

## Article

# When Housing and Communities Were Delivered: A Case Study of Post-Wenchuan Earthquake Rural Reconstruction and Recovery

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**Abstract:** This study contributes to an in-depth examination of how Wenchuan earthquake disaster survivors utilize intensive built environment reconstruction outcomes (housing and infrastructural systems) to facilitate their long-term social and economic recovery and sustainable rural development. Post-disaster recovery administered via top-down disaster management systems usually consists of two phases: a short-term, government-led reconstruction (STGLR) of the built environment and a long-term, survivor-led recovery (LTSLR) of human and social settings. However, current studies have been inadequate in examining how rural disaster survivors have adapted to their new government-provided housing or how communities conducted their long-term recovery efforts. This qualitative case study invited sixty rural disaster survivors to examine their place-making activities utilizing government-delivered, urban-style residential communities to support their long-term recovery. This study discovered that rural residents' recovery activities successfully perpetuated their original rural lives and rebuilt social connections and networks both individually and collectively. However, they were only able to manage their agriculture-based livelihood recovery temporarily. This research suggests that engaging rural inhabitants' place-making expertise and providing opportunities to improve their housing and communities would advance the long-term grassroots recovery of lives and livelihoods, achieving sustainable development.



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## 1. Introduction: Two-Staged Post-Disaster Agenda

Catastrophes, such as earthquakes, floods, hurricanes, and fires, devastate the sustainable foundation of human settlement—namely the physical, social, and economic dimensions [1]. Since the built environment (e.g., housing and infrastructure systems) grounds the physical foundation for social, economic, and other redevelopments [2], the built-environment-specific post-disaster reconstruction and recovery stage features two general phases: intensive built environment reconstruction (short-term reconstruction) and ongoing recovery (long-term recovery) [3]. Time-sensitive, large-scale, and complex built environment reconstruction is usually administered and conducted by governmental and/or relevant organizations by swiftly coordinating domestic and international resources—namely short-term, government-led reconstruction (STGLR). Through self-management of the built environment delivered by official authorities, especially pertaining to housing and communities, disaster survivors become committed to re-establishing lives and livelihoods, a process called long-term, survivor-led recovery (LTSLR). STGLR and LTSLR feature two major post-disaster stages, especially in countries with top-down disaster management systems, such as China, India, and Italy [4–6]. Current research has inadequately examined the grassroots efforts of mediating STGLR and LTSLR, namely

utilizing short-term reconstruction physical outcomes to rebuild disaster survivors' lives and livelihoods.

After the Wenchuan earthquake (Sichuan, China, 2008), the overall post-earthquake agenda followed the two stages of STGLR and LTSLR. The STGLR phase swiftly processed the intensive built environment reconstruction while limiting most disaster survivors' participation, especially in housing and community reconstruction [7]. The lack of grassroots input triggered potential barriers in the subsequent LTSLR process, threatening disaster survivors' social rehabilitation and economic recovery, as well as ultimately impacting sustainability at the individual, family, and community levels [8]. In response to the research deficit above, this post-Wenchuan earthquake grassroots efforts case study is guided by the following question: how have disaster survivors utilized STGLR outcomes to support LTSLR? This case study contributes to post-disaster reconstruction and recovery research and practice, empowering grassroots efforts to utilize governmental-designed built environment outcomes to support sustainable long-term recovery in the rural communities of Sichuan, China, in particular, while also being generally applicable to other communities facing similar post-disaster scenarios.

## 2. A Conceptual Framework: Government Interventions and Grassroots Efforts

In a human-settlement-specific post-disaster agenda, STGLR aims to restore the physical facilities serving the community, including buildings (e.g., family housing and public buildings) and infrastructural systems (e.g., the networks or systems of transportation, electricity, water and sewerage, and communication) [9]. Based on this physical foundation, LTSLR embraces the recovery and rehabilitation of all human and social dimensions (e.g., social, cultural, political, and economic). Harmonizing physical, social, and economic dimensions promotes the sustainable development of human settlement, aligned with the U.N.'s Sustainability declaration in the wake of disaster risk reduction [10]. The delivery of physical structures into disaster survivors' hands indicates a potential administrative boundary between STGLR and LTSLR. It also implies that disaster survivors will take the leadership to utilize, manage, improve, and maintain the physical environment to support their long-term efforts. Based on the two principal stakeholders of the two stages of STGLR (governmental authorities) and LTSLR (disaster survivors), this conceptual framework is rooted in the examination of two stakeholders' contributions towards synthesizing the physical, social, and economic environment in post-disaster human settlement reconstruction and recovery (See Figure 1). Namely, how does the current research examine the interconnections of different stakeholders in this two-phased process and their efforts to commit to community-based, post-disaster sustainable development?

