐ Local governmen……...…….....

☐Family……...…. ☐ Neighbors……☐Villagers…….. ☐Village committee and leaders……..

☐Social organization and volunteers…….. ☐ Doctor……. ☐ Others…….....……

Brief result of the questionnaire 3 (For Shangli villager – Risk awareness)

1. RISK AWARENESS

1.1-1.6 Possibilty of a large earthquake (>M 7.0), flood, and a fire in the future 30 years and possible damage

Possibilty	An earthquake (>M 7.0)				A large flood				A large fire			
	Earthquake		House damage		Flood		House damage		Fire		House damage	
	Number	(%)	Number	(%)	Number	(%)	Number	(%)	Number	(%)	Number	(%)
Definitely	24	15.9	44	28.8	18	11.8	29	19.1	70	46.4	81	46.4
May	37	24.5	37	24.2	47	30.9	64	42.1	52	34.4	57	34.4
May not	50	33.1	36	23.5	68	44.7	40	26.3	16	10.6	10	10.6
Definitely not	19	12.6	15	9.8	14	9.2	13	8.6	11	7.3	3	7.3
Unsure	21	13.9	21	13.7	5	3.3	6	3.9	2	1.3	2	1.3
Total	151	100.0	153	100.0	152	100.0	152	100.0	151	100.0	153	100.0

2. DISASTER PREPAREDNESS

2.1-2.3 Preparedness situation, emergency goods, and emergency measures

Preparedness situation			Emergency goods			Emergency measures		
Preparedness	Number	(%)	Goods	Number	(%)	Measures	Number	(%)
Well considered	56	36.8	Food	71	65.7	Packaged the important goods for emgency evacuation	74	71.8
			Drinking water	52	48.1			
Considered	44	28.9	First aid bag	42	38.9	Checked safe place for emgency evacuation	37	35.9
			Drugs	15	13.9			
Unsure	2	1.3	Radio	26	24.1	Considered an evacuation route	38	36.9
I almost didn't consider	21	13.8	Emergency tools	25	23.1	Discussed an emgency contact with family	27	26.2
			Personal goods	24	22.2	Discussed an emergency rescue method with neighbors	30	29.1
I never consider	29	19.1	Others	0	0	Others	2	1.9
Total	152	100.0	Total	255	236.1	Total	208	201.9

3. DISASTER RESPONDING

3.1 Action when a earthquake happens

Action	Number	Percentage (%)
Hid under a table or near a column	31	20.1
Open the window or door	5	3.2
Hold the furniture	2	1.3
Help the weak	16	10.4
Stand to prevent failling	3	1.9
Cut off the power	1	0.6
Fly outdoors	141	91.6
Others	0	0
Total	199	129.2

3.2-3.3 Awareness of safe place for emergency evacuation and location of emergency tools

Awareness	Safe place for emergency evacuation		Location of emergency tools	
	Number	Percentage (%)	Number	Percentage (%)
Yes, I know	111	88.8	110	73.8
No, I don't know	10	8.0	29	19.5
Unsure	4	3.2	10	6.7
Total	125	100.0	149	100.0

3.4 Action when a fire happens

Action	Number	Percentage (%)
Shout to notice	113	75.8
Rescue elder and children	73	49.0
Firefighting	51	34.2
Run out	37	24.8
Close the fire room door	18	12.1
Call 119	88	59.1
Ask for help	50	33.6
Others	1	0.7
Total	431	289.3

3.5-3.8 Awareness of fire extinguisher's location and usage, and a safe place and evacuation route when a flood happens

Awareness	Fire extinguisher's location		Fire extinguisher's usage		Evacuation site when flood		Evacuation route when flood	
	Number	(%)	Number	(%)	Number	(%)	Number	(%)
Yes, I know	135	88.8	122	79.2	150	98.0	146	96.7
No, I don't know	16	10.5	31	20.1	3	2.0	3	2.0
Unsure	1	0.7	1	0.6	0	0	2	1.3
Total	152	100.0	154	100.0	153	100.0	151	100.0

4. PARTICIPATION IN DISASTER EDUCATION AND TRAINING

4.1-4.2 Participation in disaster education and training activities

Awareness	Disaster education		Disaster training	
	Number	Percentage (%)	Number	Percentage (%)
Never	98	63.6	110	71.9
Once	37	24.0	25	16.3
2 times	12	7.8	12	7.8
3 times	3	1.9	2	1.3
More than 3 times	4	2.6	4	2.6
Total	154	100.0	153	100.0

5. RELIABLE GROUP WHEN EMERGENCY

5.1 Reliable group when emergency

Groups	Number	Percentage (%)
Family	108	70.1
Neighbors	73	47.4
Villagers	102	66.2
Village committee and leaders	69	44.8
Police	32	20.8
Firefighting agency	88	57.1
Army	60	39.0
Local government	98	63.6
Social organization and volunteers	33	21.4
Doctor	11	7.1
Others	1	0.6
Total	675	438.3

QUESTIONNAIRE 4 (For Shangli villager – Participation in community activities)

The main purpose of the questionnaire is to investigate the local people's participation in community activities, which include two sections: common activities and disaster-related activities. In addition, their willingness of partcipation is also asked.

Catalogy	Activity	Partcipation and Willingness	Dirving force					
			Individual	Family	Neighbors	Villagers	Village committee	Local government
Village affairs	Village affairs assistance							
Ordinary events	Festival							
	Wedding and Funeral							
	House construction							
	Meeting							
	Sports meeting							
Group activity	Elder group							
	Children							
	Youth							
	Women group							
	Sports							
Theme activity	Disaster risk reduction measures							
	Anticrime							
	Resource							
	Fire-prevention							
	Living environment improvement							
	Farming technique							
	Village development							
Welfare activity	Dailylives support							
	Condolences							
	Others							

Disaster-related activities

Catalogy	Activity	Partcipation and Willingness	Dirving force					
			Individual	Family	Neighbors	Villagers	Village committee	Local government
Disaster education	Disaster Knowledge							
	Disaster coping							
	Fire prevention							
	First Aid							
Disaster training	Disaster coping							
	Disaster drill							
	Emergency rescue							
Disaster risk inspection	Risk inspection							
	Facilities inspection							
	Facilities maintanence							
	Information check							
	Information transmission							

Brief result of the questionnaire 4

(For Shangli villager – Participation in community activities)

1. People's participation and willingness to participate in community activities

Catalogy	Activity	Willingness		Partcipation				
		Yes	No	Never	Once	2 times	≥3 times	Unsure about how many times
Village affairs	Village affairs assistance	117	14	87	1	1	0	3
Ordinary events	Festival	130	3	31	21	5	0	6
	Wedding and Funeral	131	2	16	2	0	2	71
	House construction	131	2	17	1	0	1	71
	Meeting	127	5	90	0	0	0	0
	Sports meeting	127	5	85	1	0	0	4
Group activity	Elder group	118	15	86	0	0	0	4
	Children	116	17	90	0	0	0	0
	Youth	117	16	90	0	0	0	0
	Women group	116	17	88	0	1	0	1
	Sports	117	16	89	0	0	1	0
Theme activity	Disaster risk reduction measures	121	12	87	0	0	1	2
	Anticrime	121	12	89	0	0	0	0
	Resource	120	12	89	0	0	0	0
	Fire-prevention	127	15	79	1	1	2	7
	Living environment improvement	127	6	83	2	0	1	4
	Farming technique	126	6	87	1	0	0	2
	Village development	126	6	90	0	0	0	0
Welfare activity	Dailylives support	127	5	88	0	0	0	2
	Condolences	126	6	88	0	0	0	2
	Others	-	-	-	-	-	-	-

Disaster-related activities

Catalogy	Activity	Willingness		Partcipation				
		Yes	No	Never	Once	2 times	≥3 times	Unsure about how many times
Disaster education	Disaster Knowledge	129	4	95	0	0	0	22
	Disaster coping	130	13	107	0	0	0	10
	Fire prevention	130	3	98	0	0	0	19
	First Aid	130	3	109	0	0	0	8
Disaster training	Disaster coping	131	2	95	0	0	0	22
	Disaster drill	131	2	93	0	0	0	24
	Emergency rescue	130	3	110	0	0	0	7
Disaster risk inspection	Risk inspection	125	8	94	0	0	0	23
	Facilities inspection	124	9	90	0	0	0	27
	Facilities maintanence	123	10	102	0	0	0	15
	Information check	120	13	112	0	0	0	5
	Information transmission	120	13	111	0	0	0	6

2. People's perception on driving force of community activities

Catalogy	Activity	Dirving force					
		Individual	Family	Neighbors	Villagers	Village committee	Local government
Village affairs	Village affairs assistance	3	0	2	24	76	78
Ordinary events	Festival	85	87	77	103	77	122
	Wedding and Funeral						
	House construction						
	Meeting						
	Sports meeting						
Group activity	Elder group	19	3	11	47	88	122
	Children						
	Youth						
	Women group						
	Sports						
Theme activity	Disaster risk reduction measures	10	6	7	39	91	127
	Anticrime						
	Resource						
	Fire-prevention						
	Living environment improvement						
	Farming technique						
	Village development						
Welfare activity	Dailylives support	8	3	10	29	95	124
	Condolences						
	Others						

Disaster-related activities

Catalogy	Activity	Dirving force					
		Individual	Family	Neighbors	Villagers	Village committee	Local government
Disaster education	Disaster Knowledge	23	2	1	10	68	127
	Disaster coping						
	Fire prevention						
	First Aid						
Disaster training	Disaster coping	21	1	0	8	62	125
	Disaster drill						
	Emergency rescue						
Disaster risk inspection	Risk inspection	30	3	3	16	69	127
	Facilities inspection						
	Facilities maintanence						
	Information check						
	Information transmission						

QUESTIONNAIRE 5 (For Shangli villager – Social capital)

The main purpose of the questionnaire is to investigate the community's social capital in Shangli Village. It includes six sections: groups and networks, trust and solidarity, collective action and cooperation, information and communication, social cohesion and inclusion, and empowerment and political action.

1. GROUPS AND NETWORKS

1.1 Which group you or any member of your family belong ?

☐ Village committee……☐Volunteer firefighting troop…….☐Basketball group..... ☐Others….. ☐ No...

1.2 Does this group interact with groups outside the village ?..... ☐ Frequently ☐ Occasionally ☐ No……

1.3 How many close friend do you have recently that you can call on for help ? …….

1.4 If you suddenly needed to borrow a small amount of money (week expense), are your friends willing to provide ?

☐Definitely……. ☐Probably…….. ☐Unsure…… ☐ Probably not…..…….. ☐Definitely not....

2. TRUST AND SOLIDARITY

2.1 Generally speaking, most villager in your community can be trusted or that you can't be too carefull in dealing with them ? …… ☐ People can be trusted…..…… ☐ You can't be too carefull…...

2.2 In general, are most villagers in your community willing to help if you need it ?

☐Definitely……. ☐Probably…….. ☐Unsure…… ☐ Probably not…..…….. ☐Definitely not....

2.3 In general, do you have to be alert that someone is likely to tahe advantange of you ?

☐Definitely……. ☐Probably…….. ☐Unsure…… ☐ Probably not…..…….. ☐Definitely not....

2.4 How much do you trust local government officials ?

☐ To a very great extent…☐ To a great extent.. ☐ To a small extent...☐To a very small extent…☐Unsure

2.5 How much do you trust central government officials ?

☐ To a very great extent…☐ To a great extent.. ☐ To a small extent...☐To a very small extent…☐Unsure

2.6 Woule you contribute time to the project in your community, which does not directly benefit you but has benefits for many others in the community? ……..…… ☐ Yes, I will…… ☐ No, I will not…..

2.7 Woule you contribute money to the project in your community, which does not directly benefit you but has benefits for many others in the community? ……..…… ☐ Yes, I will…… ☐ No, I will not…..

3. COLLECTIVE ACTION AND COOPERATION

3.1 In the past year, did you or any one in your family partcipate in any communal activities, in which villagers came together to do some work for the benefit of your community ? …… ☐ Yes, …..times; ☐ No

3.2 How likely is it that villagers will cooperate to try to solve the problem if there was a water supply problem in your community ?

☐Very likely…☐Somewhat likely...☐Neither likely or unlikely. ☐ Somewhat unlikely...☐Very unlikely

4. INFORMATION AND COMMUNICATION

4.1 What are your main sources of information about the government's policy ?

☐Relatives, friends and neighbors…☐Village committee...☐Local market…☐Newspaper… ☐ Radio…

☐Television……...☐Work place……..☐Other groups or organizations…☐ Internet

5. SOCIAL COHENSION AND INCLUSION

5.1 To what extent do any differences characterize your community, such as difference in wealth ?

☐To a very great extent…☐To a great extent.. ☐ To a small extent...☐To a very small extent…☐Unsure

5.2 Do any of these differences cause problems ?……..... ☐Yes……. ☐No……

5.3 Which difference most often cause problems ?

☐Difference in education……. ☐Difference in landholding…...…… ☐Difference in wealth……...…

☐Difference in social status……. ☐Difference in men and women…… ☐Difference in generation…..…

☐Difference between long-term and recent residents…… ☐Others……..…

5.4 Have these problems ever led to violence ? ……..... ☐Yes……. ☐No……

5.5 How many times in the past month that you had food or drinks together ? …….....……

5.6 In general, how safe from crime and violence do you feel when you are alone at home ?

☐Very safe……☐Moderately safe….. ☐ Neither safe nor unsafe....☐Moderately unsafe….☐Very unsafe

6. EMPOWERMENT AND POLITICAL ACTION

6.1 In general, how happy do you consider yourself to be ? …….....…….

☐Very happy☐Moderately happy☐Neither happy nor unhappy ☐ Moderately unhappy ☐ Very unhappy

6.2 Do you feel that you have the power to make important decisions that change the course of your life ?

☐Totally unable.....☐Mostly unable…... ☐Neither unable nor able…...☐Mostly able……..☐Totally able

6.3 In the past year, how many times did you join in petition for something benefiting your community ?.....

6.4 Did you vote on the last villager leader election ? ……..... ☐ Yes…… ☐No……

Brief result of the questionnaire 5 (For Shangli villager – Social capital)

1. GROUPS AND NETWORKS

1.1-1.2 Members in community groups and interaction with groups outside the village

	Groups		Interaction		
	Number	Percentage (%)		Number	Percentage (%)
No	162	76.5	No interaction	5	31.3
Village committee	9	11.1			
Volunteer firefighting troop	7	8.6	Occasionally	9	56.3
Basketball group	3	3.7			
Others	0	0	Frequently	2	12.5
Total	81	100.0	Total	16	100.0

1.3 Close friend and possibility of obtaining financial help from friends

Number of close friend	Close friend		Possibility of obtaining financial help		
	Number	Percentage (%)	Possibility	Number	Percentage (%)
0	4	12.1	Definitely	16	32.0
1	7	21.2			
2	9	27.3	Probably	21	42.0
3	4	12.1			
4	4	12.1	Unsure	6	12.0
5	2	6.1	Probably not	6	12.0
6	1	3.0	Definitely not	1	2.0
10	2	6.1			
Total	33	100.0	Total	50	100.0

2. TRUST AND SOLIDARITY

2.1 Trust on villagers

	Number	Percentage (%)
People can be trusted	62	77.5
You can't be too carefull	18	22.5
Total	80	100.0

2.2-2.3 Willing to help and alert

	Willing to help		Alert	
	Number	Percentage (%)	Number	Percentage (%)
Definitely	8	9.9	2	2.6
Probably	49	60.5	15	19.7
Unsure	23	28.4	10	13.2
Probably not	0	0	47	61.8
Definitely not	1	1.2	2	2.6
Total	81	100.0	76	100.0

2.4-2.5 Trust on local government officials and central government officials

	Local government officials		Central government officials	
	Number	Percentage (%)	Number	Percentage (%)
To a very great extent	5	6.2	17	21.0
To a great extent	28	34.6	59	72.8
Unsure	6	7.4	4	4.9
To a small extent	32	39.5	1	1.2
To a very small extent	10	12.3	0	0
Total	81	100.0	81	100.0

2.6-2.7 Contribute time and money to the community project

	Local government officials		Central government officials	
	Number	Percentage (%)	Number	Percentage (%)
Yes, I will	77	96.3	67	85.9
No, I will not	3	3.8	11	14.1
Total	80	100.0	78	100.0

3. COLLECTIVE ACTION AND COOPERATION

3.1-3.2 Partcipate in collective action and cooperation for community

	Partcipate in collective action		Cooperation for community		
	Number	Percentage (%)	Possibility	Number	Percentage (%)
Never	17	27.4	Very likely	53	67.1
Once	26	41.9	Somewhat likely	11	13.9
2 times	14	22.6	Neither likely or unlikely	8	10.1
3 times	3	4.8	Somewhat unlikely	4	5.1
6 times	1	1.6	Very unlikely	0	0
10 times	1	1.6	Other(management company)	3	3.8
Total	62	100.0	Total	79	100.0

4. INFORMATION AND COMMUNICATION

4.1 Main sources of information

Groups	Number	Percentage (%)
Relatives, friends and neighbors	9	11.1
Village committee	20	24.7
Local market	2	2.5
Newspaper	3	3.7
Radio	2	2.5
Television	53	65.4
Work place	1	1.2
Other groups or organizations	0	0
Internet	19	23.5
Total	109	134.6

5. SOCIAL COHENSION AND INCLUSION

5.1, 5.2, 5.4 Community's difference and problems or violence

Difference			Problems			Violence		
	Number	Percentage (%)		Number	Percentage (%)		Number	Percentage (%)
To a very great extent	6	8.1	Yes	46	66.7	Yes	48	64.9
To a great extent	54	73.0						
Unsure	8	10.8	No	23	33.3	No	26	35.1
To a small extent	4	5.4						
To a very small extent	2	2.7						
Total	74	100.0	Total	69	100.0	Total	74	100.0

5.3 Difference most often cause problems

Differences	Number	Percentage (%)
Difference in education	56	78.9
Difference in landholding	1	1.4
Difference in wealth	14	19.7
Difference in social status	6	8.5
Difference in men and women	1	1.4
Difference in generation	35	49.3
Difference between long-term and recent residents	23	32.4
Total	136	191.5

5.5 Have food or drinks and perception on safety

	Have food or drinks		perception on safety		
	Number	Percentage (%)	Possibility	Number	Percentage (%)
Never	11	22.0	Very safe	16	20.5
Once	14	28.0	Moderately safe	59	75.6
2 times	15	30.0	Neither safe nor unsafe	2	2.6
3 times	5	10.0			
4 times	3	6.0	Moderately unsafe	1	1.3
5 times	2	4.0	Very unsafe	0	0
Total	50	100.0	Total	78	100.0

6. EMPOWERMENT AND POLITICAL ACTION

6.1-6.2 Perception on happiness and power to change life

Perception on happiness			Power to change life		
	Number	Percentage (%)		Number	Percentage (%)
Very happy	11	13.8	Totally able	46	59.7
Moderately happy	19	23.8	Mostly able	17	22.1
Neither happy nor unhappy	13	16.3	Neither unable nor able	11	14.3
Moderately unhappy	34	42.5	Mostly unable	3	3.9
Very unhappy	3	3.8	Totally unable	0	0
Total	80	100.0	Total	77	100.0

6.3-6.4 Participation in joint petition and village election

Joint petition			Village election		
	Number	Percentage (%)		Number	Percentage (%)
Never	65	80.2	Yes	81	100.0
Once	12	14.8			
2-5 times	4	4.9	No	0	0
Total	81	100.0	Total	81	100.0

QUESTIONNAIRE 6 (For volunteer firefighters in Shangli Village)

The main purpose of the questionnaire is to investigate the ten volunteer firefighters' participation in the troop's activities, as well as to understand their experience and motivation as a volunteer firefighter. In addition, their expectation and suggestion to the volunteer firefighting troop's development in the future are also asked.

