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ORIGINAL PAPER

What makes a successful livelihood recovery? a study of China's Lushan earthquake

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Abstract

Due to China's exposure and susceptibility to natural hazards, it is important for governments and aid agencies to have tools that enable effective post-disaster livelihood recovery in creating self-sufficiency for the affected population. This paper introduces a framework of critical components that constitute a successful livelihood recovery by studying the perceptions and perspectives of those affected by the 2013 Lushan earthquake in Sichuan Province. A mixed method, namely a pilot study, questionnaire survey and interviews, was used. While the populations surveyed valued the employment benefits of creating new market and economic sectors in areas where rural farming was predominant prior to the earthquake, they considered that recovery of their housing was most essential for livelihood diversification. External assistance was also regarded highly in assisting with livelihood recovery, in which family ties and social connections seemed to have played a larger role than that of government agencies and NGOs. Lastly, the results highlighted that a goal of livelihood recovery cannot be achieved without individual well-being being considered, in relation to people's perceptions about quality of life and their physical and mental health. This paper aims to assist the Chinese policy makers and practitioners in disaster recovery in setting an agenda of preparing for livelihood recovery in peace times, or of post-disaster recovery planning should a disaster event occurs so that the economic impact and livelihood burdens of those affected can be effectively mitigated.

Keywords Livelihood · Disaster recovery · The 2013 lushan earthquake · China

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1 Introduction

Statistics from the international disaster database EM-DAT have shown a significant increase in the frequency and scale of natural hazards from 1980 to 2018 (EMDAT 2019). Climate- and geophysics-related disasters alone had killed 1.3 million people and caused more than 4.4 million people displaced during the period between 1998 and 2017 (Wallemacq and Rowena 2018). Apart from the damage to the built environment, disasters often disrupt people's livelihoods by destroying essential livelihood resources and displacing people from their employment (Sina et al. 2019b; Thorburn 2009; World Bank 2013). The 2004 Indian Ocean tsunami extensively affected the fishery and aquaculture industries in the coastal regions of India, Indonesia, Sri Lanka and Thailand, leaving 2.5 million people unemployed (Pomeroy, Ratner, Hall, Pimoljinda and Vivekanandan 2006; Sina et al. 2019b). Similarly, around 1.52 million people lost their jobs in China's Wenchuan earthquake in 2008, with most of them being farmers or workers in the agriculture sector (Liang and Wang 2013). Even the more industrialised/developed countries are not immune to the livelihood impact of large disasters. For instance, in the year following the 2010 Canterbury Earthquake in New Zealand, the unemployment rate increased by 4% (CERA 2013), and it took more than 5 years for the tourism and education industries to recover (Wood et al. 2016).

Livelihood, being an essential part of people's lives, has been extensively studied in the field of development studies. Chambers and Conway (1992) defined livelihood as a way of making a living and making life meaningful. In investigating what makes meaningful livelihood, several frameworks have been developed in the literature. The Sustainable Livelihood Approach (SLA) is the most prominent one and has been widely adopted by many government agencies and international organisations in their relevant initiatives and programmes (e.g. the UK's Department for International Development (DfID 1999), the Food and Agriculture Organisation (FAO) (2009), the United Nations Development Programme (UNDP) (Ashley and Carney 1999), and CARE International (Hussein 2002; Krantz 2001)). Many studies have touched on the different aspects of livelihood, such as livelihood assets (Moser and Dani 2008; Taher 2018), governance for institutions and organisations in supporting livelihood (Kapadia 2015; Leach et al. 1999; Régnier et al. 2008), and livelihood support strategies in different contexts (Fang et al. 2014; Sina et al. 2019a).

However, it was after the 2004 Indian Ocean tsunami that livelihood recovery in a large disaster context began receiving more attention from many practitioners and academia. The significant job losses (60%) and massive displacement (81%) of one million population affected in Indonesia alone as a result of the tsunami have alarmingly alerted the rest of the world the socio-economic effects of this catastrophe on livelihood and the importance of its fast recovery (APEC 2013). Pomeroy et al. (2006) examined the means of livelihood diversification and assessed the effectiveness of livelihood interventions for coastal communities during the post-2004 tsunami recovery period. Ismail et al. (2018) investigated the livelihood changes over time in the aftermath of the tsunami. In a longitudinal study, Sina et al. (2019a) examined the factors that had affected livelihood resilience of those relocated communities in Aceh, Indonesia, with a focus on understanding why some communities fared better than others.

In the Chinese context, research on disaster livelihood recovery has grown significantly following the Wenchuan earthquake in 2008 (Zhao et al. 2019). Some scholars looked into empirical evidence and lessons that can be learned to help the farming labour to regain their employment (Guo, Liu, Peng and Wang 2014; Yang et al. 2018). Others focused on

how the 5 capitals (natural, financial, social, physical and human capital) have differentiated livelihood outcomes post-disaster (Ting 2013; Guo et al. 2014; Xu et al. 2013; Chen et al. 2017). While there has been a call for understanding the preconditions of livelihood recovery (Yang et al. 2018), little is known about how communities themselves say about what makes a successful livelihood recovery.

Within this paper, we focus on identifying the critical components that makes a successful livelihood recovery from the community's perspective. Community's input, in terms of how they define whether their livelihoods are recovered, and what are needed in place for them to achieve the success of livelihood recovery, is important as their knowledge is an essential building block for their own resilience (Sina et al. 2019a, b). A case study of disaster recovery from the 2013 Lushan Earthquake in China was carried out. The researchers took part in disaster field trips to Lushan County, Sichuan Province in China. A pilot study, combined with a questionnaire survey and semi-structured interviews with earthquake survivors, was used to understand their livelihood recovery experience and the perceived critical components of a successful livelihood recovery. The empirical data are analysed, and insights are summarised in a framework to highlight the need to learn from those affected what are important for their livelihood recovery from their perspective, and translate such knowledge into concrete plans, policies and aid programmes to help communities achieve their intended success.