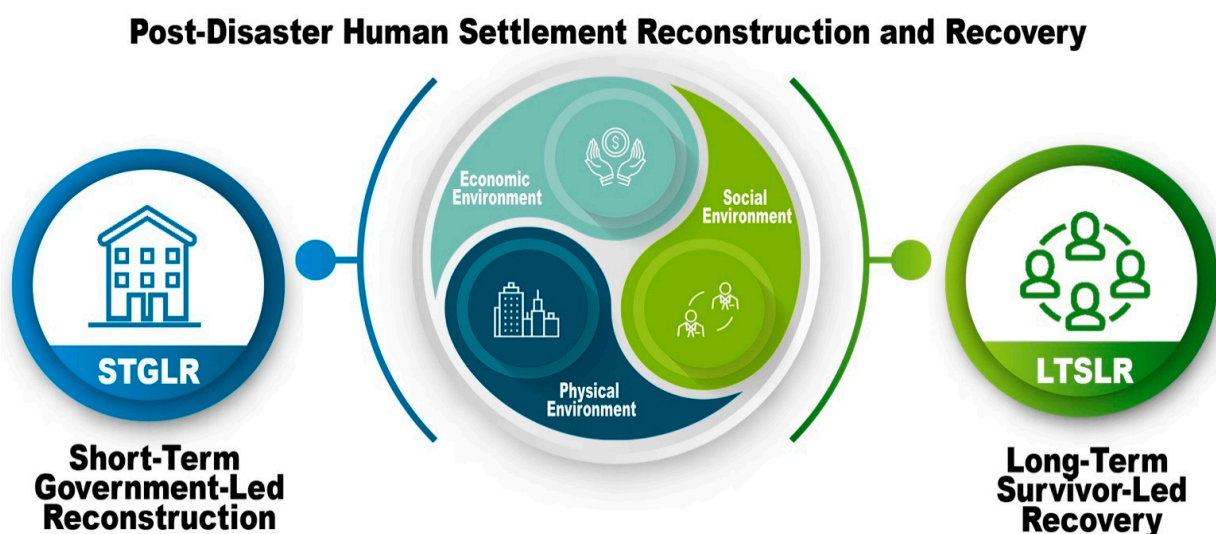


Figure 1. Short-term, government-led reconstruction and long-term, survivor-led recovery.

## 2.1. Government Interventions

Various vulnerabilities increase the residents' exposure to potential hazards, which, in turn, will further trigger prospective extreme events [11]. These vulnerabilities are rooted in the societal background, shaping the nation's political interests, economic and social development status, globalization, and related government interventions [12]. The ultimate goal of government-led disaster management is to reduce various vulnerabilities by providing appropriate assistance towards disaster survivors and their reconstruction and recovery [13]. This section will examine the government interventions of STGLR in the economic, social, and physical aspects of the post-disaster agenda in human settlement.

### 2.1.1. Uneven Economic and Social Recovery Associated with STGLR

STGLR initially addresses the physical environment vulnerability [14]. According to Johnson and Olshansky, the three major components of a government's leadership in facilitating post-disaster agendas are managing funds, distributing critical information, and stimulating collaboration that fulfills the vital large-scale, capital-intensive, and high-cost characteristics [15]. Most aspects of built environment reconstruction tend to be large-scale, capital-intensive, and high-cost investments [16]. These characteristics demonstrate that national governmental agencies and their equivalent counterparts could be among the few authorities with the capacity to complete large-scale built environment projects through intensively coordinating and arranging physical, social, human, and other resources at local, national, and international levels [17]. Although practice investigation shows that private firms and other community-based agencies can be partnered during STGLR [18], disaster survivors' direct engagement (grassroots participation) during the STGLR phase is minimal.

International experience has verified that intensive reconstruction serves as an economic stimulus by attracting enormous resources in various ways that spur economic redevelopment in the affected communities [19]. However, since the gross domestic product (GDP) is one of the visible measures of governmental achievement [20], previous research has demonstrated that post-disaster reconstruction has been primarily focused on economic growth, to which built environment reconstruction dramatically contributes [21,22]. Accordingly, social and related sector budgets were drastically severed in the overall plan to pursue swift and maximum economic outcomes [23]. Furthermore, post-disaster initiatives are expected to comprehensively integrate social, economic, and other societal dimensions into the physical reconstruction phase [24]. When this expectation joins with community-driven situations, for example, fulfilling the disaster survivors' basic living requirements (e.g., access to housing, water, and electricity), the attention of STGLR is predominantly focused on physical aspects rather than intangible dimensions (e.g., social and cultural) [25].