1. GENERAL INFORMATION

1.1 Age……1.2 Sex……1.3 Occupation……..

1.4 Are you a villager of Shangli Village……☐ Yes……. ☐ No

2. PARTICIPATION IN THE TROOP'S ACTIVITIES

2.1 How many times did you join in the following activities in the last year?

Firefighting …… times; Training …… times; Risk inspection …… times

Propaganda……times; Facility maintanence……times; Measure discussion……times

2.2 Are you able to use the following facilities or to implement a first aid during emergency ?

Fire extinguisher……☐ Able to ☐Unable to Fire hydrant…… ☐ Able to ☐ Unable to

Motor pump……...☐ Able to ☐Unable to First Aid……..…☐ Able to ☐ Unable to

2.3 To what extent do you fimilar with the emergency coping plan that made by the Shangli administrative office before holiday or festival?

☐To a very great extent …… ☐ To a great extent …… ☐To a small extent…… ☐To a very small extent

2.4 To what extent do you understand your responsibility as a volunteer firefighter ?

☐To a very great extent …… ☐ To a great extent …… ☐To a small extent…… ☐To a very small extent

2.5 To what extent do you clear with the location of the firefighting facilities ?

☐To a very great extent …… ☐ To a great extent …… ☐To a small extent…… ☐To a very small extent

2.6 How many percentage of the volunteer firefighters could join in the daily activities ?

☐Almost all of us…☐About 80% … ☐About 60% …☐About 40% …☐About 20% …☐Less than 20%

2.7 Are you able to participate in the troop's daily activities in most occasions ? …☐ Able to ☐Unable to

2.8 Why you are unable to participate in the troop's daily activities ? ……

3. EXPERIENCE AS A VOLUNTEER FIREFIGHTER

3.1 From…….(Year)To…….(Year)

3.2 The reason of joining the volunteer firefighting troop

☐ I want to join…. ☐ It is a tradition…. ☐ Appointed by the Shangli administrative office…… ☐ Others

3.3 The merit of being a volunteer firefighter

☐ I am pround of being a volunteer firefighter to protect the village……

☐ I improved the relationship with other villagers since being a volunteer firefighter……

☐ I learned much knowledge since being a volunteer firefighter……

☐ It is a good experience for my career…… ☐ It is a exciting experience…… ☐ Others……..

3.4 The shortcoming of being a volunteer firefighter

☐ Dangerous…☐Training activities are troublesome…☐Time consuming… ☐No payment…☐Others..

3.5 The villagers' evaluation on the volunteer firefighters

☐ High …… ☐ Common …… ☐ Low …… ☐ Unsure……

4. DEVELOPMENT OF THE VOLUNTEER FIREFIGHTING TROOP

4.1 In you opnion, to what extent does the village have a high fire risk ?

☐To a very great extent ☐To a great extent ☐To a small extent ☐To a very small extent ☐Unsure

4.2 In you opnion, to what extent do the village's disaster coping facilities are sufficient ?

☐To a very great extent ☐To a great extent ☐To a small extent ☐To a very small extent ☐Unsure

4.3 In you opnion, to what extent do the village's disaster risk reduction measures are sufficient ?

☐To a very great extent ☐To a great extent ☐To a small extent ☐To a very small extent ☐Unsure

4.4 In you opnion, to what extent do the volunteer firefighter are sufficient?

☐To a very great extent ☐To a great extent ☐To a small extent ☐To a very small extent ☐Unsure

4.5 In you opnion, Could the volunteer firefighters be sufficient in the future ?

☐ Yes, it could be ensured…… ☐ No, It is difficult to ensure……. ☐ Unsure……

4.6 Do you have some suggestions for the development of the volunteer firefighting troop ?…….

Brief result of the questionnaire 6 (For volunteer firefighters in Shangli Village)

1. GENERAL INFORMATION

1.1 Age

Age	Number	Percentage
25	1	10%
28	5	50%
29	1	10%
40	1	10%
44	1	10%
52	1	10%
Total	10	100%

1.2 Sex (100% are male)

1.3 Occupation (90% are Shangli administrative official staff; 10% is villager of Shangli Village)

1.4 Are you a villager of Shangli Village (30% are villager of Shangli Village; 70% are not)

2. PARTICIPATION IN THE TROOP'S ACTIVITIES

2.1 How many times did you join in the following activities in the last year?
Firefighting: (100% are 3 times); Training (100% are 4 times); Risk inspection (40% are 12 times and 60% are 10 times); Propaganda, facility maintanence and measure discussion (100% are never)

2.2 Are you able to use the following facilities or to implement a first aid during emergency ?
Fire extinguisher, fire hydrant and motor pump (100% are able to);
First Aid (90% are able to; 10% are unable to)

2.3 To what extent do you fimilar with the emergency coping plan that made by the Shangli administrative office before holiday or festival? (100% - to a very great extent)

2.4 To what extent do you understand your responsibility as a volunteer firefighter ?
(100% - to a very great extent)

2.5 To what extent do you clear with the location of the firefighting facilities ?
(100% - to a very great extent)

2.6 How many percentage of the volunteer firefighters could join in the daily activities ?
(100% - Almost all of us)

2.7 Are you able to participate in the troop's daily activities in most occasions ? (100% - able to)

2.8 Why you are unable to participate in the troop's daily activities ? (-)

3. EXPERIENCE AS A VOLUNTEER FIREFIGHTER

3.1 From……(Year)To……(Year)

From	To	Number	Percentage
2005	Now	2	20%
2010	Now	1	10%
2011	Now	1	10%
2013	Now	1	10%
2015	Now	5	50%
Total	Now	10	100%

3.2 The reason of joining the volunteer firefighting troop

(100% are appointed by the Shangli administrative office)

3.3 The merit of being a volunteer firefighter

(100%) I am pround of being a volunteer firefighter to protect the village

(100%) I learned much knowledge since being a volunteer firefighter

3.4 The shortcoming of being a volunteer firefighter

(100%) Dangerous; (80%) Training activities are troublesome; (30%) Time consuming; (90%) No payment

3.5 The villagers' evaluation on the volunteer firefighters (100%-common)

4. DEVELOPMENT OF THE VOLUNTEER FIREFIGHTING TROOP

4.1 In you opnion, to what extent does the village have a high fire risk ? (100%) To a great extent

4.2 In you opnion, to what extent do the village's disaster coping facilities are sufficient ?

(60%) To a great extent; (40%) To a small extent

4.3 In you opnion, to what extent do the village's disaster risk reduction measures are sufficient ?

(100%) To a very great extent

4.4 In you opnion, to what extent do the volunteer firefighter are sufficient?

(70%) To a small extent; (30%) Unsure

4.5 In you opnion, Could the volunteer firefighters be sufficient in the future ? (100%) Unsure

4.6 Do you have some suggestions for the development of the volunteer firefighting troop ?

(90% Payment to vounteer firefighters; 40% facilities improvement; 10% more financial support)

APPENDIX 2: SUMMARY OF STRUCTURED INTERVIEWS IN SHANGLI VILLAGE

LIST OF STRUCTURED INTERVIEWS IN SHANGLI VILLAGE

No.	Interviewee	Position	Date	Place	Content
1	Mr. Han Shigang	Shangli village committee leader	Oct. 2014	Shangli Village committee	(2014) Village information, Disaster experience, Earthquake damage, Flood inundated area.
2	Mr. Zhao Yulin	Shangli village committee clerk			
3	Mr. Yang Yuankai	Shangli administrative official leader	Aug. 2015 Feb. 2016	Shangli administrative office	(2015) Community organizations, activities; Decision-making process, operation of public and private issues; Disaster risk reduction measures (2016) Volunteer firefighting organization
4	Mr. Yang Zenglin	Shangli administrative official clerk			
5	Mr. Wen Dengqiang	Villager	Aug. 2015	Mr. Wen's shop	Construction licensing application

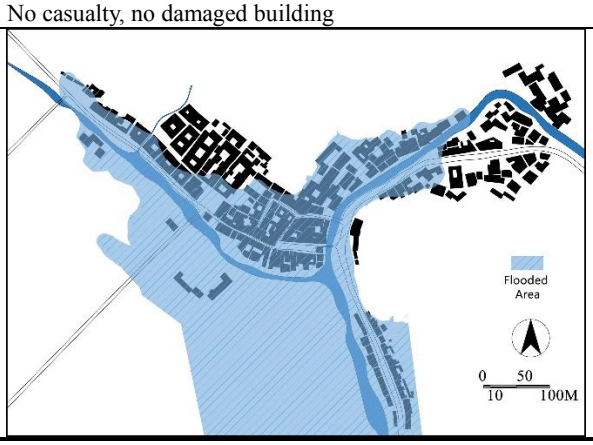
(1-2) Village and disaster information

Interviewee: Mr. Han Shigang, Shangli village committee leader; Mr. Zhao Yulin, Shangli village committee clerk

Date: Oct. 2014

Location: Shangli Village committee

Village and disaster information

Topic	Questions	Answers
Village information	History of the village	More than 300 years, a post town along South Silk Road
	Population	1099 (2013)
	Household	280
	Percentage of permanent resident	90%
Disaster experience	Earthquake	Lushan Earthquake (2013), Wenchuan Earthquake (2008)
	Flood	Floods in 8 and 28 July (2013), Flood in July (1988)
	Fire	Small accidental fires for six time during the last three decades
	Landslides	Rarely
	Others	No
Earthquake damage	Lushan Earthquake (2013)	No casualty, damaged building (damage assessment result*)
	Wenchuan Earthquake (2008)	No casualty, no damaged building
Flood inundated area	Identify the flood inundated area on the map	

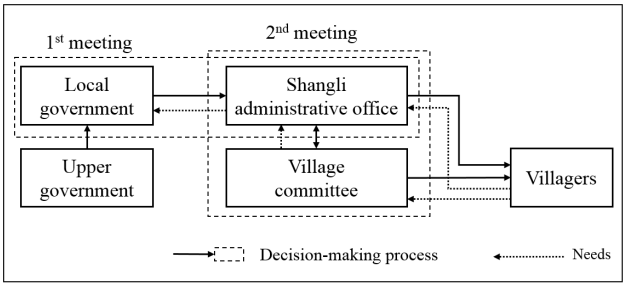
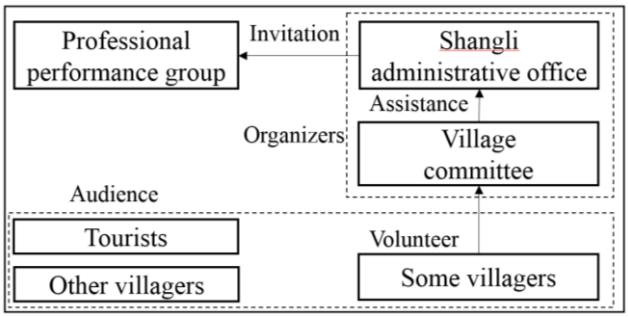
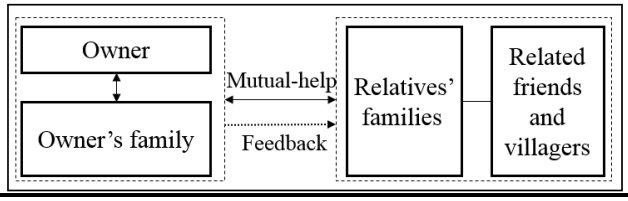
(3-4) 2015 Community asset and disaster risk reduction measures

Interviewee: Mr. Yang Yuankai, Shangli administrative official leader; Mr. Yang Zenglin, Shangli administrative official clerk

Date: Aug. 2015

Location: Shangli administrative office

Community asset

Topic	Questions	Answers
Community organizations	Governing organization	Shangli administrative office (>30 members)
		Shangli village committee (13 members)
	Community group	Group of elder people (>10 members)
		Basketball group (10 members)
	Disaster-related organization	Volunteer firefighting group (10 members)
Community activities	Festivals	Nianzhujie (Dec), Spring festival
	Weddings and funerals	Occasionally
	Building constructions	
Decision-making process	Decision-making process	
Operation of public and private issues	Public issues	
	Private issues	

Disaster risk reduction measures

Topic	Have or do not have		Details	Improvement plan
Disaster risk reduction plan	Do not have		Have fire emergency plans	No
Disaster coping facilities	Evacuation	No	Premilinary plan	Yes
	Information	No	-	No
	Firefighting	Yes	Insufficient	Yes
	Emergency transportation	No	-	No
	Storage	Yes	Insufficient	Yes
Disaster-related activities	Disaster education	Yes	Participants are limited, villagers are not involved	No
	Disaster training	Yes		No
	Risk inspection	Yes	By volunteer firefighters	No
	Facilities maintanence	No	-	No

(3-4) 2016 Volunteer firefighting organization

Interviewee: Mr. Yang Yuankai, Shangli administrative official leader; Mr. Yang Zenglin, Shangli administrative official clerk

Date: Feb. 2016

Location: Shangli administrative office

Volunteer firefighting organization

Topic	Questions	Answers
Volunteer firefighting organization	Year of found	2008
	Members	10
	Activities	Fire prevention work tracking, Fire risk inspection, Facility inspection and maintenance, Education, Firefighting training, Firefighting
	The role of Shangli administrative office, village committee, volunteer firefighters, and villagers in each activities	Generally speaking, Shangli administrative office and village committee are taking the leading role, main implementers are volunteer firefighters, villagers are not involved.

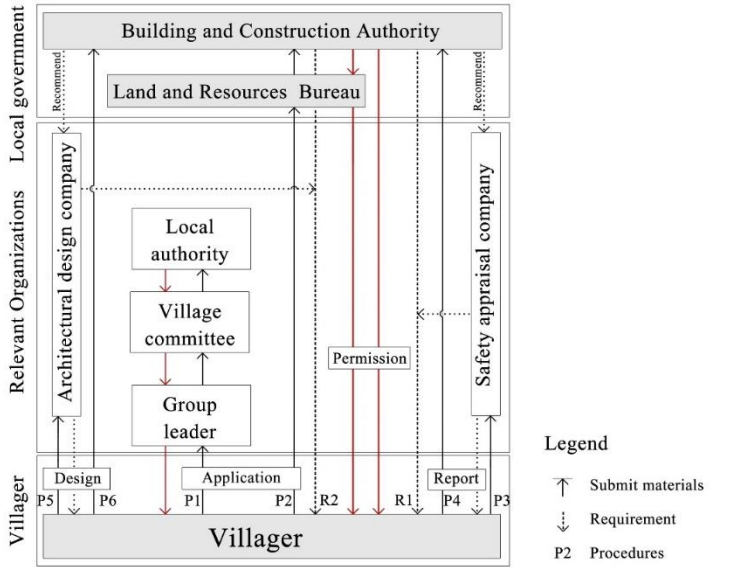
(5) Construction licensing application

Interviewee: Mr. Wen Dengqiang, Villager

Date: Aug. 2015

Location: Mr. Wen's shop

Construction licensing application

Topic	Questions	Answers
Construction licensing application	Purpose	Rebuild the damaged wooden house
	The required process	
	Difficulties	Have no access to safety appraisal and architectural design companies
	Result of application until 2015	Not yet

APPENDIX 3: STRUCTURED INTERVIEWS IN DALI VILLAGE

STRUCTURED INTERVIEW 1 (For Dali villager – Disaster experience and response)

The main purpose of the structured interview is to investigate the disaster (fire and flood) experience of the local people in Dali Village. This structured interview was conducted to 115 residents during July 2015. In addition, to investigate the disaster experience of landslide, a supplementary survey was conducted in February 2016. During this survey, people's response to fire, floods and lanslides were also investigated.

1. GENERAL INFORMATION

1.1 Age…….1.2 Sex……..……1.3 Occupation…….

1.4 Education……1.5 Household population…….

2. BUILDING DAMAGE CAUSED BY DISASTERS

2.1 To what extent your building was affected by the fire (1940s)……

☐ Unsure…… ☐ Did not affected…… ☐ One third was damaged……. ☐ Half was damaged……...

☐ Almost was damaged…… ☐ Totally damaged……

2.2 Inundated situation caused by the floods (1920s)……

☐ Unsure…… ☐ Did not affected…… ☐ Scarely inundated…… ☐ Inundated less than one meter

☐ Inundated more than one meter but less than two meters……. ☐ Inundated more than two meters

2.3 To what extent your building was affected by fire in the recent 30 years

☐ Unsure…… ☐ Did not affected…… ☐ One third was damaged……. ☐ Half was damaged……...

☐ Almost was damaged…… ☐ Totally damaged……

2.4 Inundated situation caused by floods in 1996 and 1997……...

☐ Unsure…… ☐ Did not affected…… ☐ Scarely inundated…… ☐ Inundated less than one meter

☐ Inundated more than one meter but less than two meters……. ☐ Inundated more than two meters

2.5 Why didn't you retrofitted your buildings ? …….…….……

☐ Insufficient financial capacity…….. ☐ Limited access to building technoly…… ☐ Lack of labor.

☐ Administrative licensing problem…… ☐ No necessity…….. ☐ Others……...