2 Literature review

The concept of livelihood has been used to synthesise social and economic disciplines, and it has been widely adopted in development studies and practice (Scoones 2009, 2015; Ayeb-Karlsson et al. 2016; Le Dé, Rey, Leone and Gilbert 2018). The definition of livelihood includes "means of living" and "a combination of resources used and the activities undertaken in order to live" (Régnier et al. 2008). This definition implies that resources and activities for income generation are essential for livelihood. Several studies focused on investigating the type of resources people need to sustain a living (Ashley and Carney 1999; Ellis 2000; Scoones 1998, 2009). Other research, such as that by Bebbington (1999), emphasised that only by having critical livelihood resources can people engage in a variety of livelihood activities or use livelihood strategies to achieve positive socio-economic results.

Apart from livelihood resources, the notion capacity has also achieved a wide attention in the literature of livelihood research. It refers to people's ability to cope with and recover from the impact caused by disturbances or disasters (Davis et al. 2004). The concept of capacity goes beyond the simple and limited function of capitals or resource, and it relates more closely within the community (Gaillard 2010). Vulnerability, on the other hand, has been widely used to describe the susceptibility to the impact caused by the exposure to the environmental or social change with the absence of adaptive capacity (Adger 2006). Livelihood perspectives are useful in addressing people capacity and vulnerability within the community inside the social system (Adger 2006; Scoones 2009).

In the disaster-related research domain, disaster risk reduction (DRR) broadly encompasses a wide range of activities that have a bearing on livelihood, embracing pre-event livelihood vulnerability and risks analysis and preparedness (APEC 2013). Livelihood studies in disaster settings range from identifying the livelihood vulnerabilities of people post-disaster (Cannon et al. 2003), embedding sustainable livelihood paradigm into

post-disaster livelihood recovery (Pomeroy et al. 2006; Gaillard et al. 2009), to community's capacity building for achieving livelihood resilience to climate risks (Ayeb-Karlsson et al. 2016). Many cases proved that community's own perspectives and collective wisdom would assist with livelihood vulnerability reduction. Following the 2002 Cyclone Zoe in the Solomon Islands, for instance, community members were able to utilise their traditional knowledge to build new houses for multiple purposes, not only providing a shelter for families but also a tool for earning income (Kelman 2005; Le Dé et al. 2018).

The concept of livelihood has evolved considerably since Chambers and Conway (1992)'s definition, and many aspects of livelihood recovery post-disaster have been mentioned but scattered in the literature. We conducted a literature review of different components of livelihood recovery in the context of disasters. By using content analysis (Hsieh and Shannon 2005), the components were grouped into four major categories, namely, employment, housing, external assistance and personal well-being, as shown in Table 1.

Livelihood is often discussed from an employment perspective (Guo et al. 2014; Van den Berg 2010). The effects of disasters on people's livelihood were also often pictured by statistics of job losses and unemployment rate. It was well documented that the resources on which some livelihoods are reliant, whether physical resources such as assets and tools (Daly et al. 2017; Sina et al. 2019b), or natural resources such as land, the sea, the river, etc. (Burton et al. 2011; Chatterjee 2018) are essentials for employment continuity. Shaw et al. (2006) and Guo et al. (2014) exemplified the scale of job displacement of people working in agriculture and aquaculture sectors and challenges faced for their livelihood recovery as a result of disaster damage to the land and other livelihood assets. Similarly, government's land-acquisition policy following the 2008 Wenchuan earthquake in China had also forced some farmers to leave their villages and migrate to urban centres in pursuit of jobs in factories (Han 2014).

Munas and Lokuge (2014) and Mabuku et al. (2018) suggested that another element closely related to the employment aspect of livelihood is to do with people's education and skills. In investigating determinants of livelihood changes in rural areas in Uganda, Smith et al. (2001) illustrated that the level of education is a critical element that differentiates people's coping strategies when facing weather-related shocks and stresses. Patnaik and Narayanan (2015) also found that people with higher education in the flood-prone regions in India were less likely to rely on external assistance to cope with livelihood disruptions that those with no or little education. This, however, is especially true for those working in the rural farming industries in developing countries where the livelihood resilience of those who received formal education seemed to be higher than those who relied on the manual work (Van den Berg 2010).

Some studies considered that housing/home as an essential tool connecting many aspects of livelihood in many countries (Cannon et al. 2003; Shaw et al. 2006). Tafti and Tomlinson (2015) found that in some cases, households may prioritise the use of limited resources for restoring houses in order to use their houses for different livelihood options. Housing conditions, as some scholars revealed, affect people's socio-economic state and well-being (Arlikatti et al. 2010 and Arlikatti 2012) and are a critical pre-condition for livelihood recovery (Guo et al. 2014). The safety offered by a house, in terms of house quality was regarded highly for self-supporting the recovery of livelihoods (Leon et al. 2009). In studying survivors of 2004 Indian Ocean tsunami, both Arlikatti (2012) and Sina et al. (2019) found that a safe house with structural integrity provides some psychological and well-being support for people, and this will help them quickly get back on their feet and start to pursue income-generating opportunities.

Table 1 Summary of livelihood recovery components identified from the literature

Category	Component	Source
Employment	Income resources	Burton et al. 2011; Chatterjee 2018; Daly et al. 2017; Guo et al. 2014; Han 2014; Shaw et al. 2006
	Education and skills	Mabuku et al. 2018; Munas and Lokuge 2014; Patnaik and Narayanan 2015; Smith et al. 2001; Van den Berg 2010
Housing/Sheltering	Housing conditions	Arlikatti 2012; Guo et al. 2014
	Safety and robustness of a house	Arlikatti 2012; Leon et al. 2009; Sina et al. 2019a
External assistance	Social networks	Minamoto 2010
	Government policies	Ahrens and Rudolph 2006; Blaikie 2009; De Silva and Yamao 2007
Personal well-being	Physical health	Aitsi-Selmi and Murray 2015; Gaillard et al. 2009; Shaw et al. 2006
	Mental health	de Mel et al.2008; Shaw et al. 2006

The third category of livelihood recovery is the external assistance people can receive from their families, friends, government agencies and other social groups. In examining the interrelationship between social vulnerabilities and post-disaster sustainable livelihood, Cannon et al. (2003) highlighted the importance of the role of families, friends and external organisations in people's livelihood recovery, which further assist in reducing their vulnerabilities to future events. Other studies found that people's social networks (Minamoto 2010), namely, their connections to social capitals and the type and amount of policy support from government agencies (Ahrens and Rudolph 2006; Blaikie 2009; De Silva and Yamao 2007) can determine livelihood outcomes amongst different communities.