Since disaster initiates a complex interplay of physical, social, and economic factors, failure to synthesize these three dimensions in official post-disaster initiatives may exacerbate various inequalities, further exposing disaster survivors to prospective risks [26]. Specifically, a safe-built environment significantly contributes to disaster survivors' physical health, mental wellness, and overall well-being by protecting them from potential disasters; however, the lack of social consideration delays survivors' overall recovery [14]. For instance, the Bangladesh (2009) intensive infrastructure-focused post-Cyclone Aila reconstruction neglected to integrate community participation and adaptation with livelihood transformation, resulting in some affected people's failure to recover ten years after the disaster [27]. Hence, balancing physical reconstruction with economic redevelopment, social recovery, and other societal aspects is essential for any governmental, post-disaster effort. Alternatively stated, STGLR should accomplish a sound physical platform to advance overall reconstruction and recovery, committed to vulnerability reduction and sustainable development [28].

### 2.1.2. Limited Community-Based Participation in STGLR

The Sendai Framework for Disaster Risk Reduction 2015–2030 called for an inclusive approach to disaster risk reduction [29]. Engaging disaster survivors in the decision-making process and implementation to decide their own communities' reconstruction is the first step [30]. This bottom-up engagement enacts inclusive social learning and socially sustainable transformation, addressing social inequalities and promoting social justice [31]. In contrast, top-down, government-led disaster management effectively centralizes resources that target emergency issues and swift built environment reconstruction [32,33]. To some extent, this approach has functioned mainly at the exclusion of community-based, bottom-up input that would address the easily ignored dimensions in the governments' efforts (STGLR) [14]. Particularly, Imperiale and Vanclay argue that the national government's command-and-control reconstruction interventions after the 2009 L'Aquila earthquake, Italy, restricted local authority figures from accomplishing decision-making processes, resulting in geographic risks and social inequalities that have seriously jeopardized long-term recovery [4].

Furthermore, politically and economically driven physical (built environment) reconstruction has, at times, effectively and efficiently accommodated tremendous numbers of homeless disaster survivors, swiftly providing them with basic living necessities [34]. However, this mission-oriented focus presents a high possibility of neglecting the broader scope of related societal dimensions and grassroots input, further jeopardizing community-based, long-term sustainable development [16]. Therefore, to mitigate this potential detrimental outcome, community-based strategies have been developing to promote grassroots engagement. As an illustration, labor market interventions provide employment opportunities to disaster victims to participate in STGLR-related projects [35]. Paid employment guarantees disaster survivors a primary income to fulfill their basic living and social needs, and more importantly, enables them to prepare for potential extreme events [36]. However, most of the existing interventions of STGLR only allow disaster survivors to partially participate in pre-set governmental projects [37,38].

Briefly, potential barriers of STGLR, such as neglect of social and economic recovery and limited grassroots participation, directly influence physical reconstruction outcomes. How could the disaster survivor carry out LTSLR on these physical structures? The following section examines grassroots post-disaster LTSLR efforts to adapt to the new environment.

## 2.2. Grassroots Post-Disaster Efforts

### 2.2.1. Grassroots Participation in Post-Disaster Agenda

Post-disaster grassroots participation was structured as a permanent force in disaster scenarios that advocate for environmental and social justice [2]. Achieving environmental and social justice has been an equal degree of protection from various hazards and access to post-disaster decision-making processes [39]. Grassroots efforts form a bottom-up approach that allows especially vulnerable and marginalized groups' voices to be heard at the decision-making level [24]. Furthermore, this engagement appreciates community-based, traditional place-making expertise founded on the long-term interplay between inhabitants and their surroundings [40]. These traditional place-making skills and knowledge could essentially address the neglect and weaknesses within the government-led reconstruction plans, increasing disaster survivors' benefits from the built environment [41].

STGLR aims to achieve equal distribution of built environmental benefits towards all inhabitants, regardless of their social backgrounds and/or status [42]. However, most top-down governmental interventions largely exclude local inhabitants' engagement, especially in the decision-making process of planning and designing the new built environment. Hence, new housing and communities are designed by the top-level decision-makers, namely government officials, real estate developers, policymakers, and other stakeholders, who might not live in the affected communities [43]. Neglecting the final beneficiary, failing to include disaster survivors in decision-making not only betrays social justice but also creates a scenario where new housing and communities are incongruent with disaster



survivor needs and desires [44], establishing physical barriers to continued LTSLR [25]. Unfortunately, current research has not deeply examined how disaster survivors cope with these challenges, promoting LTSLR and achieving post-disaster sustainable development.