3. PEOPLE'S FIRE-RESISTANCE BUILDING IMPROVEMENT

4. PLEMENTARY SURVEY ON DAMAGE CAUSED BY LANDSLIDES AND RESPONSE

5. PEOPLE'S FLOOD-RESISTANCE BUILDING IMPROVEMENT

Brief result of the structured interview 1

(For Dali villager – Disaster experience and response)

1. GENERAL INFORMATION

1.1 Age

	Number	Percentage (%)
<20	14	12.3
20-29	13	11.4
30-39	16	14.0
40-49	23	20.2
50-59	21	18.4
60-69	15	13.2
70-79	8	7.0
>79	4	3.5
Total	114	100.0

1.2 Sex

	Number	Percentage (%)
Male	64	56.1
Female	50	43.9
Total	114	100.0

1.3 Occupation

	Number	Percentage (%)
Agriculture	75	65.8
Self-employed	3	2.6
Migrant labors	14	12.3
Student	17	14.9
Others	5	4.4
Total	114	100.0

1.4 Education

	Number	Percentage (%)
No	18	16.1
Primary school	37	33.0
Junior high school	38	33.9
Senior high school	15	13.4
College and above	4	3.6
Total	112	100.0

1.5 Household population

	Number	Percentage (%)
1	5	4.5
2	3	2.7
3	6	5.4
4	24	21.4
5	33	29.5
6	20	17.9
7	8	7.1
8	6	5.4
9	2	1.8
10	2	1.8
11	2	1.8
13	1	0.9
Total	112	100.0

2. BUILDING DAMAGE CAUSED BY DISASTERS

2.1-2.4 Damage caused by the fires and floods

Fire					Flood				
	Fire (1940s)		Recent 30 years			Flood (1920s)		Floods (1996 and 1997)	
Damage situation	Number	(%)	Number	(%)	Inundated situation	Number	(%)	Number	(%)
Unsure	66	57.9	3	2.6	Unsure	64	8.1	3	3.0
Did not affected	36	31.6	104	91.2	Did not affected	35	29.7	73	73.7
1/3 burnt	1	0.9	1	0.9	Scarely inundated	10	24.3	9	9.1
Half burnt	1	0.9	3	2.6	Less than one meter	3	32.4	12	12.1
More than half burnt	2	1.8	2	1.8	more than one meter, less than two meters	1	2.7	1	1.0
Totally burnt	8	7.0	1	0.9	more than two meters	0	2.7	1	1.0
Total	114	100.0	114	100.0	Total	113	100.0	99	100.0

2.5 Reason of no retrofit

	Number	Percentage (%)
Insufficient financial capacity	56	57.1%
Limited acess to building technology	23	23.5%
Lack of labor	10	10.2%
Administrative licensing problem	1	1.0%
No necessity	28	28.6%
Others	9	9.2%
Total	127	129.6%

3. PEOPLE'S FIRE-RESISTANCE BUILDING IMPROVEMENT

Types		Pillar	Beam	Wall	Abbreviation	Number (%)
Non-transformed buildings (Original)		Wood	Wood	Wood	W-W-W	212 (71%)
Transformed buildings	Type 1	Wood	Wood	Brick	W-W-B	25 (8%)
	Type 2	Brick	Wood	Brick	B-W-B	22 (7%)
	Type 3	Brick	RC	Brick	B-RC-B	4 (1%)
	Type 4	RC	RC	Brick	RC-RC-B	6 (2%)
	Not clear	—	—	Brick	—	31 (10%)

4 SUPPLEMENTARY SURVEY ON DAMAGE CAUSED BY LANDSLIDES AND RESPONSE

4.1 Damage caused by landslides within 10 years

	Number	Percentage (%)
1	8	21.1
2	6	15.8
3	2	5.3
4	1	2.6
10	17	44.7
14	1	2.6
15	2	5.3
20	1	2.6
Total	38	100.0

4.2 The severest damage

	Number	Percentage (%)
Partly	35	89.7
Half	4	10.3
Total	39	100.0

4.3 Affected situation

	Number	Percentage (%)
Foundation	6	15.4
Wall	38	97.4
Total	44	112.8

4.4 Plan to move

	Number	Percentage (%)
No	10	25.6
Yes	29	74.4
Total	39	100.0

4.5 Reason of have not move

	Number	Percentage (%)
No land	30	76.9
No money	21	53.8
No labor	4	10.3
No necessity	10	25.6
Total	65	166.7

4.6 A retaining wall

	Number	Percentage (%)
No	32	82.1
Yes	7	17.9
Total	39	100.0

5. PEOPLE'S FLOOD-RESISTANCE BUILDING IMPROVEMENT

(Note: A. Elevated; B. Stilted; C. Elevated and stilted; D. No improvement)

No.	From riverbank (M)	Stilted (M)	Material	Elevated (M)	Material	Wall of 1st floor	Note
A58	0	0	-	0	-	Wood	D
A09	2.4	2.4	Brick	0	-	Wood	B
A11	0	0	-	0	-	Wood	D
A12	2	2	Brick	0	-	Wood	B
A13	1.5	0	-	1.5	Stone	Wood	A
A14	0	0	-	0	-	Wood	D
A32	1.1	0	-	1.1	Stone	Wood	A
A30	3	3	Brick	0	-	Wood	B
B41	3.1	1.5	Wood	1.6	Stone	Wood	C
B42	0	0	-	0	-	Wood	D
B44	0.4	0.4	Wood	0	-	Wood	B
D17	2.6	0	-	2.6	Stone	Wood	A
D18	2.6	0	-	2.6	Stone	Wood	A
D19	2.2	0	-	2.2	Stone	Wood	A
D20	0.7	0	-	0.7	Stone	Wood	A
E17	0	0	-	0	-	Wood	D
E16	0	0	-	0	-	Brick	D
E15	0	0	-	0	-	Wood	D
E14	0.6	0	-	0.6	Stone	Wood	A

E13	0	0	-	0	-	Wood	D
E12	1	0	-	1	Stone	Wood	A
E53	0	0	-	0	-	Brick	D
E23	1.5	0	-	1.5	Stone	Wood	A
E24	0.5	0	-	0.5	Stone	Wood	A
E25	0	0	-	0	-	Wood	D
E26	0	0	-	0	-	Brick and wood	D
E27	0.3	0	-	0.3	Stone	Wood	A
E28	2.5	2.5	Stone	0	-	Wood	B
E29	0	0	-	0	-	Wood	D
E37	2.9	2.9	Stone	0	-	Wood	B
E52	3	3	Wood	0	-	Brick and wood	B
E38	3	3	Brick	0	-	Brick and wood	B
E51	0	0	-	0	-	Wood	D
E40	4	2.5	Brick, stone	1.5	Stone	Wood	C
E41	3.5	2.2	Stone	1.3	Stone	Wood	C
E42	3	0	-	3	Stone	Wood	A
C27	0	0	-	0	-	Wood	D
C26	0	0	-	0	-	Wood	D
C30	0	0	-	0	-	Wood	D
C32	0	0	-	0	-	Wood	D
C12	3	3	-	0	-	Wood	B
C04	1.5	1.5	Brick	0	-	Brick	B
C05	0.5	0.5	Stone	0	-	Wood	B
C03	0	0	-	0	-	Wood	D
C02	0	0	-	0	-	Wood	D
C01	0	0	-	0	-	Wood	D
F15	0.5	0.5	Brick	0	-	Wood	B
F18	2.5	2.5	Wood	0	-	Wood	B
F17	0.4	0.4	Stone	0	-	Wood	B
F23	0.5	0	-	0.5	Stone	Wood	A
F22	0.3	0	-	0.3	Stone	Wood	A
F21	0.8	0	-	0.8	Stone	Wood	A
F20	0	0	-	0	-	Wood	D
F03	0	0	-	0	-	Wood	D
F02	0	0	-	0	-	Wood	D
F01	0	0	-	0	-	Wood	D
G02	4	0	-	4	Stone	Wood	A
G04	5	2.5	Wood	2.5	Stone	Wood	C
G07	0	0	-	0	-	Wood	D
G08	0	0	-	0	-	Brick	D
G14	2.5	0	-	2.5	Stone	Wood	A
G16	0	0	-	0	-	Brick	D
G17	0	0	-	0	-	Brick	D
G19	0	0	-	0	-	Wood	D

STRUCTURED INTERVIEW 2 (For Dali villager – Risk awareness)

The main purpose of the structured interview is to investigate the disaster experience and response of the local people in Dali Village. The content, which is same with in Shangli Village, is omitted (Please see the questionnaire 3 in appendix 1). This structured interview was conducted to 115 residents during July 2015. The brief results of the structured interview are as follows.

1. RISK AWARENESS

1.1-1.6 Possibilty of a earthquake, flood, and a fire in the future 30 years and possible damage

Possibilty	An earthquake (>M 7.0)				A large flood				A large fire			
	Earthquake		House damage		Flood		House damage		Fire		House damage	
	Number	(%)	Number	(%)	Number	(%)	Number	(%)	Number	(%)	Number	(%)
Definitely	0	0	35	30.7	7	6.1	18	15.8	9	8.0	44	38.3
May	2	1.7	38	33.3	26	22.6	28	24.6	36	31.9	40	34.8
May not	42	36.5	18	15.8	49	42.6	15	13.2	42	37.2	25	21.7
Definitely not	56	48.7	16	14.0	29	25.2	43	37.7	21	18.6	4	3.5
Unsure	15	13.0	7	6.1	4	3.5	10	8.8	5	4.4	2	1.7
Total	115	100.0	114	100.0	115	100.0	114	100.0	113	100.0	115	100.0

2. DISASTER PREPAREDNESS

2.1-2.3 Preparedness situation, emergency goods, and emergency measures

Preparedness situation			Emergency goods			Emergency measures		
Preparedness	Number	(%)	Goods	Number	(%)	Measures	Number	(%)
Well considered	8	7.1	Food	15	41.7	Packaged the important goods for emgency evacuation	8	27.6
			Drinking water	12	33.3			
Considered	31	27.4	First aid bag	10	27.8	Checked safe place for emgency evacuation	13	44.8
			Drugs	7	19.4			
Unsure	0	0	Radio	2	5.6	Considered an evacuation route	16	55.2
I almost didn't consider	40	35.4	Emergency tools	4	11.1	Discussed an emgency contact with family	9	31.0
			Personal goods	5	13.9	Discussed an emergency rescue method with neighbors	13	44.8
I never consider	34	30.1	Others	11	30.6	Others	2	6.9
Total	113	100.0	Total	66	183.3	Total	61	210.3

3. DISASTER RESPONDING

3.1 Action when a earthquake happens

Action	Number	Percentage (%)
Hid under a table or near a column	20	17.7
Open the window or door	4	3.5
Hold the furniture	0	0
Help the weak	29	25.7
Stand to prevent failling	2	1.8
Cut off the power	11	9.7
Fly outdoors	66	58.4
Others	36	31.9
Total	168	148.7

3.2-3.3 Awareness of safe place for emergency evacuation and location of emergency tools

Awareness	Safe place for emergency evacuation		Location of emergency tools	
	Number	Percentage (%)	Number	Percentage (%)
Yes, I know	47	43.9	27	24.5
No, I don't know	44	41.1	62	56.4
Unsure	16	15.0	21	19.1
Total	107	100.0	110	100.0

3.4 Action when a fire happens

Action	Number	Percentage (%)
Shout to notice	46	43.0
Rescue elder and children	80	74.8
Firefighting	38	35.5
Run out	13	12.1
Close the fire room door	10	9.3
Call 119	37	34.6
Ask for help	47	43.9
Others	4	3.7
Total	275	257.0

3.5-3.8 Awareness of fire extinguisher's location and usage, and a safe place and evacuation route when a flood happens

Awareness	Fire extinguisher's location		Fire extinguisher's usage		Evacuation site when flood		Evacuation route when flood	
	Number	(%)	Number	(%)	Number	(%)	Number	(%)
Yes, I know	95	83.3	52	46.0	107	93.9	96	85.0
No, I don't know	17	14.9	58	51.3	5	4.4	9	8.0
Unsure	2	1.8	3	2.7	2	1.8	8	7.1
Total	114	100.0	113	100.0	114	100.0	113	100.0

4. PARTICIPATION IN DISASTER EDUCATION AND TRAINING

4.1-4.2 Participation in disaster education and training activities

Awareness	Disaster education		Disaster training	
	Number	Percentage (%)	Number	Percentage (%)
Never	77	67.0	79	68.7
Once	15	13.0	17	14.8
2 times	8	7.0	6	5.2
3 times	12	10.4	11	9.6
More than 3 times	3	2.6	2	1.7
Total	115	100.0	115	100.0

5. RELIABLE GROUP WHEN EMERGENCY

5.1 Reliable group when emergency

Groups	Number	Percentage (%)
Family	66	58.4
Neighbors	52	46.0
Villagers	55	48.7
Village committee and leaders	58	51.3
Police	15	13.3
Firefighting agency	20	17.7
Army	15	13.3
Local government	35	31.0
Social organization and volunteers	22	19.5
Doctor	12	10.6
Others	8	7.1
Total	358	316.8

STRUCTURED INTERVIEW 3 (For Dali villager – Participation in community activities)

The main purpose of the structured interview is to investigate the local people's participation in community activities, which include two sections: common activities and disaster-related activities. In addition, their willingness of partcipation is also asked. The content, which is same with in Shangli Village, is omitted (Please see the questionnaire 4 in appendix 1). This structured interview was conducted to 115 residents during July 2015. The brief results of the structured interview are as follows.

1. People's participation and willingness to participate in community activities

Catalogy	Activity	Willingness		Partcipation				
		Yes	No	Never	Once	2 times	≥3 times	Unsure
Village	Village affairs assistance	79	32	90	1	2	10	9
Ordinary events	Festival	99	12	19	5	6	18	64
	Wedding and Funeral	104	7	9	0	2	15	86
	House construction	96	15	29	1	0	14	67
	Meeting	73	38	102	3	1	0	6
	Sports meeting	67	44	94	3	1	1	13
Group activity	Elder group	82	28	99	0	1	2	10
	Children	75	35	98	4	3	1	6
	Youth	74	36	102	0	2	0	8
	Women group	71	40	95	5	2	2	8
	Sports	73	38	100	0	2	0	10
Theme activity	Disaster risk reduction measures	81	30	98	1	0	1	12
	Anticrime	77	34	99	1	2	0	10
	Resource	79	32	102	1	0	1	8
	Fire-prevention	90	21	87	2	2	2	19
	Living environment improvement	88	23	83	2	1	2	24
	Farming technique	89	22	91	2	0	3	16
	Village development	89	22	96	0	1	2	13
Welfare activity	Dailylives support	93	18	86	2	0	0	24
	Condolences	92	19	88	2	0	0	22
Disaster-related activities								
Catalogy	Activity	Willingness		Partcipation				
		Yes	No	Never	Once	2 times	≥3 times	Unsure about how many times
Disaster education	Disaster Knowledge	103	9	89	2	0	0	21
	Disaster coping	104	8	88	2	0	0	22
	Fire prevention	104	8	84	2	0	0	26
	First Aid	103	9	98	0	0	0	13
Disaster training	Disaster coping	96	16	94	3	0	0	15
	Disaster drill	96	16	96	1	0	0	15
	Emergency rescue	95	17	103	0	0	0	9
Disaster risk inspection	Risk inspection	92	20	109	0	0	0	3
	Facilities inspection	92	20	110	0	0	0	2
	Facilities maintanence	91	21	111	0	0	0	1
	Information check	90	22	111	0	0	0	1
	Information transmission	90	22	109	0	0	0	3

2. People's perception on driving force of community activities

Catalogy	Activity	Dirving force					
		Individual	Family	Neighbors	Villagers	Village committee	Local government
Village affairs	Village affairs assistance	6	5	4	33	101	18
Ordinary events	Festival	19	23	13	57	84	19
	Wedding and Funeral						
	House construction						
	Meeting						
	Sports meeting						
Group activity	Elder group	9	3	3	47	91	15
	Children						
	Youth						
	Women group						
	Sports						
Theme activity	Disaster risk reduction measures	11	5	4	43	97	21
	Anticrime						
	Resource						
	Fire-prevention						
	Living environment improvement						
	Farming technique						
	Village development						
Welfare activity	Dailylives support	6	3	7	37	93	20
	Condolences						
	Others						

Disaster-related activities

Catalogy	Activity	Dirving force					
		Individual	Family	Neighbors	Villagers	Village committee	Local government
Disaster education	Disaster Knowledge	3	3	2	27	92	34
	Disaster coping						
	Fire prevention						
	First Aid						
Disaster training	Disaster coping	2	3	3	30	94	31
	Disaster drill						
	Emergency rescue						
Disaster risk inspection	Risk inspection	3	3	2	27	93	31
	Facilities inspection						
	Facilities maintanence						
	Information check						
	Information transmission						

STRUCTURED INTERVIEW 4 (For Dali villager – Social capital)

The main purpose of the structured interview is to investigate the community's social capital in Dali Village. It includes six sections: groups and networks, trust and solidarity, collective action and cooperation, information and communication, social cohesion and inclusion, and empowerment and political action. This structured interview was conducted to 115 residents during February 2016.

1. GROUPS AND NETWORKS

1.1 Which group you or any member of your family belong ?

☐ Village committee……☐Volunteer firefighting troop…….☐Grand Song team... ☐Singing group…….
☐ Dong dram team…..... ☐ Elder group (Zhailao)……..☐Bird group…….. ☐ Others……

1.2 Of these groups to which you or members of your family belong, which one is the most important ?

☐ Village committee……☐Volunteer firefighting troop…….☐Grand Song team... ☐Singing group…….
☐ Dong dram team…..... ☐ Elder group (Zhailao)……..☐Bird group…….. ☐ Others……

1.3 Does this group interact with groups outside the village ?..... ☐ Frequently ☐ Occasionally ☐ No……

1.4 How many close friend do you have recently that you can call on for help ? …….

1.5 If you suddenly needed to borrow a small amount of money (week expense), are your friends willing to provide ?

☐Definitely……. ☐Probably…….. ☐Unsure…… ☐ Probably not…..…….. ☐Definitely not....

2. TRUST AND SOLIDARITY

2.1 Generally speaking, most villager in your community can be trusted or that you can't be too carefull in dealing with them ? …… ☐ People can be trusted…..…… ☐ You can't be too carefull…...

2.2 In general, are most villagers in your community willing to help if you need it ?

☐Definitely……. ☐Probably…….. ☐Unsure…… ☐ Probably not…..…….. ☐Definitely not....

2.3 How much do you trust local government officials ?

☐ To a very great extent…☐ To a great extent.. ☐ To a small extent...☐To a very small extent…☐Unsure

2.4 How much do you trust central government officials ?

☐ To a very great extent…☐ To a great extent.. ☐ To a small extent...☐To a very small extent…☐Unsure

2.5 Woule you contribute time to the project in your community, which does not directly benefit you but has benefits for many others in the community? …….…… ☐ Yes, I will…… ☐ No, I will not…..

2.6 Woule you contribute money to the project in your community, which does not directly benefit you but has benefits for many others in the community? …….…… ☐ Yes, I will…… ☐ No, I will not…..

3. COLLECTIVE ACTION AND COOPERATION

3.1 In the past year, did you or any one in your family partcipate in any communal activities, in which villagers came together to do some work for the benefit of your community ? …… ☐Yes, …..times; ☐No

3.2 How likely is it that villagers will cooperate to try to solve the problem if there was a water supply problem in your community ?

☐Very likely…☐Somewhat likely...☐Neither likely or unlikely. ☐ Somewhat unlikely...☐Very unlikely

4. INFORMATION AND COMMUNICATION

4.1 What are your main sources of information about the government's policy ?

☐Relatives, friends and neighbors…☐Village committee...☐Local market…☐Newspaper… ☐ Radio…

☐Community bulletin board…….☐Television……☐Work place….. ☐ Zhailao…… ☐Internet..

☐Grand Song team or singing group…….☐Other groups or organizations……..