The original sustainable livelihood framework used personal well-being as one of the livelihood outcomes that go beyond the materialised concerns of people's income (Chambers 1997). However, several studies found that personal well-being and access to physical and psychological facilities, such as health insurance and psychological services, are considered important determinants of long-term livelihood recovery (Aitsi-Selmi and Murray 2015; Gaillard et al. 2009; Shaw et al. 2006). In addition, both people's physical (Hahn et al. 2009) health and mental health (de Mel et al. 2008; Shaw et al. 2006) were essential and can be used as the main indicators in the livelihood vulnerability index to assess the livelihood recovery outcomes following a disastrous event.

3 The context of the study

On 20 April, 2013, an earthquake measuring a magnitude of 7.0 on the Richter scale hit Lushan County, Ya'an City in China's Sichuan Province, known as Lushan earthquake. The affected region is shown in Fig. 1. According to the Chinese National Strong Motion Network Centre (2013), over 80 seismic monitoring stations in Sichuan, Yunnan, Gansu and Shanxi provinces recorded ground motions during the Lushan earthquake. As of 22 April, 2013, China's Ministry of Civil Affairs reported that the earthquake death toll had reached 203, with 11,492 people injured and more than 1.5 million affected (Xiong, Xie, Ge, Pan and Cheung 2015). As of May 2013, the direct economic loss as a result of this event reached US$3.2 billion.

Lushan County is a mountainous rural area, with 75 per cent of its population working in the agricultural sector. However, at the time of the Lushan earthquake, most areas in Lushan County were still recovering from the 2008 Wenchuan earthquake that had occurred five years ago along the Longmenshan Fault (Xu et al. 2013). Due to its close proximity to the epicentre, Lushan County suffered most impact from the earthquake (see Table 2). It accounted for around 62 per cent of the fatalities and 39 per cent of injuries in all the affected areas (Xin 2015). Data from the 2013 Sichuan Statistical Yearbook showed that GDP growth in Lushan Country slowed down in the year when the earthquake hit (Sichuan Statistical Bureau 2013). The worst hit economic sector in Lushan County was tourism, with the number of tourists in the following year falling by 11 per cent.

The disaster management system in China follows a top-down institutional framework (Zhang et al. 2015), which means that the central government and high-level leaders play a large role in post-disaster recovery (Xu et al. 2016). Since the Wenchuan Earthquake in 2008, the Chinese people had learned from the catastrophe and were able to implement some of the learnings in the recovery from the Lushan Earthquake. The Chinese central government exhibited strong leadership in both the immediate response and reconstruction phases of Lushan Earthquake. The counterpart-aid strategies (also known as paired