5. SOCIAL COHENSION AND INCLUSION

5.1 To what extent do any differences characterize your community, such as difference in wealth ?

☐To a very great extent…☐To a great extent.. ☐ To a small extent...☐To a very small extent…☐Unsure

5.2 Do any of these differences cause problems ?……..... ☐ Yes……. ☐ No……

5.3 How many times in the past month that you had food or drinks together ? …….....……

5.4 In general, how safe from crime and violence do you feel when you are alone at home ?

☐Very safe……☐Moderately safe….. ☐ Neither safe nor unsafe....☐Moderately unsafe….☐Very unsafe

6. EMPOWERMENT AND POLITICAL ACTION

6.1 In general, how happy do you consider yourself to be ?

☐Very happy☐Moderately happy☐Neither happy nor unhappy ☐ Moderately unhappy ☐ Very unhappy

6.2 Do you feel that you have the power to make important decisions that change the course of your life ?

☐Totally unable.....☐Mostly unable…... ☐Neither unable nor able…...☐Mostly able……..☐Totally able

6.3 In the past year, how many times did you join in petition for something benefiting your community ?.....

6.4 Did you vote on the last villager leader election ? ……..... ☐ Yes…… ☐No……

Brief result of the structured interview 4 (For Dali villager – Social capital)

1. GROUPS AND NETWORKS

1.1-1.2 Members in community groups and interaction with groups outside the village

	Groups		Interaction		
	Number	Percentage (%)		Number	Percentage (%)
No	19	17.6	No interaction	17	21.3
Village committee	8	7.4			
Volunteer firefighting troop	29	26.9	Occasionally	52	65.0
Singing group	31	28.7			
Drama group	14	13.0	Frequently	11	13.8
Bird fighting group	50	46.3			
Zhailao member	54	50.0			
Total	81	189.8	Total	80	100.0

1.3 Close friend and possibility of obtaining financial help from friends

Number of close friend	Close friend		Possibility of obtaining financial help		
	Number	Percentage (%)	Possibility	Number	Percentage (%)
0	6	17.6	Definitely	18	16.7
1	2	5.9			
2	6	17.6	Probably	61	56.5
3	4	11.8			
4	2	5.9	Unsure	25	23.1
5	4	11.8	Probably not	2	1.9
6	1	2.9	Definitely not	2	1.9
10	9	26.5			
Total	34	100.0	Total	108	100.0

2. TRUST AND SOLIDARITY

2.1 Trust on villagers

	Number	Percentage (%)
People can be trusted	84	77.8
You can't be too carefull	21	19.4
Unsure	3	2.8
Total	108	100.0

2.2 Willing to help

	Willing to help	
	Number	Percentage (%)
Definitely	13	12.0
Probably	64	59.3
Unsure	29	26.9
Probably not	2	1.9
Definitely not	0	0
Total	108	100.0

2.3-2.4 Trust on local government officials and central government officials

	Local government officials		Central government officials	
	Number	Percentage (%)	Number	Percentage (%)
To a very great extent	7	6.5	16	14.8
To a great extent	53	49.1	73	67.6
Unsure	35	32.4	16	14.8
To a small extent	13	12.0	3	2.8
To a very small extent	0	0	0	0
Total	108	100.0	108	100.0

2.5-2.6 Contribute time and money to the community project

	Local government officials		Central government officials	
	Number	Percentage (%)	Number	Percentage (%)
Yes, I will	108	100.0	105	97.2
No, I will not	0	0	3	2.8
Total	108	100.0	108	100.0

3. COLLECTIVE ACTION AND COOPERATION

3.1-3.2 Partcipate in collective action and cooperation for community

	Partcipate in collective action		Cooperation for community		
	Number	Percentage (%)	Possibility	Number	Percentage (%)
Never	16	15.2	Very likely	18	16.7
Once	3	2.9	Somewhat likely	46	42.6
2 times	9	8.6	Neither likely or unlikely	39	36.1
3 times	4	3.8	Somewhat unlikely	4	3.7
4 times	2	1.9	Very unlikely	1	0.9
10 times	71	67.6	Other(management company)	0	0
Total	105	100.0	Total	108	100.0

4. INFORMATION AND COMMUNICATION

4.1 Main sources of information

Groups	Number	Percentage (%)
Relatives, friends and neighbors	38	36.9
Village committee	36	35.0
Local market	0	0
Newspaper	0	0
Radio	57	55.3
Community bulletin board	63	61.2
Television	13	12.6
Work place	3	2.9
Zhailao	22	21.4
Grand Song team or singing group	0	0
Internet	5	4.9
Other groups or organizations	2	1.9
Total	239	232.0

5. SOCIAL COHENSION AND INCLUSION

5.1, 5.2 Community's difference and problems

Difference			Problems		
	Number	Percentage (%)		Number	Percentage (%)
To a very great extent	2	1.9	Yes	24	22.4
To a great extent	69	64.5			
Unsure	26	24.3	No	83	77.6
To a small extent	9	8.4			
To a very small extent	1	0.9			
Total	107	100.0	Total	107	100.0

5.3-5.4 Have food or drinks and perception on safety

	Have food or drinks		Perception on safety		
	Number	Percentage (%)	Possibility	Number	Percentage (%)
Never	9	9.2	Very safe	11	10.2
2 times	2	2.0	Moderately safe	70	64.8
3 times	10	10.2	Neither safe nor unsafe	15	13.9
4 times	16	16.3			
5 times	12	12.2			
6 times	1	1.0	Moderately unsafe	11	10.2
>6 times	48	49.0	Very unsafe	1	0.9
Total	98	100.0	Total	108	100.0

6. EMPOWERMENT AND POLITICAL ACTION

6.1-6.2 Perception on happiness and power to change life

Perception on happiness			Power to change life		
	Number	Percentage (%)		Number	Percentage (%)
Very happy	2	1.9	Totally able	5	4.6
Moderately happy	51	47.2	Mostly able	37	34.3
Neither happy nor unhappy	39	36.1	Neither unable nor able	60	55.6
Moderately unhappy	14	13.0	Mostly unable	6	5.6
Very unhappy	2	1.9	Totally unable	0	0
Total	108	100.0	Total	108	100.0

6.3-6.4 Participation in joint petition and village election

Joint petition			Village election		
	Number	Percentage (%)		Number	Percentage (%)
Never	29	26.9	Yes	100	100.0
Once	13	12.0			
2-5 times	46	42.6	No	0	0
>5 times	2	1.9			
Unsure	18	16.7			
Total	108	100.0	Total	100	100.0

STRUCTURED INTERVIEW 5 (For volunteer firefighters in Dali Village)

The main purpose of the structured interview is to investigate the ten volunteer firefighters' participation in the troop's activities, as well as to understand their experience and motivation as a volunteer firefighter. In addition, their expectation and suggestion to the volunteer firefighting troop's development in the future are also asked. This structured interview was conducted to 10 volunteer firefighters during February 2016.

1. GENERAL INFORMATION

1.1 Age……1.2 Sex……1.3 Occupation……..

2. PARTICIPATION IN THE TROOP'S ACTIVITIES

2.1 How many times did you join in the following activities in the last year?

Firefighting …… times; Training …… times; Risk inspection …… times

Propaganda……times; Facility maintanence……times; Measure discussion……times

2.2 Are you able to use the following facilities or to implement a first aid during emergency ?

Fire extinguisher……☐ Able to ☐Unable to Fire hydrant…… ☐ Able to ☐ Unable to

Motor pump……...☐ Able to ☐Unable to First Aid……..…☐ Able to ☐ Unable to

2.3 How many percentage of the volunteer firefighters could join in the daily activities ?

☐Almost all of us…☐About 80% … ☐About 60% …☐About 40% …☐About 20% …☐Less than 20%

2.4 Are you able to participate in the troop's daily activities in most occasions ? … ☐ Able to ☐ Unable to

2.5 Why you are unable to participate in the troop's daily activities ? ……

3. EXPERIENCE AS A VOLUNTEER FIREFIGHTER

3.1 From…….(Year)To…….(Year)

3.2 The reason of joining the volunteer firefighting troop

☐ I want to join…. ☐ It is a tradition…. ☐ Appointed by the Shangli administrative office…… ☐ Others

3.3 The merit of being a volunteer firefighter

☐ I am pround of being a volunteer firefighter to protect the village……

☐ I improved the relationship with other villagers since being a volunteer firefighter……

☐ I learned much knowledge since being a volunteer firefighter……

☐ It is a good experience for my career…… ☐ It is a exciting experience…… ☐ Others……..

3.4 The shortcoming of being a volunteer firefighter

☐ Dangerous…☐Training activities are troublesome…☐Time consuming… ☐No payment…☐Others..

3.5 The villagers' evaluation on the volunteer firefighters

☐ High …… ☐ Common …… ☐ Low ……☐ Unsure……

4. DEVELOPMENT OF THE VOLUNTEER FIREFIGHTING TROOP

4.1 In you opnion, to what extent does the village have a high fire risk ?

☐To a very great extent ☐To a great extent ☐To a small extent ☐To a very small extent ☐Unsure

4.2 In you opnion, to what extent do the village's disaster coping facilities are sufficient ?

☐To a very great extent ☐To a great extent ☐To a small extent ☐To a very small extent ☐Unsure

4.3 In you opnion, to what extent do the village's disaster risk reduction measures are sufficient ?

☐To a very great extent ☐To a great extent ☐To a small extent ☐To a very small extent ☐Unsure

4.4 In you opnion, to what extent do the volunteer firefighter are sufficient?

☐To a very great extent ☐To a great extent ☐To a small extent ☐To a very small extent ☐Unsure

4.5 In you opnion, Could the volunteer firefighters be sufficient in the future ?

☐ Yes, it could be ensured…… ☐ No, It is difficult to ensure……. ☐ Unsure……

4.6 Do you have some suggestions for the development of the volunteer firefighting troop ?…….

Brief result of the structured interview 5 (For volunteer firefighters in Dali Village)

1. GENERAL INFORMATION

1.1 Age

Age	Number	Percentage
34	1	10%
36	1	10%
38	1	10%
45	1	10%
48	1	10%
52	2	20%
54	1	10%
55	1	10%
58	1	10%
Total	10	100%

1.2 Sex (100% are male)

1.3 Occupation (90% are Shangli administrative official staff; 10% is villager of Shangli Village)

1.4 Are you a villager of Shangli Village
(10% are farmer; 30% are migrant workers; 50% are village committee members; 10% are half farmer half migrant worker)

2. PARTICIPATION IN THE TROOP'S ACTIVITIES

2.1 How many times did you join in the following activities in the last year?
Training (10% are never; 30% are 2 times; 50% are 12 times; 10% is 15 times); Facility maintanence (70% are never; 30% are 12 times); Firefighting, risk inspection, Propaganda, and measure discussion (100% are never)

2.2 Are you able to use the following facilities or to implement a first aid during emergency ?
Fire extinguisher and fire hydrant (100% are able to); Motor pump (90% are able to; 10% are unable to); First Aid (10% are able to; 90% are unable to)

2.3 How many percent of the volunteer firefighters could join in the daily activities ?
(100% - about 50% of the members could participate, the absent members are not in the village)

2.4 Are you able to participate in the troop's daily activities in most occasions ? (100% - I am able to unless I have to work outside of the village)

2.5 Why you are unable to participate in the troop's daily activities ? (-)

3. EXPERIENCE AS A VOLUNTEER FIREFIGHTER

3.1 From…….(Year)To…….(Year)

From	To	Number	Percentage
1990	Now	1	10%
2001	Now	1	10%
2006	Now	1	10%
2007	Now	1	10%
2008	Now	1	10%
2010	Now	3	30%
2013	Now	1	10%
2015	Now	1	10%
Total	Now	10	100%

3.2 The reason of joining the volunteer firefighting troop

(100% are appointed by the village committee; 70% are want to join)

3.3 The merit of being a volunteer firefighter

(100%) I am pround of being a volunteer firefighter to protect the village

(20%) I have improved the relationship with other villagers since being a volunteer firefighter

(30%) I gained much knowledge since being a volunteer firefighter

3.4 The shortcoming of being a volunteer firefighter (100%) No shortcoming

3.5 The villagers' evaluation on the volunteer firefighters (20% are high; 70% are common; unsure is 10%)

4. DEVELOPMENT OF THE VOLUNTEER FIREFIGHTING TROOP

4.1 In your opnion, to what extent does the village have a high fire risk ? (100% To a very great extent)

4.2 In your opnion, to what extent do the village's disaster coping facilities are sufficient ?

(30%) To a great extent; (70%) To a very small extent

4.3 In your opnion, to what extent do the village's disaster risk reduction measures are sufficient ?

(20%) To a great extent; (70%) To a small extent

4.4 In your opnion, to what extent do the volunteer firefighter are sufficient?

(60%) To a great extent; (30%) To a small extent; (10%) Unsure

4.5 In your opnion, Could the volunteer firefighters be sufficient in the future ?

(90%) Yes, it could be ensured; (10%) Unsure

4.6 Do you have some suggestions for the development of the volunteer firefighting troop ?

(50% suggested more financial support; 40% suggested that all villagers should be involved; 40% suggested facilities improvement; 10% suggested the troop's activities should be more professional)

SEMI-STRUCTURED INTERVIEW (For village leader in Dali Village)

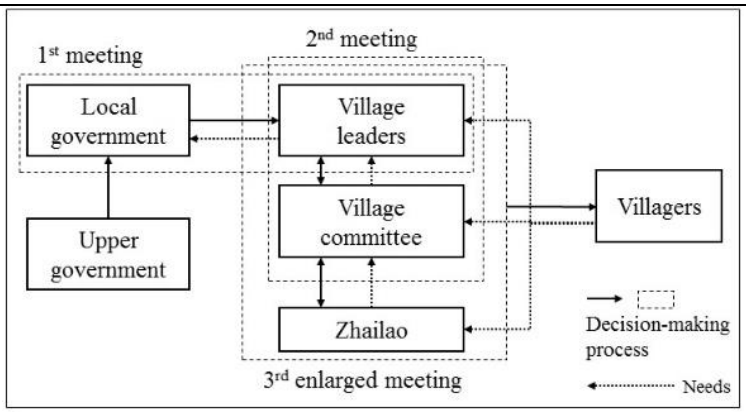
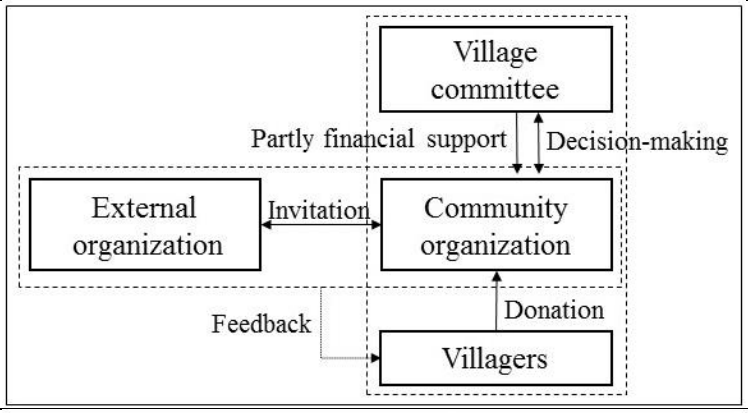
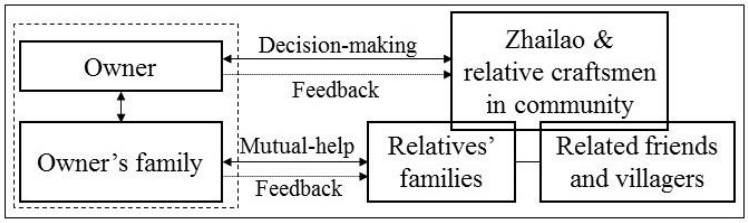
The main purpose of the semi-structured interview is to understand the village and disaster information, and community's disaster risk reduction measures in Dali Village.

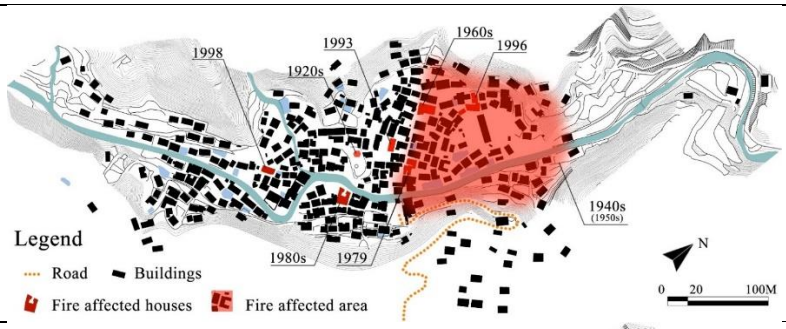
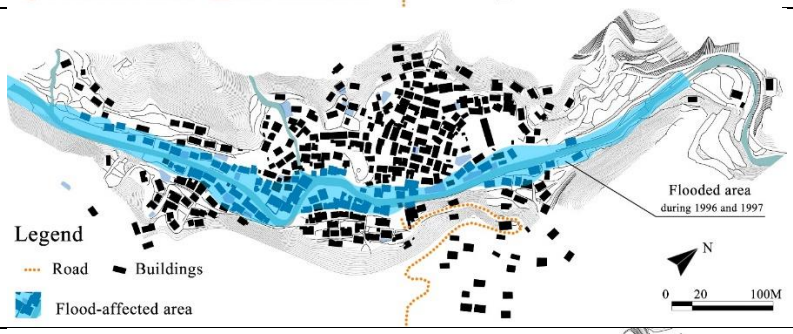
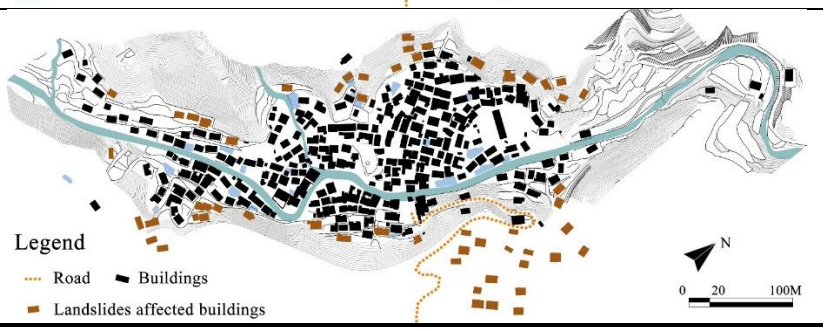
Interviewee: Mr. Shi Jinchang, the village leader in Dali Village

Date: July 2015 and February 2016

Location: Mr. Shi's house

1. VILLAGE PROPERRY AND DISASTER IMFORMATION

Topic	Questions	Answers
Village information	History of the village	Village was built during 1730s, migranted from Jiangxi province
	Population	1308 (2016)
	Household	309
	Percentage of permanent resident	100% Dong ethnic people
Decision-making process	Decision-making process	
Operation process of public and private issues	Public issues	
	Private issues	
Disaster experience	Earthquake	Rarely, Jianhe Earthquake M 5.5 (2016)
	Flood	Floods in 1996 and 1997, Flood in 1920s
	Fire	High risk
	Landslides	Every year
	Others	No

Disaster damage	Earthquake	—
	Fire	
	Flood inundated area	
	Landslides affected area	

2. BUILDING IMPROVEMENT PROJECTS

2.1 What is the purpose of the building improvement projects ?…….....……..…….

Answer: The purpose is to improve the vulnerable residential houses in rural villages. However, the real action of the local government is limited to financial support for new building construction. Thus, some problems were caused. For example, the distribution of the financial support led to conflict among villagers. In addition, in historical villages, the subsidy is used for decorating the houses that are not good-looking in a traditional style. Consequently, the vulnerable buildings are not realy improved at all.

2.2 Please describe the stakeholders of the financial, technical support and the implementer of the building improvement projects ……..……..……..……...

Answer: The local government provided financial support, and delegated business companies to conduct the projects.

2.3 Please describe the roles of the local government, village leaders, village committee, community groups, villagers during the building improvement projects ……..……

Answer: The plan and implementation are all decided by the local government. Our village committee is

just in charge of cordinating the villagers to cooperate when we get the arrangement from local government.

2.5 Do these projects give specific consideration on the conservation of cultural heritage ?..…….
Answer: There seems not much consideration on the conservation of cultural heritage. It is really a problem that I feel quite difficult. For example, one project is about fire break, which is remarkably urgently needed in our village. However, it is impossible to make a fire break from the perspective of village conservation, but we don't know how to deal with this ambivalent situation. What we can do is to set aside this problem under the high fire risk and wait for local government and fire agency's decision.

2.6 Please describe the whole process of the ground oven tranformation project ...……
Answer: The plan and implementation are all decided by the local government. They provided financial support and delegated workers to conduct the project in every household one by one. Our village committee is just in charge of cordinating the villagers to cooperate when we get the arrangement from local government.

2.7 Please describe the effect of the ground oven tranformation project ……..…
Answer: This project really reduced the fire risk in our village. So does the electrical wiring replacement project.

2.8 How the villagers are involved in the ground oven tranformation project ? ……
Answer: They just need to treat the workers everyday during the project in their house.

2.9 Who provide the design of a new brick oven, and could the people raise some personal idea ? ……
Answer: The design is decided. Families basically have the same lifestyle and need a same oven.

3. INFRASTRUCTURE IMPROVEMENT PROJECT

3.1 Please describe the plans of infrastructure improvement……
Answer: The local government planned to conducted five projects for water resource, building improvement, electrical wiring replacement, ground oven transformation, and fire break construction. Among these, electrical wiring replacement and ground oven transformation have been completed in our village.

3.2 Please describe the stakeholders of the financial, technical support and the implementer of the infrastructure improvement project ……
Answer: It is same with building improvement projects. The plan and implementation are all decided by the local government. They also provided financial support and delegated workers to conduct the projects.

3.4 Please describe the roles of the local government, village leaders, village committee, community groups, villagers during the water supply infrastructure improvement project ……..……..……
Answer: The plan and implementation are all decided by the local government. Our village committee is

just in charge of cordinating the villagers to cooperate when we get the arrangement from local government. Villagers are required to work for projects sometimes.

4. FIRE PROTECT MEASURES

4.1 Please describe the fire protection measures in your village ……

Answer: Local government conducted overn transformation and electrical wiring replacement projects in our village. In addition, we have volunteer firefighting troop and night patrol. Most important is that we are trying to raise people's awareness by educating them and we always correct them when we find some dangerous behavior. Since our people are very active, if something happens, everyone will do their best.

4.2 Does your village still have some traditional fire protection measures ? ……

Answer: Yes, we have night patrol since long time ago and have delegated patroller since 1994. This activity is formally decided from 2008.