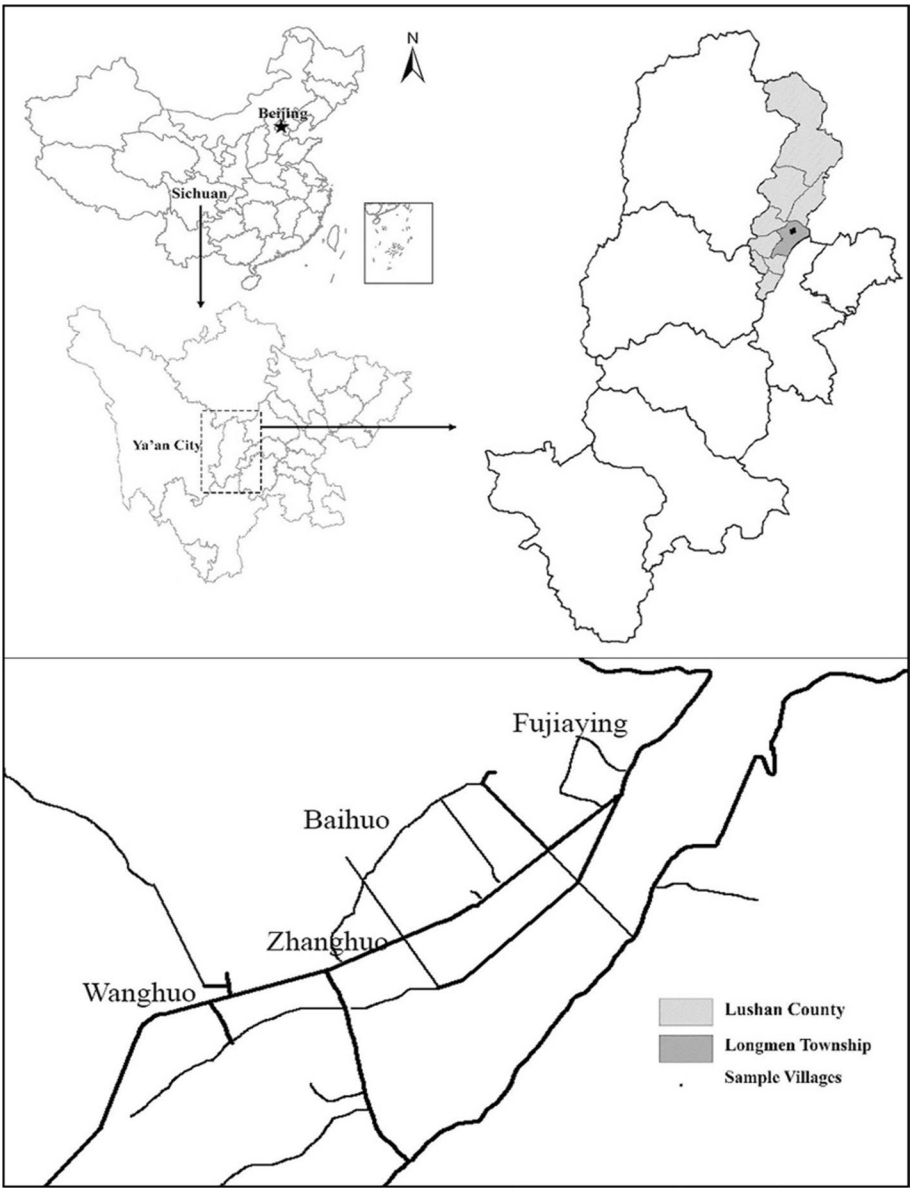

Fig. 1 Location of the areas affected by the Lushan earthquake

assistance or one-on-one assistance) which originated from the Wenchuan earthquake recovery experience were exercised in the recovery of Lushan Earthquake. In Lushan's recovery, it is the aid receipt jurisdictions during the Wenchuan Earthquake recovery to provide recovery assistance to the areas that were heavily affected by the Lushan Earthquake. Deyang City that had fully recovered from the Wenchuan Earthquake was assigned to assist Lushan County, especially help with the revival of its economy (Wei 2015). The

Table 2 Basic information of the Lushan County

Region	GDP growth in 2013 post-earthquake	Fatalities during the earthquake (*n*)	People injured (*n*)	Impact on local tourism
All affected areas	10% in Sichuan	193	15,554	Number of visitors increased by 28.4%*
Lushan county	0.5% in Lushan County	120	6118	Number of visitors fell by 11%

*A comparison is made between Sichuan Province and Lushan County in terms of growth of GDP and tourism

livelihood recovery initiatives implemented for Deyang City following the Wenchuan Earthquake had also formed the foundation for livelihood recovery from the Lushan Earthquake.

4 Research methodology

This research used a case study approach, defined as the study of a "contemporary phenomenon in the real-life context", which encourages the use of a range of data collection methods as a way to assemble a comprehensive picture and case analysis (Yin 2013). By nature, the research presented in this article is exploratory as it is attempted to identify the critical components for livelihood recovery in a specific context. A case study to investigate the perspectives of local communities in the selected Lushan County in Sichuan, China, which was worst hit by the 2013 Lushan earthquake would provide an understanding of whether the perceived livelihood recovery components in this case are similar to, or different from, the literature and other recovery experiences (Yin 2013).

The field trips to Lushan for data collection for this research began in 2015. An analysis of actual recovery experience in Lushan County 2 years on from the earthquake at a time when people could reflect on the challenges they faced and what they did to be able to cope, adapt and recover, can help shed light on the critical components for livelihood recovery. This retrospective approach, according to Paton et al. (2015), is valuable in incorporating these components into pre-disaster preparedness and post-disaster recovery planning.

A triangulation method (Mertens and Hesse-Biber 2012), namely a combination of both quantitative and qualitative methods, was used for data collection. Torrance (2012) argued that triangulation can benefit research with the involvement of respondents in interpreting both qualitative and quantitative data. Two field trips were undertaken by the researcher in 2015, 2016, 2018, respectively, in four villages located in Longmen Township, Lushan County, namely, Wanghuo, Baihuo, Zhanghuo and Fujiaying. The researcher was originally from China and had half-a-year study experience in Ya'an city, who had no barrier in understanding Sichuan dialect during the field trip. Those villages were selected for this research primarily due to the damage severity, data accessibility, the type of recovery. The four villages all suffered significant damage and casualties from the Lushan earthquake. The primary industry in these four villages was farming. While recovery Baihuo and Fujiaying was existing villages, Wanghuo and Zhanghuo were the new villages in new locations.

The interviewees were selected based on "convenience selection" due to the limited time and funding during the field trip (Creswell 2013). Due to the practical condition that a significant number of villagers were out for migrant work, and there was limited time and funding for the field trip, the sampling population is not representative of the entire affected area, but it can provide some insights in the most affected villages. The ethics approval for data collection was obtained from the University of Auckland Human Participants Ethics Committee (Ethics approval reference number 014782). The interviews and questionnaires were collected anonymously. The purpose of the first field trip in July 2015 was to carry out a pilot study with selected 20 villagers across the four villages. The pilot study was to verify the eight components identified from the literature. Through interviews, the first researcher interviewed these villagers and asked them to comment on the applicability and relevance of each component derived from the literature in Table 1, and to add any new component or comment on those that are not relevant. Table 3 below presents a

Table 3 A summary of livelihood recovery components identified from the pilot study and the literature

Category	Component	Source
Employment	Income resources	Burton et al. 2011; Chatterjee 2018; Daly et al. 2017; Guo 2014; Han 2014; Shaw et al. 2006
	Education and skills	Mabuku et al. 2018; Munas and Lokuge 2014; Patnaik and Narayanan 2015; Smith et al. 2001; Van den Berg 2010
	Access to employment opportunities	Pilot study
	Need for work-life balance	Pilot study
Housing/Sheltering	Housing conditions	Arlikatti 2012; Guo 2014
	Safety and robustness of a house	Arlikatti 2012; Leon et al. 2009; Sina et al. 2019b
	Housing functionality	Pilot study
	Housing ownership	Pilot study
External assistance	Social networks	Minamoto 2010
	Government policies	Ahrens and Rudolph 2006; Blaikie 2009; De Silva and Yamao 2007
	Assistance from external families	Pilot study
	NGO's assistance	Pilot study
Personal well-being	Physical health	Aitsi-Selmi and Murray 2015; Gaillard et al. 2009; Shaw et al. 2006
	Mental health	de Mel et al. 2008; Shaw et al. 2006
	Quality of life	Pilot study
	Livelihood satisfaction	Pilot study
	Sense of security	Pilot study

summary of identified livelihood recovery components through the pilot study, comparing to those identified from the literature.

Through the pilot study, another nine components were added into the list, namely, housing functionality, housing ownership, access to employment opportunities, need for work-life balance, assistance from external families and from non-government organisations (NGOs), quality of life, livelihood satisfaction and feeling of security. These additional components were also categorised into the four groups as shown in Table 3.