4.3 Please describe the condition of firefighting water resource and facilities in your village……

Answer: Usually, we can use the water from ponds or our river, which has three dam. In addition, local government is planning to build two common firefighting water tanks and a higher water tank with a total storage capacity of 230m^3 .

5. THE DEVELOPMENT OF THE VOLUNTEER FIREFIGHTING TROOP

5.1 Please describe the foundation and activities of volunteer firefighting troop in your village ……

Answer: Our volunteer firefighting troop as established in 2008 according to the local government's regulation. The troop has 44 members in total at present. 13 are village committee members, the other 31 are villagers. Since a great number of local people go out for migrant works, there are averagely just 20 members available at ordinary times.

5.2 Does the volunteer firefighting troop in your village have some problems of development ? ……

Answer: First, our troop lack of involvement of young generations, while more and more young people goes out to cities for work. Most of the available members are above 50 years old. Second, we lack of enough financial support to get enough facilities and for other measures. In addition, our volunteer need to be professionalized. Fourth, it is urgent that our village need a plan for a firebreak. But we have no idea, so that we are waiting for the local government to pay more attention to the vulnerability of our village.

APPENDIX 4: GENERAL INFORMATION OF 27 SURVEYED TRADITIONAL RESIDENTIAL BUILDINGS IN DALI VILLAGE

No. (01) A14 July 2015 and February 2016

Material

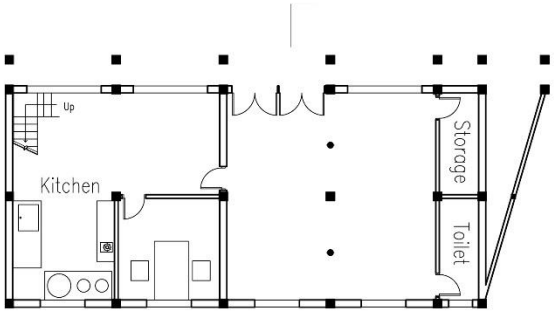
Location	Beam and pillar	Wall	Ceiling	Stairs
1F	Wood [Brick] RC	Wood [Brick] Adobe	[Wood] Brick Cement	[Wood] Brick Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

Cooking and heating facilities | **Fire protection facilities**

Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	[Have] no	[Have] no
[Have] no	Have [no]	[Have] no	Have [no]	Have [no]	[Have] no	Combustibles: S	

Effect of oven tranformation: [5] 4 3 2 1 0

PLANS & SECTIONS



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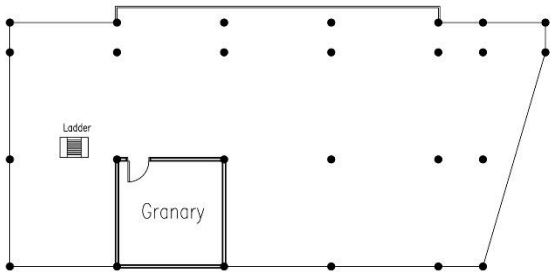

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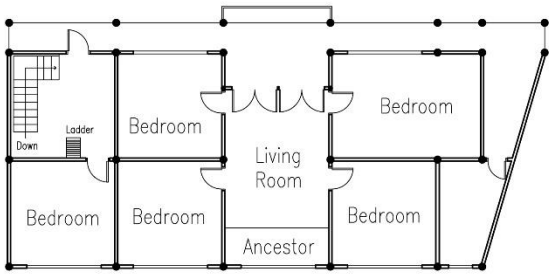

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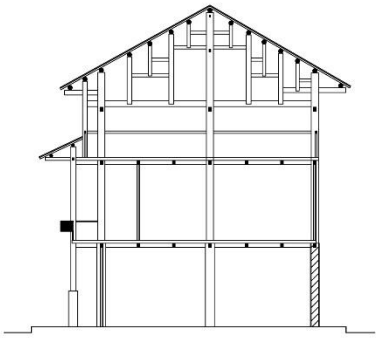


SECTION

No. (02) A17 July 2015 and February 2016

Material

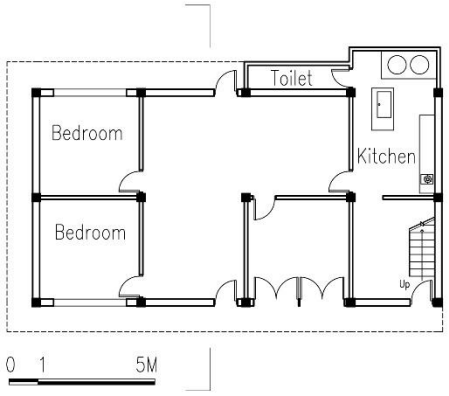
Location	Beam and pillar	Wall	Ceiling	Stairs
1F	Wood [Brick] RC	Wood [Brick] Adobe	[Wood] Brick Cement	Wood [Brick] Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	Wood [Brick] Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

Cooking and heating facilities | **Fire protection facilities**

Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	Have [no]	[Have] no
[Have] no	Have [no]	[Have] no	[Have] no	[Have] no	[Have] no	Combustibles: S	

Effect of oven tranformation: [5] 4 3 2 1 0

PLANS & SECTIONS



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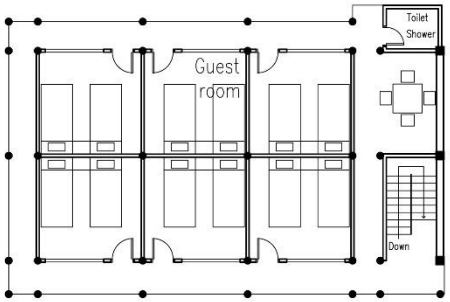

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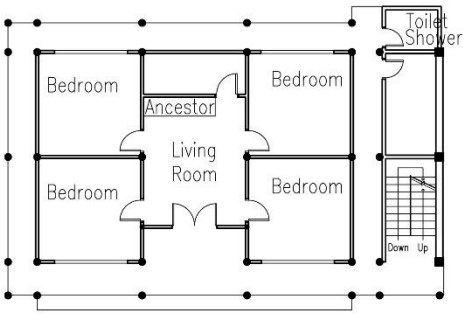

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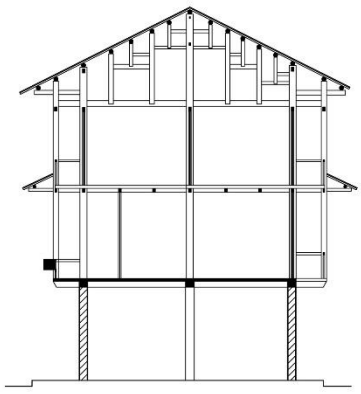


SECTION

No. (03) A23	July 2015 and February 2016

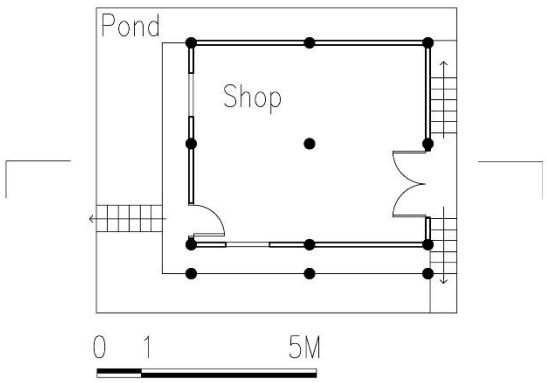
Material

Location	Beam and pillar	Wall	Ceiling	Stairs
1F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	Wood Brick [Cement]
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

Cooking and heating facilities						**Fire protection facilities**	
Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	[Have] no	Have no
Have no	Have no	Have no	Have no	Have no	Have no	Combustibles: —	

Effect of oven tranformation: **5 4 3 2 1 0**

PLANS & SECTIONS



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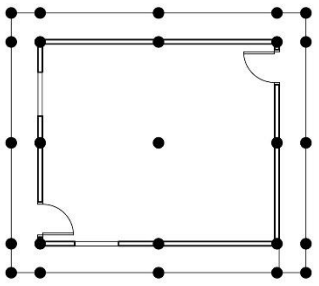

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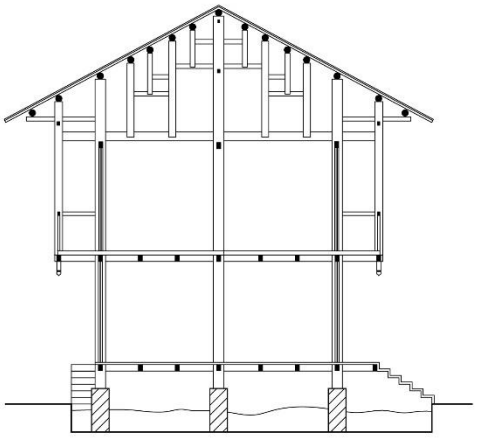


SECTION

No. (04) A35 July 2015 and February 2016

Material

Location	Beam and pillar	Wall	Ceiling	Stairs
1F	Wood [Brick] RC	Wood [Brick] Adobe	[Wood] Brick Cement	Wood [Brick] Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

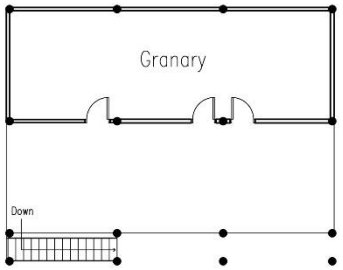
Cooking and heating facilities | **Fire protection facilities**

Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	Have [no]	Have [no]
[Have] no	[Have] no	[Have] no	Have [no]	Have [no]	[Have] no	Combustibles: S	

Effect of oven tranformation: [5] 4 3 2 1 0

PLANS & SECTIONS

1F PLAN



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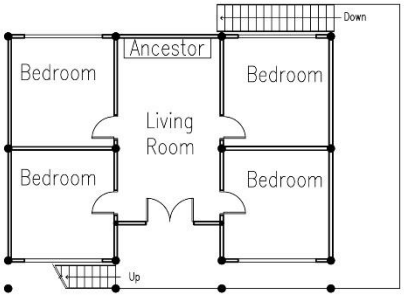

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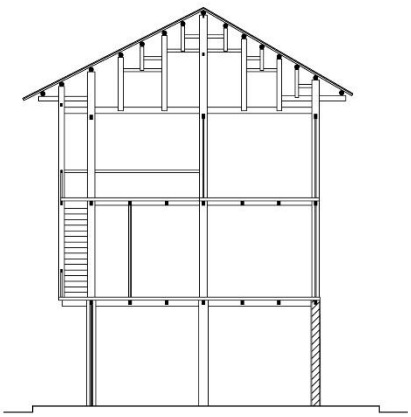


SECTION

No. (05) A53 July 2015 and February 2016

Material

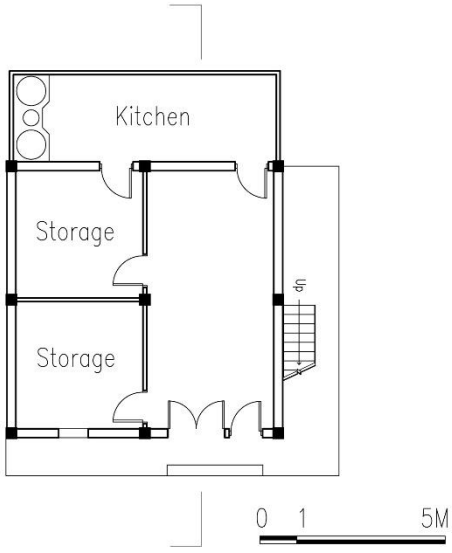
Location	Beam and pillar	Wall	Ceiling	Stairs
1F	Wood [Brick] RC	Wood [Brick] Adobe	[Wood] Brick Cement	[Wood] Brick Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

Cooking and heating facilities | **Fire protection facilities**

Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	Have [no]	Have [no]
[Have] no	[Have] no	[Have] no	Have [no]	Have [no]	Have [no]	Combustibles: M	

Effect of oven tranformation: [5] **4 3 2 1 0**

PLANS & SECTIONS



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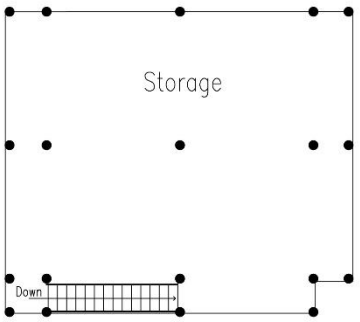

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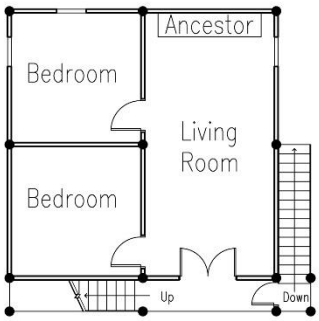

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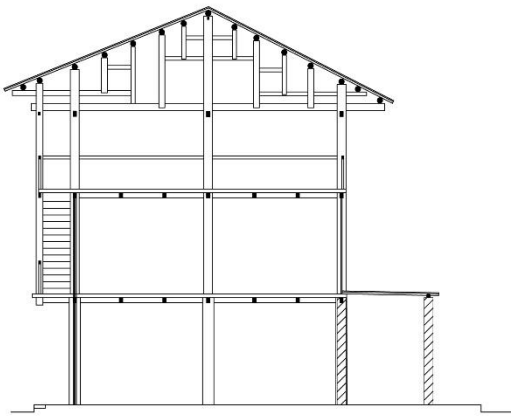


SECTION

No. (06) B17	July 2015 and February 2016

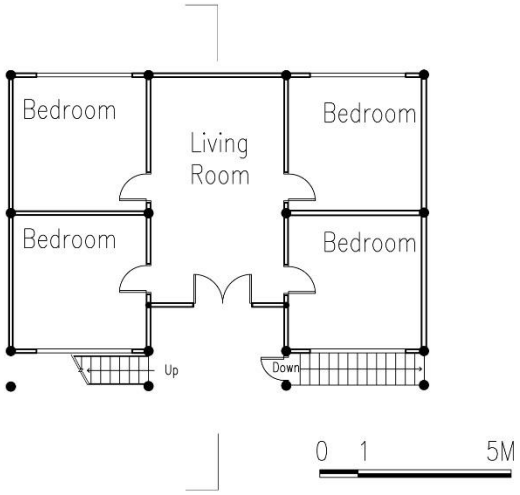
Material

Location	Beam and pillar	Wall	Ceiling	Stairs
1F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	Wood Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

Cooking and heating facilities						**Fire protection facilities**	
Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	[Have] no	[Have] no
[Have] no	[Have] no	[Have] no	Have [no]	Have [no]	Have [no]	Combustibles: S	

Effect of oven tranformation: 5 [4] 3 2 1 0

PLANS & SECTIONS



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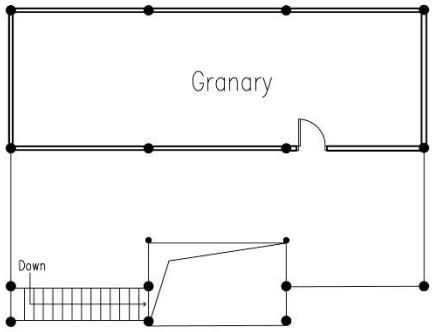

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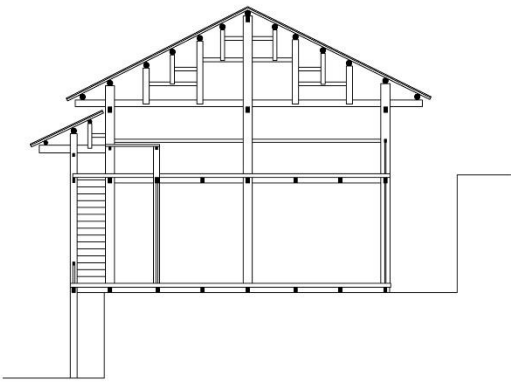


SECTION

No. (07) B25 July 2015 and February 2016

Material

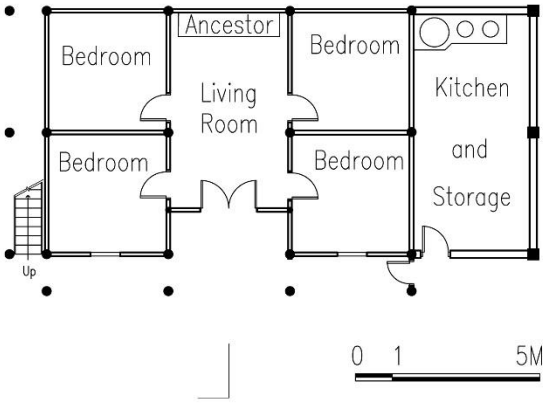
Location	Beam and pillar	Wall	Ceiling	Stairs
1F	[Wood] Brick RC	Wood [Brick] Adobe	[Wood] Brick Cement	[Wood] Brick Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

Cooking and heating facilities | **Fire protection facilities**

Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	Have [no]	[Have] no
[Have] no	[Have] no	[Have] no	Have [no]	Have [no]	Have [no]	Combustibles: S	

Effect of oven tranformation: [5] **4 3 2 1 0**

PLANS & SECTIONS



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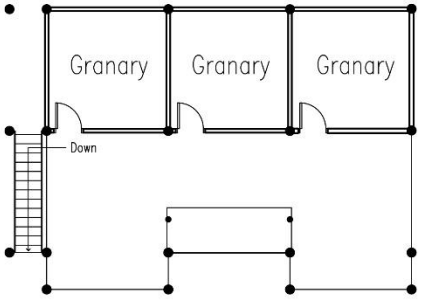

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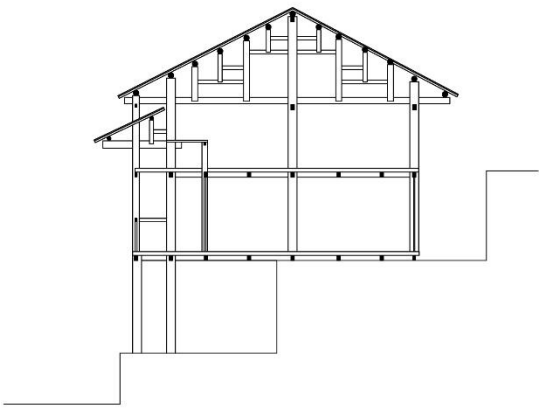