A questionnaire survey quantitatively investigating people's perception about the relevance of each component was developed drawing on the results from both literature review and pilot study. The questionnaire included 4 sections. The first section asked for demographic information from the respondent; the second section asked the respondent to describe their perception of the importance of the four main categories of livelihood recovery (employment, housing, external assistance and well-being) and describe how these 4 categories interrelate. The third section asked the respondent to rank each component in terms of their perceived importance to livelihood recovery on a five-point Likert scale from 1 to 5, where 1 represented "Not important at all" and 5 represented "Very important". The final section was an open-ended question inviting respondents to provide comments on what successful livelihood recovery looks like/means to them.

Before the questionnaire survey was carried out, an announcement was made by the Longmen Township government to all the four villages about the purpose of this research project and the intention of collecting questionnaire data between August and September 2015. This announcement allowed us to access the households in 4 villages by visiting them one by one. Out of 307 households which had been visited and door-knocked by the researchers, only 150 households were willing to participate in the questionnaire survey. Among the 150 households, persons aged 18 years or over who could represent the household were invited to participate in the questionnaire survey. Of these, 76 (50.6%) questionnaires were answered. A preliminary framework that shows the critical livelihood recovery components was developed from analysis of the questionnaire results. Follow-up interviews were carried out at the beginning of 2016 with 20 selected survey respondents who had indicated their willingness to participate interviews in the questionnaire survey. The purpose of interviews was to capture the in-depth data about why some respondents had perceived certain components important to their livelihood recovery. The information about the participants in this research is shown in Table 4. The first and second researchers undertook the third field trip between April and May 2018 to validate the framework developed from the questionnaire and interview results. Questionnaire results were analysed using SPSS. The interviews were recorded, transcribed, coded and analysed using NVivo 12. In what follows, the research results are presented in the form of a synthesis of questionnaire and interview.

The interviewees are selected based on the random sampling. However, due to the willingness of the participants and the practical conditions that many villagers were out for migrant work, there is some certain bias for the sampling.

5 Results

The demographic information about the questionnaire participants is listed in Table 5. As seen in Table 5, about 36% respondents are in a household of 5 people. The number of female participants (54%) was higher than male participants (46%). Indeed, in

Table 4 Participant information

Village	Population/number of households	Number of sampled households	Questionnaire respondents (n)	Interviewees (code)	Profile of interviewees	Questionnaire response rate (%)
Baihuo	291/81	42	20	5 (B1–B5)	2 migrant workers, 3 farmers	47.6
Wanghuo new village	233/115	55	20	5 (W1–W5)	2 migrant workers, 2 farmers, 1 self-employed	36.3
Zhanghuo new village	225/61	28	20	5 (WN1–WN5)	2 migrant workers, 2 farmers, 1 self-employed	71.4
Fujiaying	230/50	25	16	5 (Z1–Z5)	2 migrant workers, 1 farmer, 2 self-employed	64
Total	979/307	150	76	20	–	50.6

Table 5 Demographic profile of the questionnaire respondents

	Baihuo ($n=20$)	Wanghuo ($n=20$)	Zhanghuo ($n=20$)	Fujiaying ($n=16$)	Total ($n=76$)	
Gender						
Male	6	12	9	8	35	46%
Female	14	8	11	8	41	54%
Household number						
2	0	0	2	1	3	4%
3	2	3	0	2	7	9%
4	8	6	4	4	22	29%
5	5	6	10	6	27	36%
6	4	5	4	2	15	20%
7	1	0	0	1	2	3%
Age						
18–30	4	2	1	3	10	13%
31–40	5	2	7	3	17	22%
41–50	6	7	10	8	31	41%
51–60	3	8	2	2	15	20%
61 or older	2	1	0	0	3	4%
Occupation before the earthquake						
Farmer	13	13	15	12	53	70%
Self-employed	4	2	3	3	12	16%
House care	1	2	0	0	3	4%
No job	2	1	2	3	8	10%
Occupation after the earthquake						
Farmer	9	10	8	5	33	43%
Self-employed	6	2	6	4	18	24%
House care	1	4	0	0	5	7%
No job	5	6	4	5	20	26%

total 87% of surveyed participants have more than 3 people in their household. Most participants fall into the working age category with the majority (41%) being of an age between forty-one and fifty years old. It is essential to know that around 70% of participants reported that they had a job as a farmer before the earthquake and only 43% of them remained as a farmer after the earthquake. It is interesting to see that there is an increase in self-employment after the earthquake (24%), compared to 16% before the earthquake. There is 10% of respondents reported that they did not have a job before the earthquake and 26% reported that they did not have a job after the earthquake.

Statistical analysis in Table 6 shows how the 4 principal categories, to a varying degree, contribute to successful post-disaster livelihood recovery practice. Housing was considered the most important category, followed by employment, external assistance and personal well-being of individuals. The ranks in Table 6 indicate the relative perceived importance of each component when compared with other components within the same category. Figure 2 shows the interrelationships between those components.

Table 6 Statistical analysis of questionnaire results

Categories	Component	Mean	Ranking within the component	Significance (2 tailed)
Housing/Sheltering ($M=4.76$)	Housing functionality	4.65	1	.011*
	Housing condition	4.63	2	.021*
	Safety and robustness of a house	4.46	3	.650
	Housing ownership	4.28	4	.021*
Employment ($M=4.57$)	Income resources	4.67	1	.002*
	Access to employment opportunities	4.57	2	.213
	Education and skills	4.49	3	.649
	Need for work-life balance	4.11	4	.000*
Personal well-being ($M=4.13$)	Quality of life	4.53	1	.002*
	Livelihood satisfaction	4.43	2	.002*
	Physical health	4.41	3	.096
	Mental health	4.40	4	.180
	Feeling of security	4.23	5	.011*
External assistance ($M=4.47$)	Assistance from external families	4.67	1	.495
	Social networks	4.61	2	.278
	Government's assistance	4.41	3	.127
	NGOs' assistance	4.34	4	.109

With μ is the population mean and $\mu_0=4.5$ is the critical rank, the null hypothesis H_0: $\mu=\mu_0$ and the alternative hypothesis H_1: $\mu>\mu_0$. The significance level for the 2 tailed is 0.05

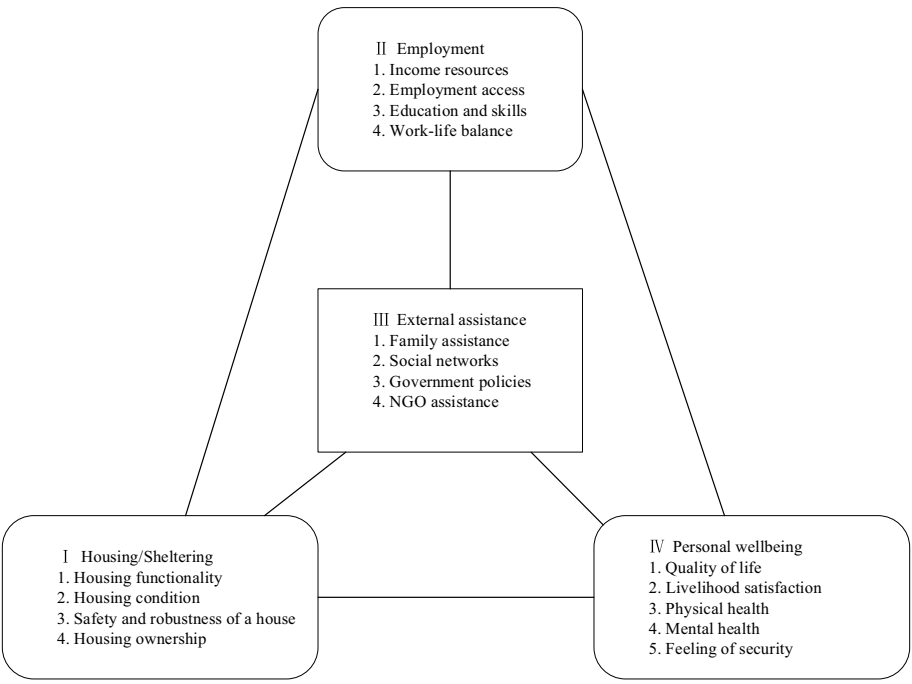

Fig. 2 A framework for post-disaster livelihood recovery

6 Discussion

In the third field trip between April and May 2018, when asked about the validity of the framework in Fig. 2, a consensus from the people who participated in the research was that this framework had captured their perspective and can be potentially a useful tool for livelihood support agencies and communities themselves to identify areas that require substantial support at an individual or household level so that the recovery of people's livelihood can be more effective. In addition, several interviewees (B3, W2, WN5 and Z4) acknowledged that the framework captured the essential 'ingredients' required for their livelihood recovery.

6.1 Category 1: Housing

The interview results suggested that the majority of questionnaire participants considered housing as being an indispensable part of their livelihood recovery. The critical role housing played in livelihood, according to interviewee B1, reflected a traditional perspective of rural villagers that housing is the single greatest asset of their lives and livelihood. This result is in line with what Rapoport (1982) proposed that housing can be used not only as an asset, but also a socio-economic production tool to generate income. Field observations revealed that most villagers in the studied sites used parts of their rebuilt or restored houses as grocery stores, places to store production tools, areas to feed their livestock or poultry, or for other self-employed business purposes. Rebuilding houses to be multi-functional houses is particularly important for those who do not have any formal skills and regaining skills post-disaster prove difficult for them (Mukherji 2008; Sina et al. 2019a).

It is therefore not surprising that housing functionality received the top rank in the questionnaire survey (Mean 4.65), followed by housing conditions (Mean 4.63), which, according to most interviewees (e.g. B3–B5), was closely linked to occupants' well-being. As Ya'an City was known as a 'raining city', frequent wet conditions often grew moulds in people's house, which triggered health hazards and increased occupants' susceptibility to illness and medical issues. This further affects many aspects of at-risk people with existing medical conditions, in particularly affecting their ability to participate in work. Interviewee WN1 emphasised this by saying:

> Our damaged house, though still habitable, tends to have poor conditions especially when it rains, and the whole family suffer from sore knees, bad emotions and feelings, poor productivity.

This finding, however, echoes the results in some studies that housing conditions can oftentimes serve as an indicator of the quality of life, which is further associated with people's livelihood outcome (Guo and Kapucu 2018; Xiao et al. 2018). Aside from housing conditions, another housing aspect considered essential for livelihood recovery was the safety and robustness of a house (Mean 4.46). Most of the interviewed households in the Wanghuo Community complained about the poor workmanship of home repairs from local builders and subcontractors. Interviewee W1 commented:

> We wanted to start a new business by using one front room for a tea shop. It leaks a lot, and if it rains, it will prevent us from opening the shop.

Housing quality and livelihoods are also intertwined into the concept of "build back better" during the reconstruction period (Kennedy et al. 2008). A good quality house, in the case of serving as an income earning tool, is critical in empowering local communities and people's livelihoods (Jha 2010). The questionnaire respondents also considered home ownership as an important aspect of livelihood recovery (Mean 4.28). According to Chambers (1987), a secure ownership of livelihood assets was an effective way to offset disaster shocks and risks. Recovery policies following the Lushan earthquake tended to favour those who own a house. Interviews revealed that most renters are migrant workers and their employment was often transient or short-term due to employers' perception that they may not stay around if they do not own a house. This finding is in line with a study in India in examining the recovery of communities affected by floods that housing ownership is often related to people's identity and socio-economic status, which significantly influence people's choice of livelihood and personal well-being (Mukherji 2008).