SECTION

No. (08) C07	July 2015 and February 2016

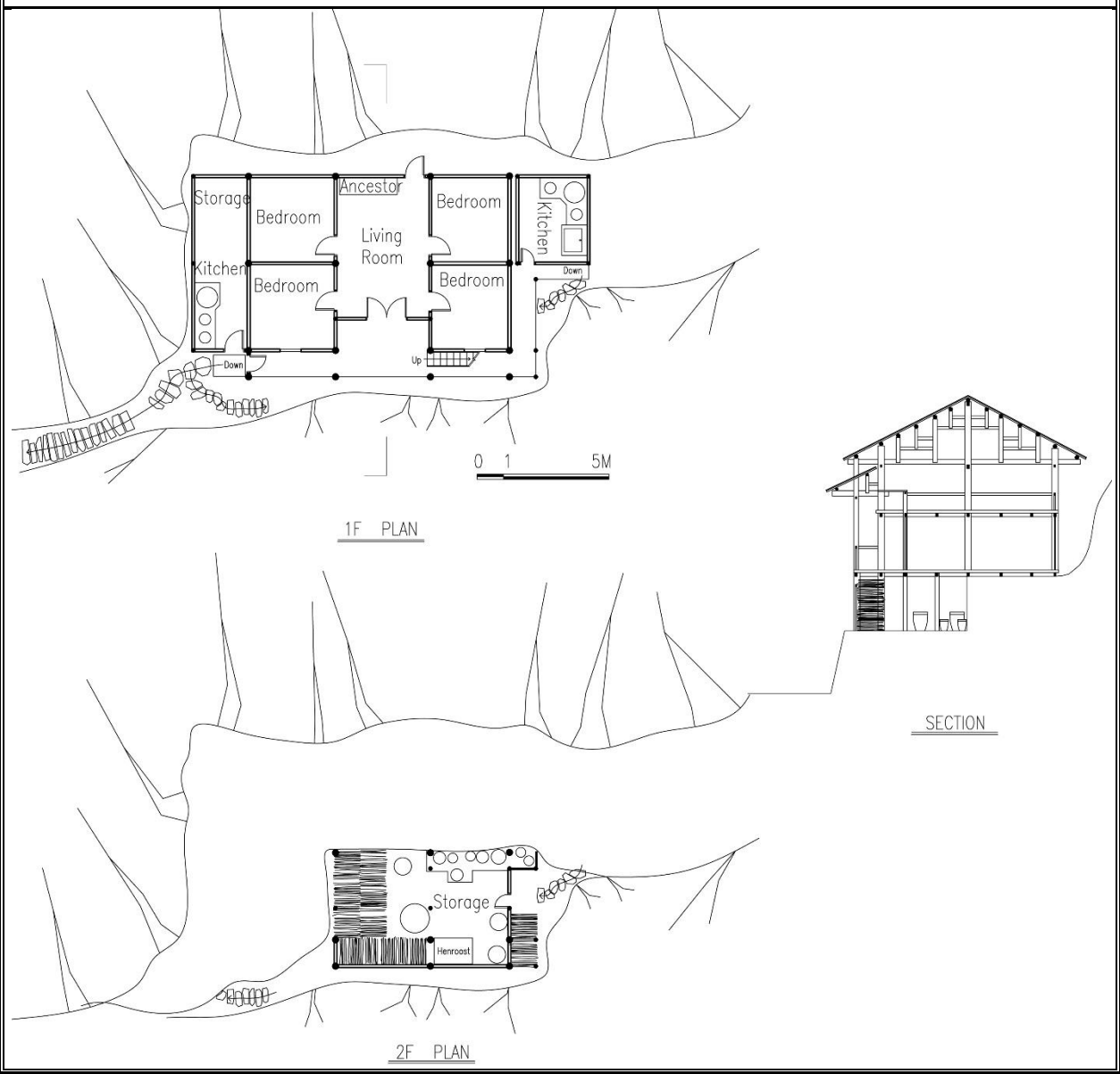
Material

Location	Beam and pillar	Wall	Ceiling	Stairs
1F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

Cooking and heating facilities						**Fire protection facilities**	
Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	Have [no]	[Have] no
[Have] no	[Have] no	[Have] no	Have [no]	Have [no]	Have [no]	Combustibles: S	

Effect of oven tranformation: [5] **4 3 2 1 0**

PLANS & SECTIONS



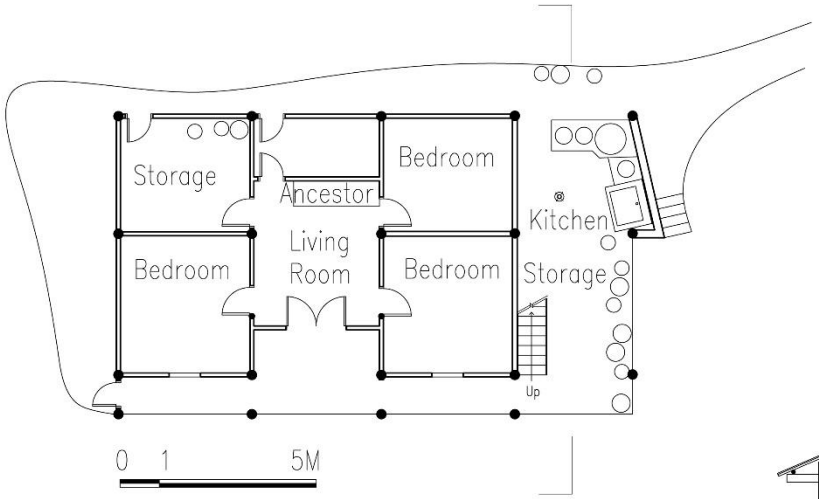
Material

Location	Beam and pillar	Wall	Ceiling	Stairs
1F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

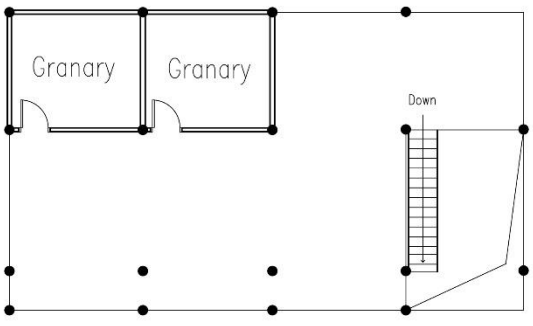
Cooking and heating facilities						**Fire protection facilities**	
Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	Have [no]	[Have] no
[Have] no	[Have] no	[Have] no	[Have] no	Have [no]	Have [no]	Combustibles: M	

Effect of oven tranformation: 5 [4] 3 2 1 0

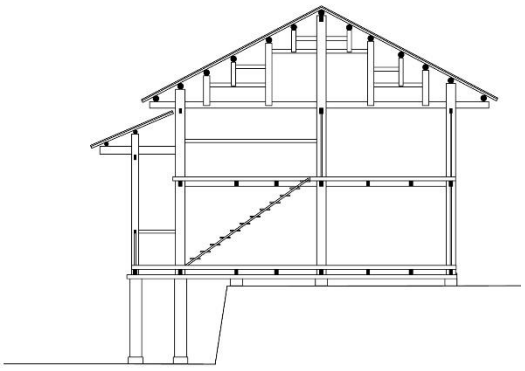
PLANS & SECTIONS



1F PLAN



2F PLAN



SECTION

Material

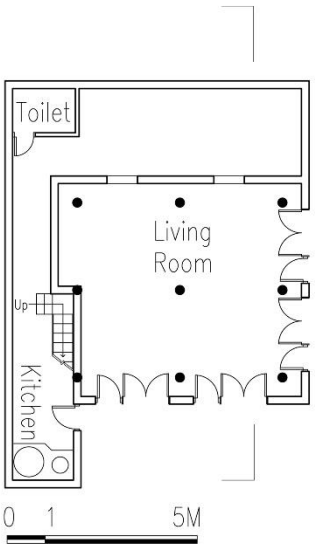
Location	Beam and pillar	Wall	Ceiling	Stairs
1F	[Wood] Brick RC	Wood [Brick] Adobe	[Wood] Brick Cement	[Wood] Brick Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

Cooking and heating facilities | **Fire protection facilities**

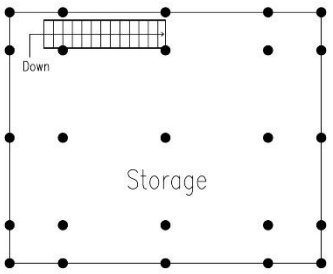
Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	Have [no]	[Have] no
[Have] no	[Have] no	[Have] no	[Have] no	Have [no]	[Have] no	Combustibles: S	

Effect of oven tranformation: [5] 4 3 2 1 0

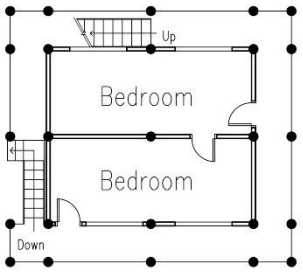
PLANS & SECTIONS



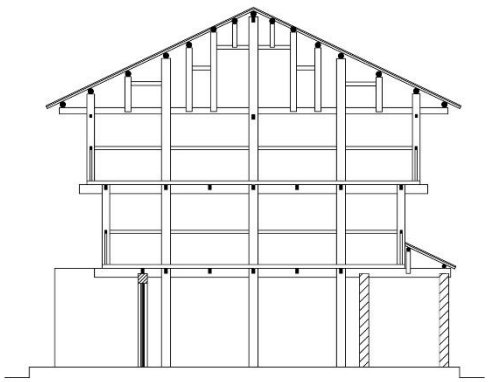
1F PLAN



3F PLAN



2F PLAN



SECTION

Material

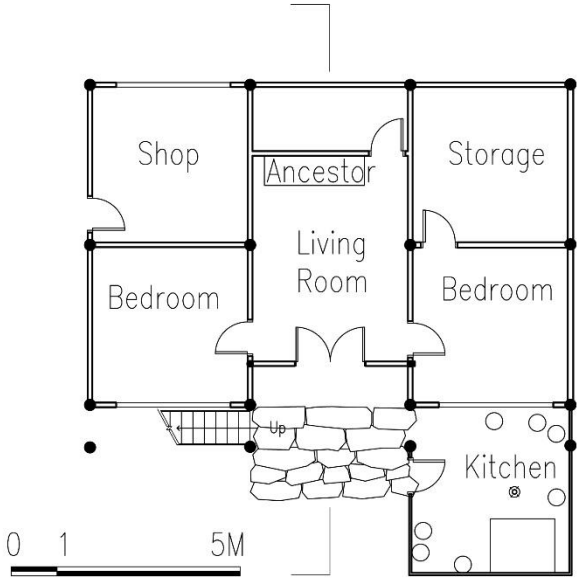
Location	Beam and pillar	Wall	Ceiling	Stairs
1F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

Cooking and heating facilities | **Fire protection facilities**

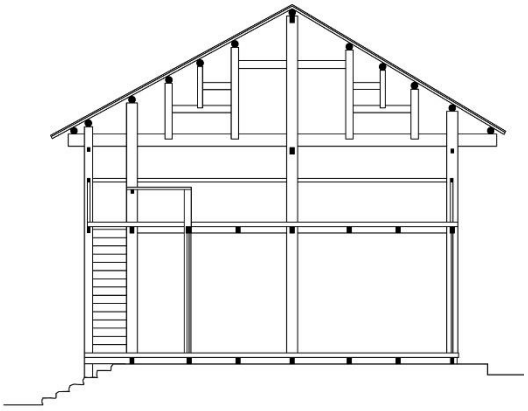
Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	[Have] no	[Have] no
[Have] no	[Have] no	[Have] no	Have [no]	Have [no]	Have [no]	Combustibles: S	

Effect of oven tranformation: 5 [4] 3 2 1 0

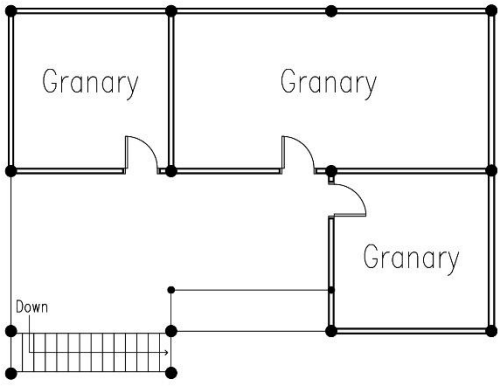
PLANS & SECTIONS



1F PLAN



SECTION



2F PLAN

Material

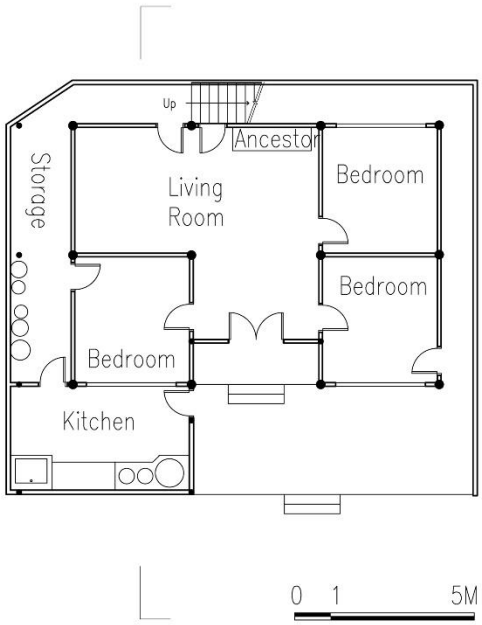
Location	Beam and pillar	Wall	Ceiling	Stairs
1F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

Cooking and heating facilities | **Fire protection facilities**

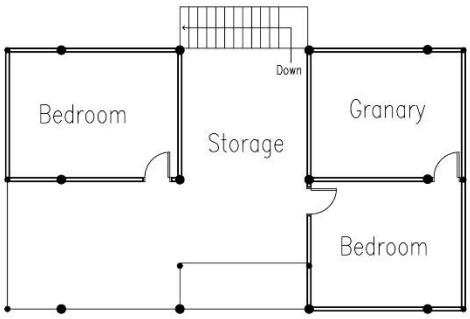
Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	Have [no]	[Have] no
[Have] no	Have [no]	[Have] no	[Have] no	Have [no]	Have [no]	Combustibles: S	

Effect of oven tranformation: [5] **4 3 2 1 0**

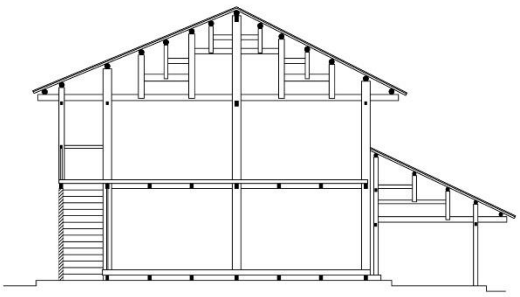
PLANS & SECTIONS



1F PLAN



2F PLAN



SECTION

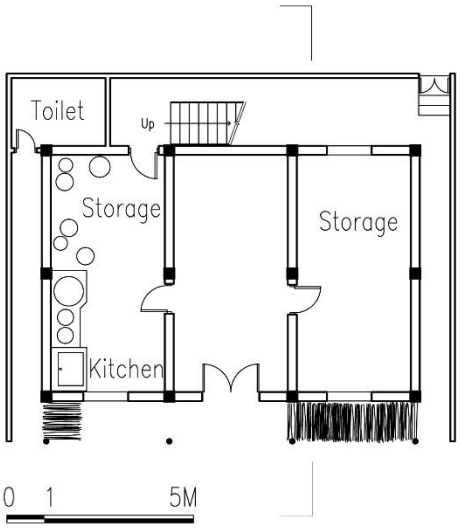
Material

Location	Beam and pillar	Wall	Ceiling	Stairs
1F	[Wood] Brick RC	Wood [Brick] Adobe	[Wood] Brick Cement	[Wood] Brick Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

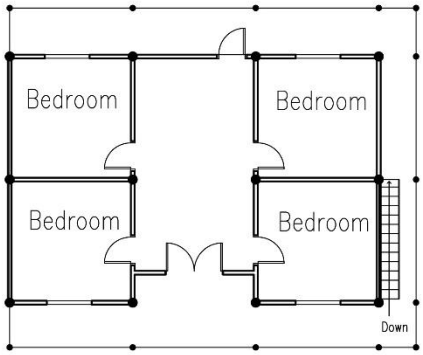
Cooking and heating facilities						Fire protection facilities	
Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	Have [no]	[Have] no
[Have] no	[Have] no	Have [no]	[Have] no	Have [no]	Have [no]	Combustibles: S	

Effect of oven tranformation: 5 [4] 3 2 1 0

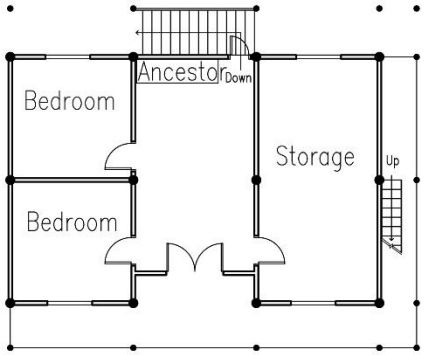
PLANS & SECTIONS



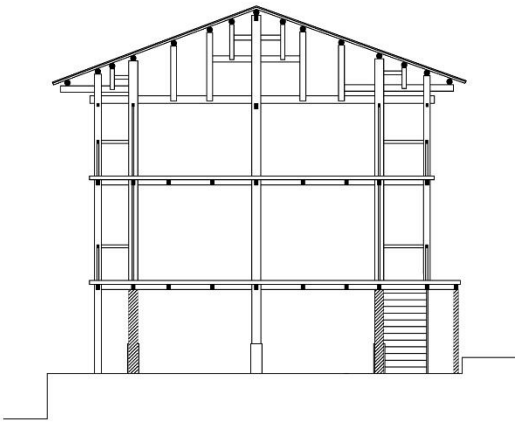
1F PLAN



3F PLAN



2F PLAN



SECTION

Material

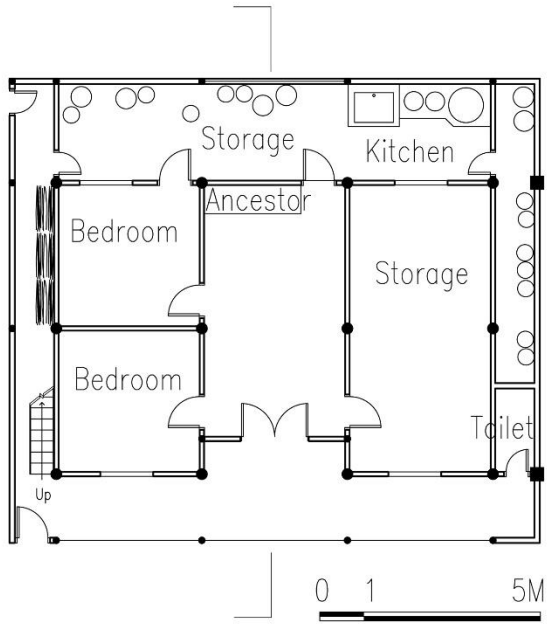
Location	Beam and pillar	Wall	Ceiling	Stairs
1F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

Cooking and heating facilities | **Fire protection facilities**

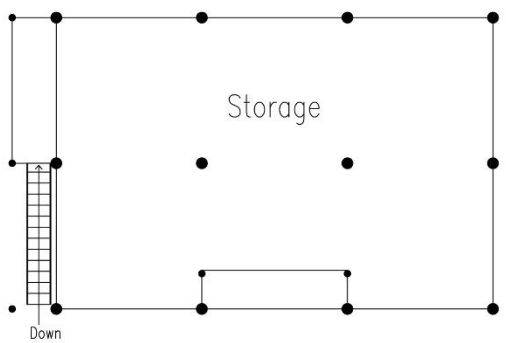
Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	[Have] no	[Have] no
[Have] no	[Have] no	[Have] no	Have [no]	Have [no]	[Have] no	Combustibles: S	

Effect of oven tranformation: [5] 4 3 2 1 0

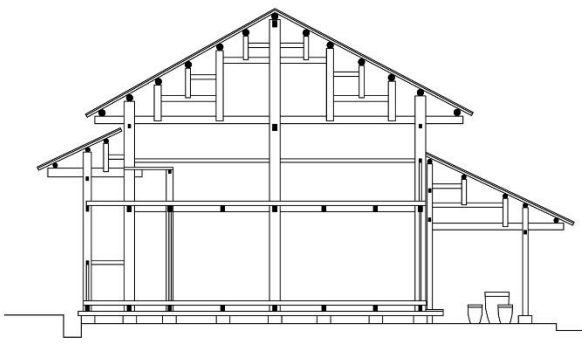
PLANS & SECTIONS



1F PLAN



2F PLAN



SECTION

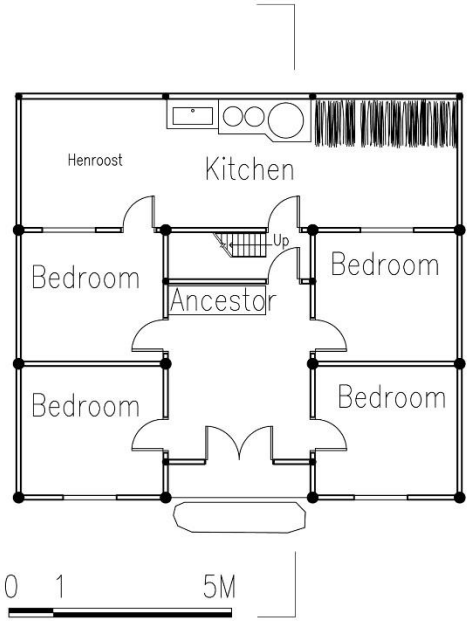
Material

Location	Beam and pillar	Wall	Ceiling	Stairs
1F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