6.2 Category 2: Employment

The interview results suggested that the majority of residents considered employment as another critical component that constituted successful livelihood recovery. In particular, resources for income generation received the highest rank in this category (Mean 4.67). Field observations and interviews revealed that some farmland in Longmen Township had been acquired by the local government to become "picking gardens" (gardens where tourists come to pick fruit, often Kiwifruit) in order to boost tourism. Most farmers of a relatively older age (more than 41 years old) who used to heavily rely on their land to generate income had traded land for a one-off cash compensation and lost a sustained means of livelihood. In some cases, the government subdivided some areas into 'mini' farmlands, but the land was not big enough for farmers to plant sizable crops and vegetables. Consequently, many farmers deserted their land and left for Ya'an City for urban jobs. This is similar to what happened in coastal areas following the 2004 Indian Ocean tsunami in Aceh, Indonesia, where traditional rice farms were traded to the Aceh government and a majority of farmers had to migrate to urban areas seeking lower-skilled jobs in the factories (Daly et al. 2017).

Apart from income resources, access to employment opportunities was considered to be the second most important aspect of employment. Interviews revealed that many people who lost their job and income in the earthquake had participated in the reconstruction of damaged houses and infrastructure, but they ended jobless when the reconstruction was near completion. Interviewees (Z4) explained that:

> We tried to look for other job opportunities, but there were limited options due to my age, education and level of skills. In the mountainous areas, apart from farming and tourism, there is not much we can do. There are very few working opportunities in the village after the reconstruction was finished.

According to APEC (2013), creation of public work opportunities is often considered helpful to help disaster affected populations to gain work following disasters. Provision of job opportunities as such, though short-term, was considered as a critical component for livelihood restoration in a resettlement programme in Baihe County of Sichuan, China, to help people upskill in construction-related jobs following the 2008 Wenchuan earthquake (Xiao et al. 2018). A similar case study following Cyclone Aila

in Bangladesh also revealed that public work can be an essential buffer to help people transition from job displacement to job placement (Saha 2017).

Questionnaire results showed that people believed education and skills deserved more attention in the livelihood recovery process. Only around 30 percent of the people surveyed were confident that they were capable of utilising the skills they learned from training sessions offered by the government agencies. For example, the local government in Lushan County aimed to provide villagers affected by the quake with the skills needed to work in certain enterprises (Liang and Cao 2015; Sichuan Provincial Government 2013), such as construction enterprises and clothing factories in Lushan County. However, these training sessions required trainees to have a certain level of literacy which the majority of villagers did not have. Interviews suggested that most displaced villagers had to opt out of some sessions and could only participate in the training programmes that were labour-intensive, such as construction work for men and handcrafts for women. It was widely acknowledged that tailored education and training are helpful in addressing inequality in income distribution (Daly et al. 2017; Thorburn 2009). Similarly, following the 2004 Indian Tsunami, some training provided for traditional crafting sectors provided to be useful in livelihood rehabilitation in Aceh Province of Indonesia (Sina et al. 2019b).

Finally, work-life balance was seen as an important component for employment in this research (4.11). Some interviewees stated that the urgency to secure income after losing their former employment in the earthquake had compelled them to seek any labour-intensive work with long working hours. Interviewee WN3 commented that they needed to work at least 10 h non-stop for US$10 per day in the "picking gardens", and had little time for her young children. For others who are migrant workers in factories, working at a fast pace and at high intensity was the norm, leaving them little time for their families. The interviews also brought to light that quality of employment remains a big issue, with low salary, long work hours and uncertainties faced by those who regained employment in earthquake recovery. Work-life balance has been considered as one of the most important dimensions to predict people's well-being and family life (OECD 2013). However, there was a general sense that questionnaire respondents were struggling to achieve that due to lack of job opportunities that can offer a decent income. Villagers interviewed expressed their strong desire for rapid economic recovery in the region to have more jobs created and for them to access better employment options.

6.3 Category 3: External assistance

The questionnaire results revealed that respondents considered external assistance to be a crucial pillar category that underpinned the other 3 categories. When asked about which type of assistance they believed had influenced how they restored their means of livelihood, there was a consensus that in-kind or monetary support from their extended families and community groups was better received than that from the government and NGOs. As one interviewee (Z1) claimed:

> We rely heavily on social ties from family members and neighbours. They know what we can do and cannot do and are willing to provide us with all kinds of assistance at different times. However, the programmes from outside the community, like the training programme, it was one-off, we still couldn't find a job and the outcomes from these programmes were not monitored.

Shortly after the earthquake, the government had initiated different policies to support the households. For instance, local government has issued housing subsidies for those households whose houses had suffered critical damage. The amount of money to the households was based on the size of the family, which was 26,000, 290,000 and 32,000 RMB, respectively. The financial aid received by the villagers was associated with the family size and the assessment of housing damage, which was related to the connection with the government. Such a finding was consistent with the evidence that social support from nuclear family or even external family related to the financial aid received by the government following the 2008 Wenchuan earthquake (Tse et al. 2013; Wei and Han 2018). Furthermore, villagers claimed that they managed to find new employment due to their own social connections.

The results from the questionnaire also showed that assistance from the government agencies was considered critical in livelihood recovery. Interviews showed that public participation in earthquake recovery had increased, however, the participation was only limited to several community leaders in the studied villages. As reported in another study that oftentimes the livelihood recovery goals of local residents are not aligned with the overall objectives of economic recovery at the township level, thus the government assistance which is mainly targeted to changed economic structure of the townships was not received well (He et al. 2019).

NGOs' assistance received lowest score in this category (Mean 4.47). According to the interviewees, the roles that NGOs played during the recovery process were largely related to skills training programmes working with local government. While a few studies emphasised the critical roles of NGOs during the recovery process (Islam 2015), the majority of interviewees were unsatisfied with the training programmes provided by the NGOs, and their lack of understanding of the real needs of people was cited as a main reason.

6.4 Category 4: Personal well-being

Although considered to play a less significant role compared to other 3 categories, interviews suggested that personal well-being was an indispensable category of livelihood recovery. Nearly half of questionnaire respondents considered individual well-being important for their livelihood recovery. According to interviewee B3:

> When the government and NGOs offered assistance for us, most of them were about housing subsidies and employment; very few organisations had considered our personal well-being and how it would affect our ability to make a living.

Such a statement echoed the claim that post-disaster response and recovery process following the 2008 Wenchuan earthquake had ignored people's mental health (Liang and Wang 2013). Along with mental assistance, social support after the earthquake has also been claimed as effective in helping people overcome their stress and anxiety, especially for vulnerable population (Ren et al. 2015; Yang et al. 2010). Although it is widely acknowledged that unemployment implies negative mental statement, poor psychological conditions also have higher chances to lower people's opportunities in finding new jobs (Paul and Moser 2009). Thus, government initiatives should incorporate mental health into the recovery programmes.

Quality of life was considered as the most critical component in the category of personal well-being (Mean 4.53). This referred to what is Chambers and Conway (1992) had called, for a livelihood not only be making a living, but also making a meaningful living.

Improvement in the quality of life often improves livelihood aspects, such as livelihood resilience (Fang et al. 2018; Sina et al. 2019b) and livelihood sustainability (Pomeroy 2006).

Livelihood satisfaction received the second highest rank in the category of personal well-being (Mean 4.43). This result was similar to two studies found that after the Wenchuan earthquake, compared with those who were not affected by the disaster, people in the earthquake-affected areas were generally unsatisfied about their livelihood (Ke et al. 2010; Liang and Cao 2015). In the questionnaire survey, both physical and mental health were highly ranked as critical components of well-being that lead to successful livelihood recovery. This was consistent with the study by Kachali et al. (2010), which claimed that workers' well-being was one of the most critical factors in predicting workers' employment status following the 2010 Canterbury earthquake in New Zealand.

Interviewees further suggested that there was a general lack of awareness of mental health issues arising from the earthquake, and that little psychological assistance was provided. According to Wang et al. (2000), Chinese people are inclined to deny mental health issues due to the fear that they might be discriminated or isolated from the community. Zhang et al. (2011) advocated that mental health services and associated education programmes were needed in the psychological relief work and the importance of this was also evidenced in studies following the 2008 Wenchuan earthquake. Another source of stress most interviewees cited was the fear of unsafe neighbourhood as a result of the government's development initiatives to boost local tourism after the earthquake. Similarly, having a safe neighbourhood was also considered important in several livelihood resilience studies (Sina et al. 2019a; Tellman et al. 2014). In the interviews, those who were parents reported their concern over the safety of their children when tourists flooded into the village.

Overall, the framework developed demonstrates how external assistance can be leveraged to support the other three categories in achieving better livelihood recovery outcomes. In practice, recovery of housing, labour market and well-being is often handled separately and independent of each other (Abramson et al. 2010). It is suggested that the disaster recovery practitioners, government agencies and social groups in China need to address the livelihood recovery from a more holistic view, drawing on the relationships among the identified categories suggested in this research.

Furthermore, although external assistance was considered as essential to underpin the other three categories of livelihood recovery components, the aid from social groups, especially those NGOs seemed to be less well received. The aftermath of 2008 Wenchuan earthquake had for the first time witnessed significant movements of social groups in post-quake response and recovery (Huang et al. 2011). As illustrated by Lu and Xu (2015), there is still space for NGOs and local government to partake during the recovery process following the Wenchuan earthquake. The findings from this research warrant a need for Chinese NGOs to continuously build capacities to better understand livelihood needs of the affected people before they decide what assistance to offer.

The housing aspect, which was considered as an integral part of the livelihood recovery, deserves more attention from disaster recovery practitioners and policy makers in places where there is a trend for houses to be used as income generation assets. A valuable theoretical implication is that very few studies have addressed the role of housing and individual well-being in determining people's livelihoods in daily lives (Sina et al. 2019b). This article has raised an alerting message to disaster-related practitioners and researchers for an improved understanding of the psychological and mental effects of job losses due to a disaster, and the stress of re-gaining livelihood during recovery.

Compared with the widely used livelihood framework, which has been claimed as quite complex (Scoones 2009, 2015), especially that communities have difficulties in participating in the decision-making process to build capacity and reduce vulnerability for better livelihood outcome (Gaillard 2009). One example is calimed by Daly et al. (2020) that following the 2004 Indian Ocean Tsunami, there appeared to be inconsistencies with the aid provided by the aid agencies and the practical needs by local residents during the recovery stage. Similarly, as indicated by Han et al. (2020), the perceived livelihood recovery from the communities was inconsistent with what the government had claimed following the Wenchuan earthquake. The designed framework in this study, one the other hand, is more community-based as all the components are identified from the individuals within the community. It is flexible and can be modified based on different case studies.

7 Conclusions

In this research, the case study of 2013 Lushan earthquake in China provided an opportunity to explore the critical components of post-disaster recovery with a focus on livelihood. The investigation on the relationships among different categories also provided a perspective on how to help local communities in Lushan to identify the indispensable components of livelihood following disasters. The results showed that the components that were considered as critical for achieving successful livelihood following the Lushan earthquake fall into 4 categories, namely housing, employment, personal well-being and external assistance. In the villages surveyed in Lushan, 'housing' came before 'employment' as the most important category during the livelihood recovery process. A specific focus on assisting 'housing functionality' can help communities regain their livelihood capacity, especially for self-employed individuals. Although 'personal wellbeing' was generally considered as the least important amongst these categories, the research sheds light on how the well-being part and inner psychological side of people can affect employment choices and livelihood situations in the selected areas.

Additionally, the research findings—critical components that constitute a successful livelihood recovery—were derived from those people who were directly affected by a large earthquake and had displaced from their homes and jobs, and their reflections on what were important for them. Therefore, the perceptive empirical findings need to be used by government agencies and social organisations with care. Whether the finding from this framework is applicable in other contexts needs to be examined in the future studies. The identified components and their rankings are only applicable in the Lushan context based on the perspectives of local communities, and it can only be interpreted as their perceptions. The usage of this framework in other contexts needs to be adopted and adjusted according to different socio-cultural conditions. At the same time, the usefulness of this study is based solely on the components that constitute the livelihood recovery while other characteristics of the selected communities have not been fully considered. Thus, further studies on factors that affect the livelihood recovery also need to be identified in order to help local communities address their specific needs to make the argument more concrete.

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Compliance with ethical standards

Conflict of interest To the best knowledge of the authors, there is no conflict of interest in this manuscript.

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