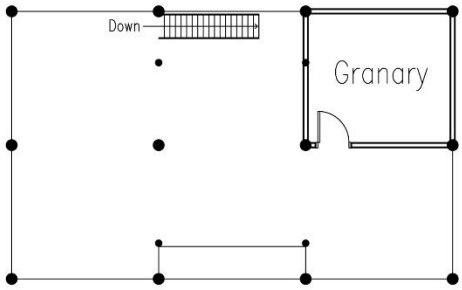
Cooking and heating facilities						**Fire protection facilities**	
Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	[Have] no	[Have] no
[Have] no	[Have] no	[Have] no	Have [no]	Have [no]	[Have] no	Combustibles: S	

Effect of oven tranformation: 5 [4] 3 2 1 0

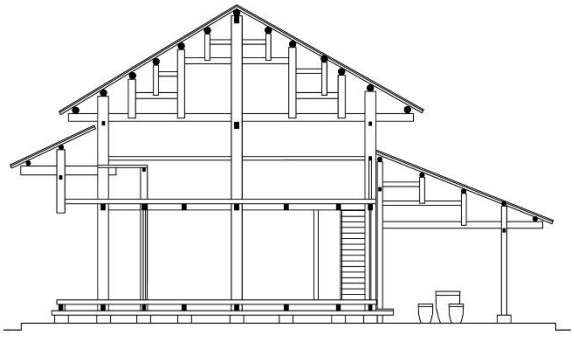
PLANS & SECTIONS



1F PLAN



2F PLAN



SECTION

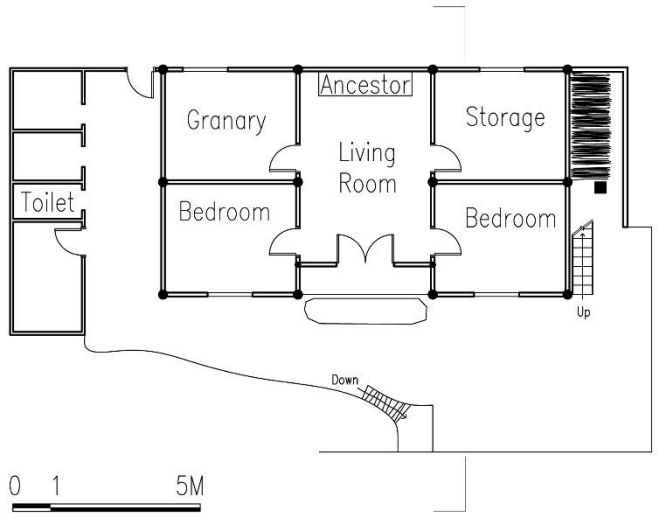
Material

Location	Beam and pillar	Wall	Ceiling	Stairs
1F	Wood [Brick] RC	Wood [Brick] Adobe	[Wood] Brick Cement	Wood [Brick] Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

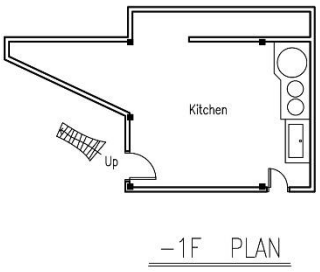
Cooking and heating facilities						Fire protection facilities	
Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	Have [no]	[Have] no
[Have] no	[Have] no	[Have] no	[Have] no	Have [no]	[Have] no	Combustibles: S	

Effect of oven tranformation: [5] 4 3 2 1 0

PLANS & SECTIONS



1F PLAN



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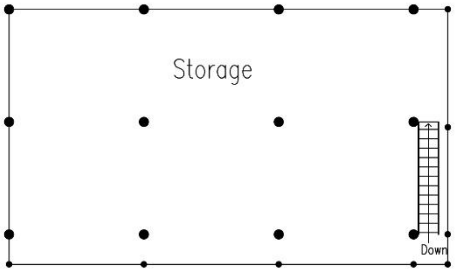
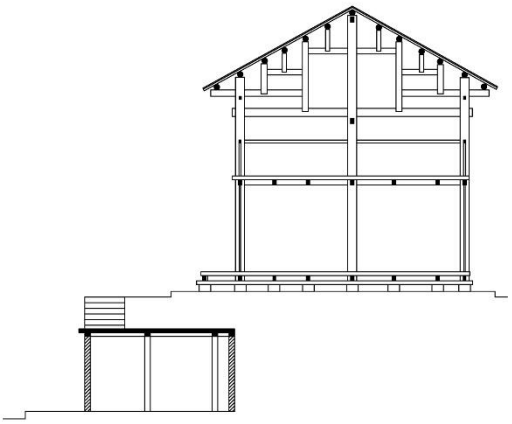


2F PLAN



SECTION

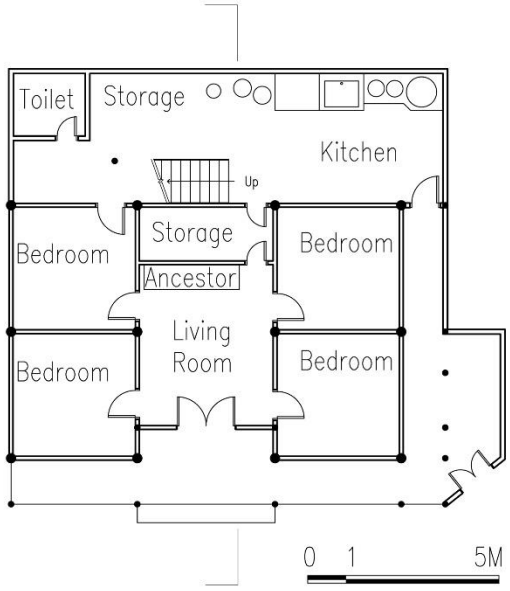
Material

Location	Beam and pillar	Wall	Ceiling	Stairs
1F	Wood [Brick] RC	[Wood] Brick Adobe	[Wood] Brick Cement	Wood [Brick] Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

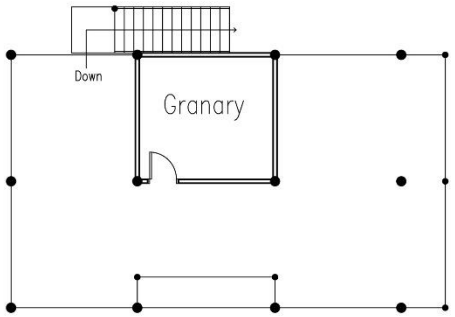
Cooking and heating facilities						**Fire protection facilities**	
Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	[Have] no	[Have] no
[Have] no	[Have] no	[Have] no	Have [no]	Have [no]	Have [no]	Combustibles: S	

Effect of oven tranformation: 5 [4] 3 2 1 0

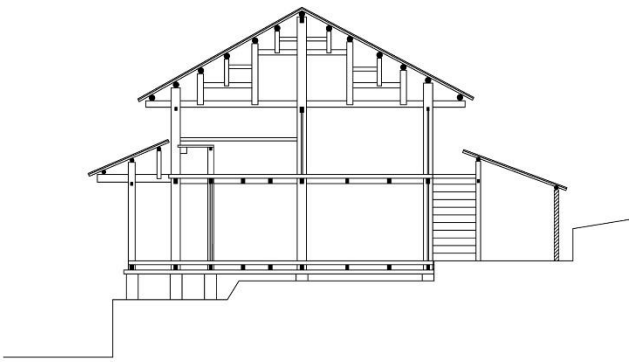
PLANS & SECTIONS



1F PLAN



2F PLAN



SECTION

Material

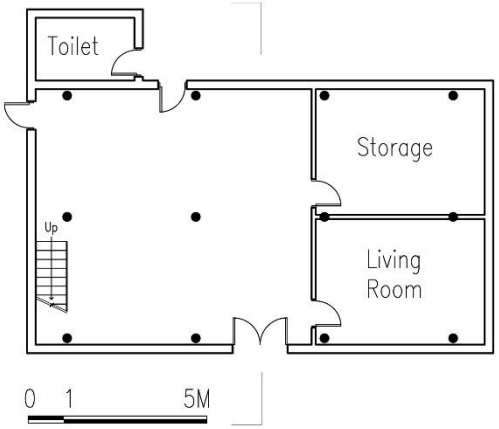
Location	Beam and pillar	Wall	Ceiling	Stairs
1F	[Wood] Brick RC	Wood [Brick] Adobe	[Wood] Brick Cement	[Wood] Brick Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

Cooking and heating facilities | **Fire protection facilities**

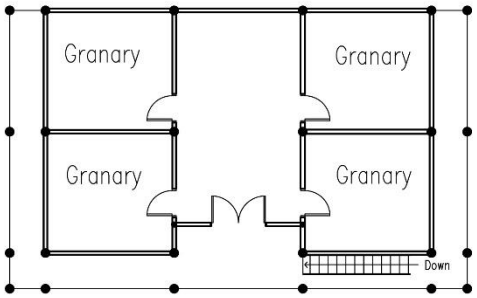
Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	Have [no]	[Have] no
[Have] no	[Have] no	[Have] no	Have [no]	Have [no]	Have [no]	Combustibles: S	

Effect of oven tranformation: [5] **4 3 2 1 0**

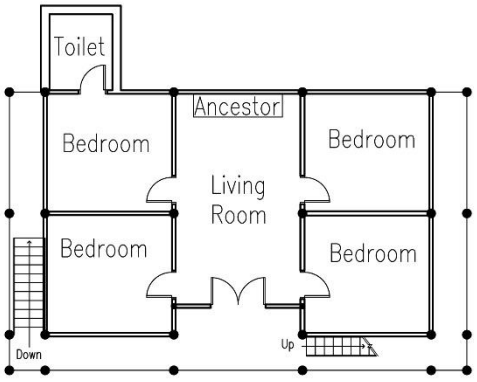
PLANS & SECTIONS



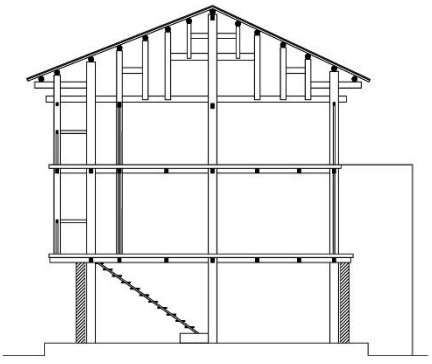
1F PLAN



3F PLAN



2F PLAN



SECTION

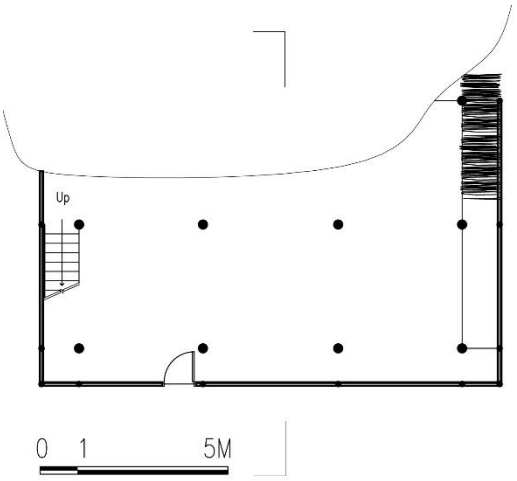
Material

Location	Beam and pillar	Wall	Ceiling	Stairs
1F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

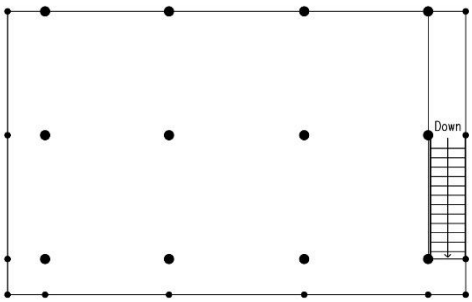
Cooking and heating facilities						Fire protection facilities	
Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	[Have] no	[Have] no
[Have] no	[Have] no	[Have] no	Have [no]	Have [no]	[Have] no	Combustibles: S	

Effect of oven tranformation: [5] 4 3 2 1 0

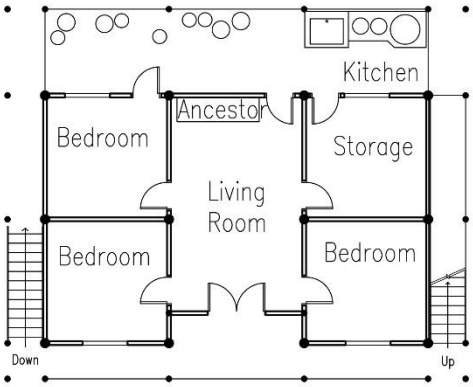
PLANS & SECTIONS



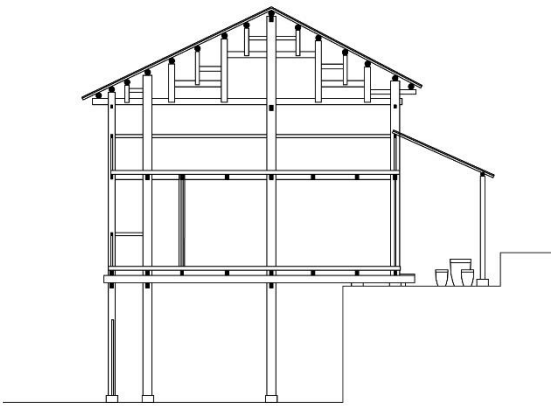
1F PLAN



3F PLAN



2F PLAN



SECTION

No. (20) F04 July 2015 and February 2016

Material

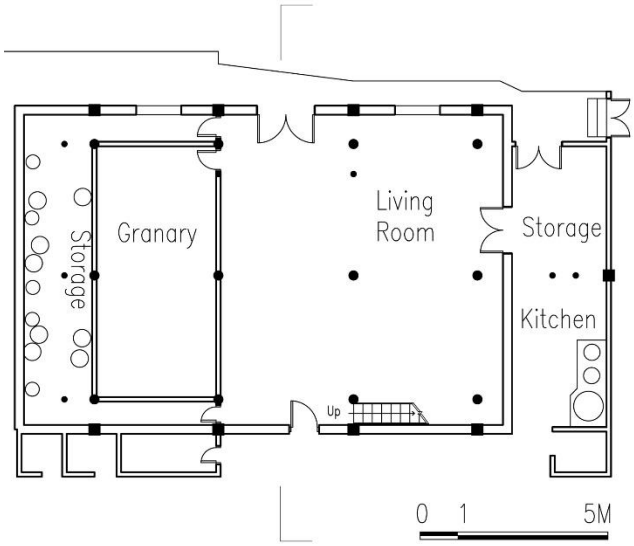
Location	Beam and pillar	Wall	Ceiling	Stairs
1F	[Wood] Brick RC	Wood [Brick] Adobe	[Wood] Brick Cement	[Wood] Brick Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

Cooking and heating facilities | **Fire protection facilities**

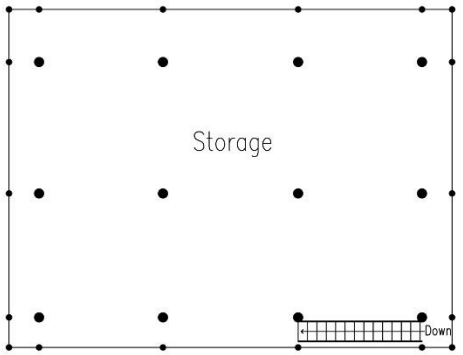
Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	[Have] no	[Have] no
[Have] no	[Have] no	[Have] no	Have [no]	Have [no]	[Have] no	Combustibles: S	

Effect of oven tranformation: [5] 4 3 2 1 0

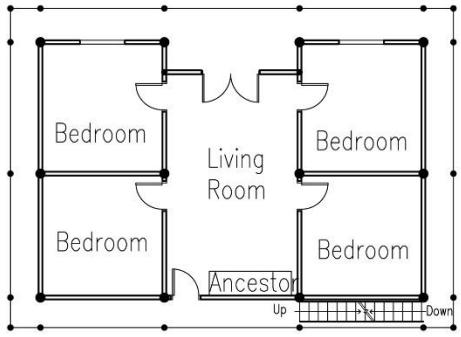
PLANS & SECTIONS



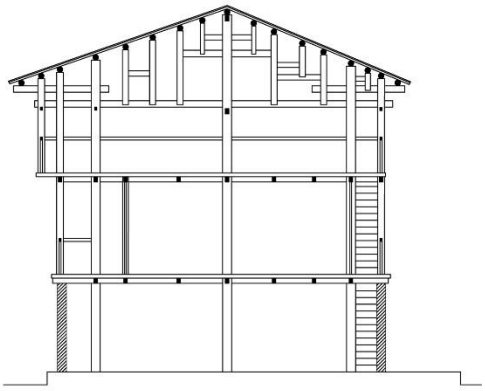
1F PLAN



3F PLAN



2F PLAN



SECTION

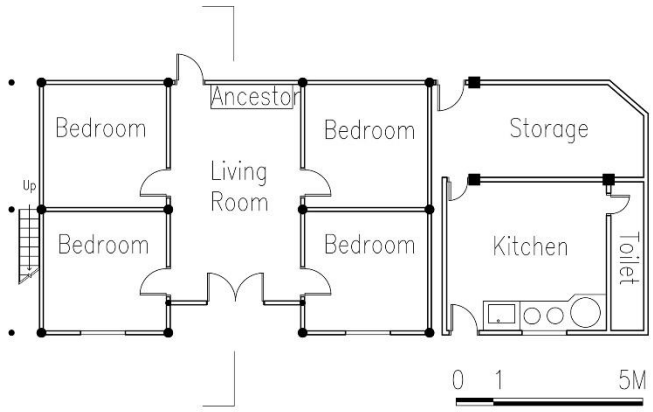
Material

Location	Beam and pillar	Wall	Ceiling	Stairs
1F	[Wood] Brick RC	Wood [Brick] Adobe	[Wood] Brick Cement	[Wood] Brick Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

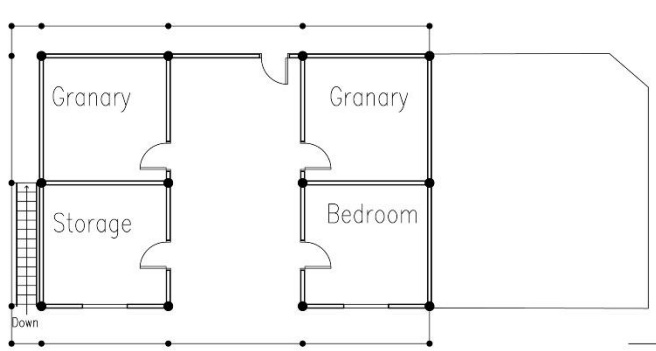
Cooking and heating facilities						**Fire protection facilities**	
Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	[Have] no	Have [no]
[Have] no	[Have] no	[Have] no	[Have] no	Have [no]	Have [no]	Combustibles: S	

Effect of oven tranformation: 5 [4] 3 2 1 0

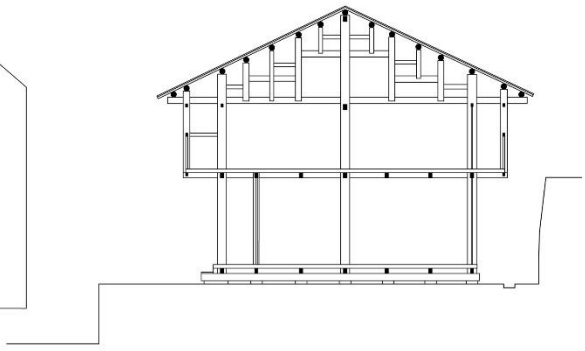
PLANS & SECTIONS



1F PLAN



2F PLAN



SECTION

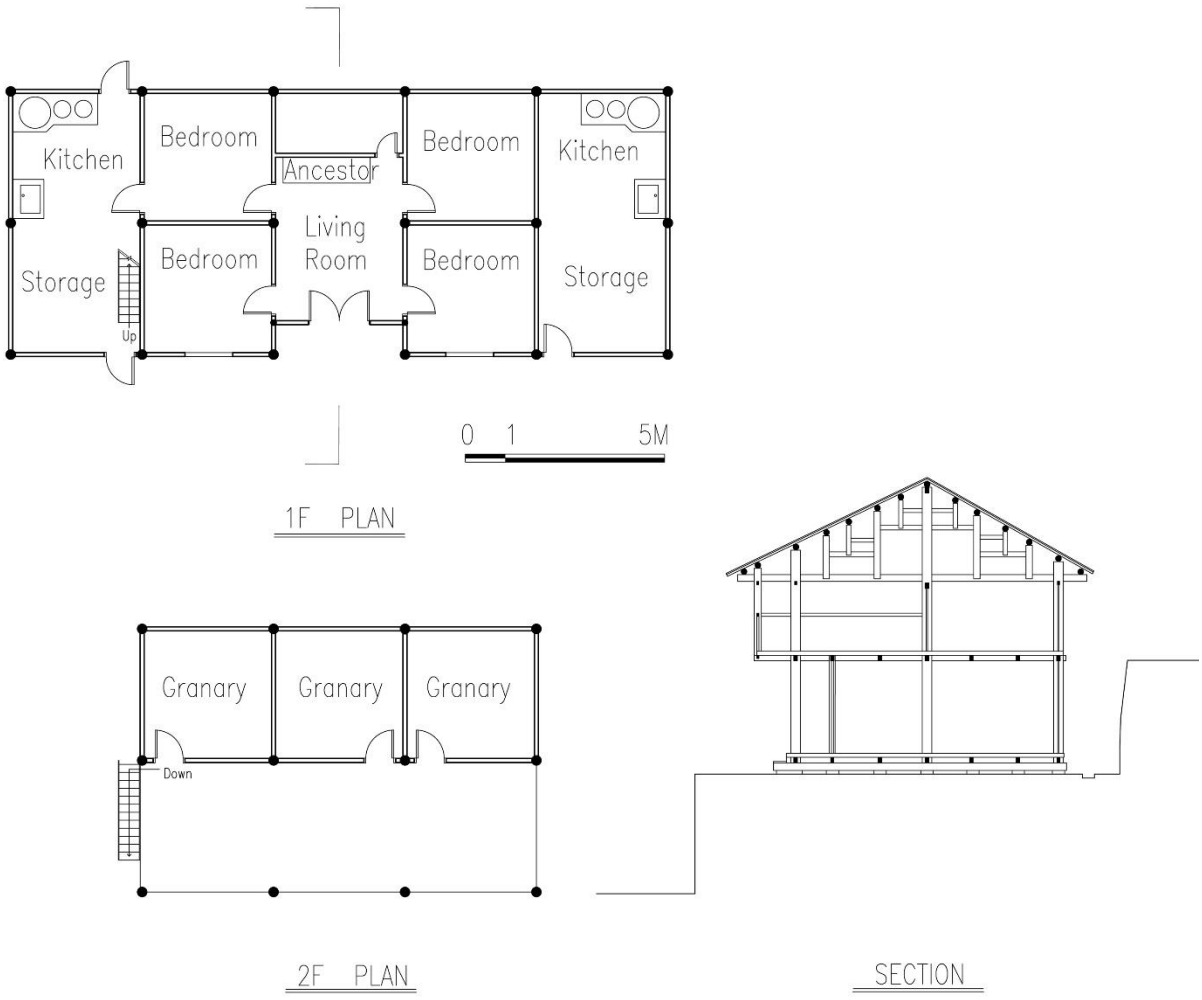
Material

Location	Beam and pillar	Wall	Ceiling	Stairs
1F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

Cooking and heating facilities						Fire protection facilities	
Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	[Have] no	[Have] no
[Have] no	[Have] no	[Have] no	Have [no]	Have [no]	Have [no]	Combustibles: M	

Effect of oven tranformation: [5] 4 3 2 1 0

PLANS & SECTIONS

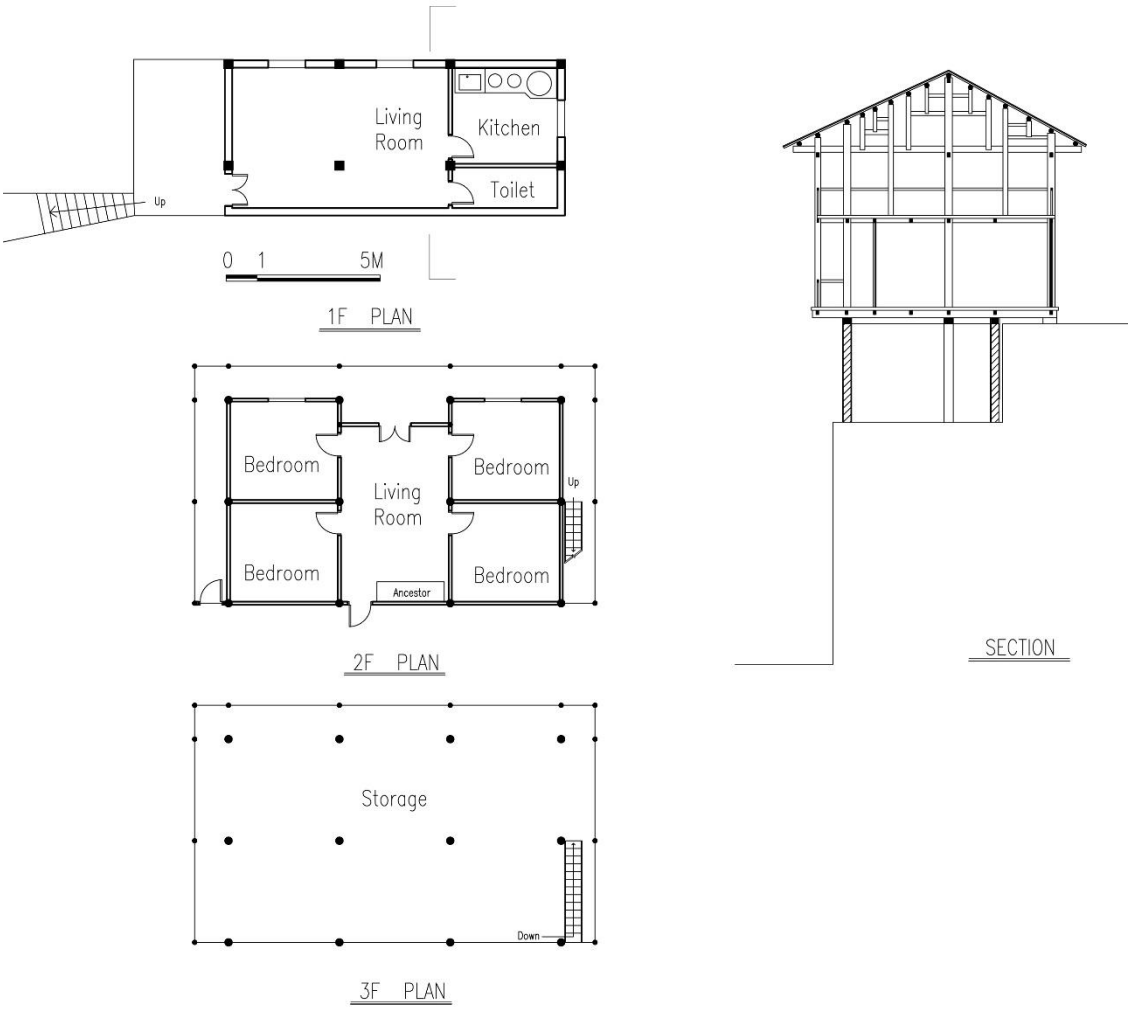


No. (23) G05					July 2015 and February 2016
Material					
Location	**Beam and pillar**	**Wall**	**Ceiling**		**Stairs**
1F	Wood [Brick] RC	Wood [Brick] Adobe	[Wood] Brick Cement		[Wood] Brick Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement		[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles	**Eaves**	Wood, tiles

Cooking and heating facilities						**Fire protection facilities**	
Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	[Have] no	[Have] no
[Have] no	Have [no]	[Have] no	Have [no]	Have [no]	[Have] no	Combustibles: L	

Effect of oven tranformation: [5] 4 3 2 1 0

PLANS & SECTIONS



Material

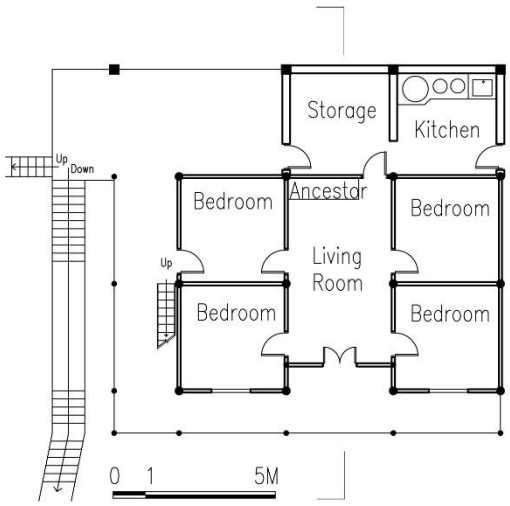
Location	Beam and pillar	Wall	Ceiling	Stairs
1F	Wood [Brick] RC	Wood [Brick] Adobe	[Wood] Brick Cement	[Wood] Brick Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

Cooking and heating facilities | **Fire protection facilities**

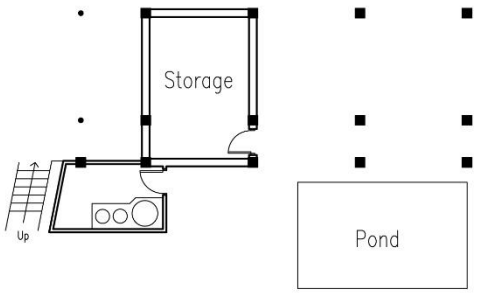
Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	[Have] no	[Have] no
[Have] no	Have [no]	[Have] no	[Have] no	Have [no]	Have [no]	Combustibles: S	

Effect of oven tranformation: [5] 4 3 2 1 0

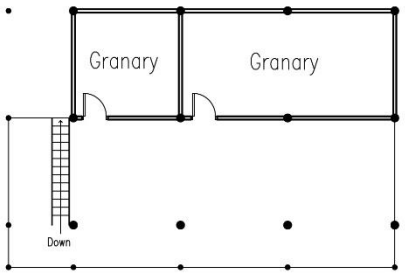
PLANS & SECTIONS



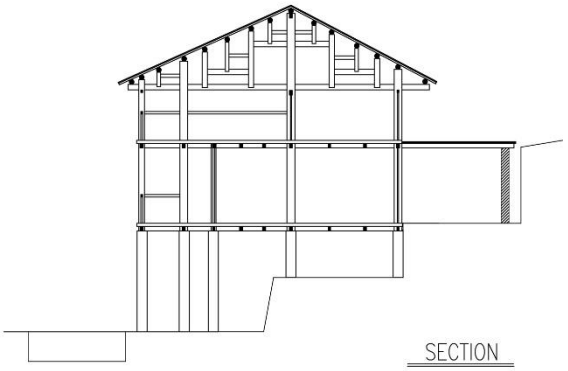
1F PLAN



−1F PLAN



2F PLAN



SECTION

Material

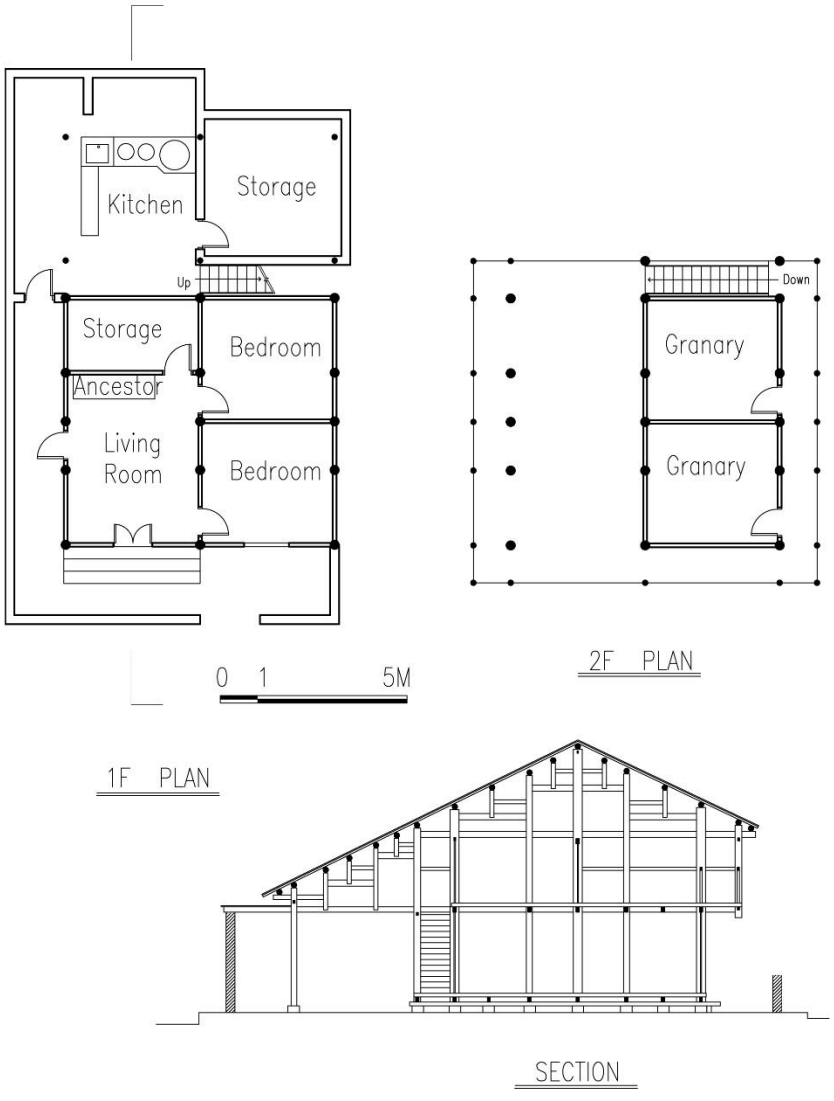
Location	Beam and pillar	Wall	Ceiling	Stairs
1F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

Cooking and heating facilities | **Fire protection facilities**

Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	[Have] no	[Have] no
[Have] no	[Have] no	[Have] no	Have [no]	Have [no]	Have [no]	Combustibles: S	

Effect of oven tranformation: [5] **4 3 2 1 0**

PLANS & SECTIONS



Material

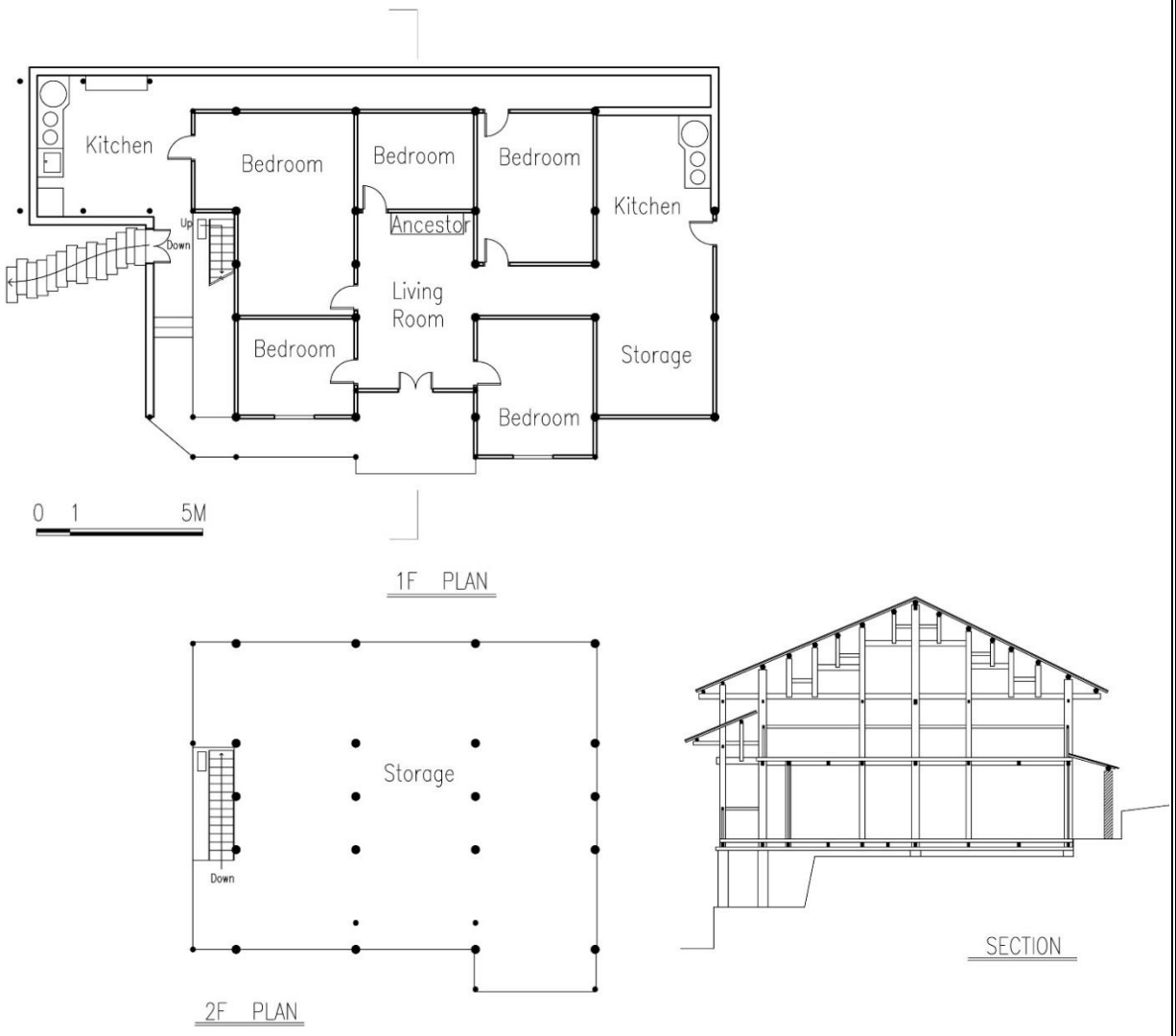
Location	Beam and pillar	Wall	Ceiling	Stairs
1F	[Wood] Brick RC	Wood [Brick] Adobe	[Wood] Brick Cement	[Wood] Brick Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

Cooking and heating facilities | **Fire protection facilities**

Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	Have [no]	[Have] no
[Have] no	[Have] no	[Have] no	Have [no]	Have [no]	[Have] no	Combustibles: L	

Effect of oven tranformation: [5] **4 3 2 1 0**

PLANS & SECTIONS



Material

Location	Beam and pillar	Wall	Ceiling	Stairs
1F	Wood [Brick] RC	Wood [Brick] Adobe	[Wood] Brick Cement	[Wood] Brick Cement
2F	[Wood] Brick RC	[Wood] Brick Adobe	[Wood] Brick Cement	[Wood] Brick Cement
Roof	**Surface** Tile	**Inner surface**	Wood, tiles **Eaves**	Wood, tiles

Cooking and heating facilities | **Fire protection facilities**

Fire facility			Electrical facility		Gas facility	Fire extinguisher	Water reserve
Brick oven	Ground oven	Heating fire	Induction cooker	Electrical heater	Gas oven	Have [no]	[Have] no
[Have] no	[Have] no	[Have] no	Have [no]	Have [no]	Have [no]	Combustibles: M	

Effect of oven tranformation: 5 [4] 3 2 1 0

PLANS & SECTIONS