### 2.2.2. Rebuilding Lives and Livelihoods

Shifting from STGLR into LTSLR encourages disaster survivors to develop clear goals in rebuilding their lives and livelihoods. During LTSLR, as governmental and other external sponsors' determination may cease to fully support recovery activities, local inhabitants must take the reins [45]. This transfer enables disaster survivors to utilize and maintain STGLR outcomes to fulfill their social and economic needs, achieving sustainable development. Therefore, there is a great need for more comprehensive transition period examination to learn how grassroots efforts accomplish this transfer. These examinations will contribute to existing literature and inform future government-led interventions to better serve disaster survivors. More importantly, they will provide evidence-based strategies regarding how disaster survivors manage the physical outcomes to cope with their interim needs and longer-term challenges [3].

At the community level, disaster survivors, whose lives and livelihoods were threatened and even destroyed by disasters, have the most incentive to coordinate their community-wide resources to reduce potential risks [5]. Previous studies have generally demonstrated that local inhabitants have specific capacities to facilitate long-term recovery [46], including political [47], social [48], leadership [49], and economic capacity [50]. As an illustration, Crawford and Morrison argue that the community-led reconstruction program after the 2015 Nepal earthquake repaired local social connections and promoted social inclusion through engaging with marginalized and under-represented groups [51]. Moreover, an evaluation of long-term livelihood recovery following the 2004 Indian Ocean tsunami in Aceh, Indonesia, demonstrated that local disaster survivors could utilize financial aid provided by external sponsors to restore their livelihoods to their pre-disaster levels [52]. In short, existing research has explored certain types of grassroots capacities in long-term recovery settings rather than systematically examining the collective contributions of inter-connections among the physical, social, and economic dimensions, eventually promoting ongoing sustainable development. Although the built environment serves as the foundation for almost all post-disaster efforts, research regarding how disaster survivors adapt to their new communities and facilitate their social and economic recovery remains inadequate.

Succinctly, every post-disaster agenda is a brand-new lesson for affected communities and their political authorities, generating both opportunities and challenges. When the top-down system (government interventions) successfully delivers built environment public assets (STGLR) into private hands, the weaknesses of this approach also generate potential challenges for disaster survivors' long-term recovery continuance (LTSLR). Exploring disaster survivor STGLR outcome utilization feasibility to support LTSLR is urgently needed. This study contributes to the research deficit by bridging STGLR and LTSLR and, more importantly, informs the current post-disaster practice agenda of empowering grassroots efforts, supporting ongoing community sustainable development.

## 3. Post-Wenchuan Earthquake Efforts

The 8.0 magnitude Wenchuan earthquake recorded more than 69,000 fatalities and rendered over 11 million people homeless, with approximately 115 million people affected overall [53,54]. In addition to the tremendously horrific human cost, over 4 million families' housing, 7444 schools, and more than 34,000 km of highways were destroyed [55]. Housing and infrastructural system reconstruction served 5.4 million earthquake survivors [56]. The political system informed the post-earthquake agenda, strictly following the two stages of STGLR and LTSLR. How have the disaster survivors utilized intensive physical reconstruction (STGLR) outcomes to continue the long-term recovery of rebuilding lives and livelihoods (LTSLR)? The following three principal characteristics of STGLR, associated with the conceptual framework presented above, illustrate that the Wenchuan case features

a typical and vital empirical example to answer this question [57]. Examining these grass-roots efforts within the Wenchuan case provides a trustworthy reference for international communities that apply the same or similar disaster management policies.

### *3.1. Characteristic 1: Focusing on Built Environment Reconstruction*

Providing safe accommodation for such a considerable number of homeless earthquake survivors became a top priority of the National Post-Earthquake Reconstruction and Recovery Master Plan [58]. This was precisely aligned with China's overall economic stimulus strategies during that period, in which the built-environment-related investments had been the primary economic focus [59]. Correspondingly, out of the 25 percent of the total fiscal stimulus package that had been designated to support the Wenchuan efforts, most of the funding was spent on housing and infrastructure-related built environment reconstruction. At the same time, social dimensions and related investments were reduced and squeezed into the overall budget [22].

### *3.2. Characteristic 2: Neglecting Rural Features*

Almost all of the worst-hit and second-to-worst-hit areas were located in the rural areas of Sichuan [48]. In these rural communities, the rural residents (primarily farmers) used to live in rural settlements of traditional houses close to their agricultural facilities, characteristically "diffuse[d] and dense in spatial distribution" and "uniform and small in size" [60] (p. 1). However, the earthquake-triggered geological risks resulted in some places being no longer suitable for rebuilding [61]. To quickly provide housing, "concentrated rural settlements" were developed in rural areas, collectively relocating nearby farmers to one central place [44]. Moreover, the national master plan required that the post-earthquake efforts comply with the national policy of rural development [62,63]. Accordingly, these concentrated rural settlements followed urban residential communities' planning and architectural design with condominium buildings (no higher than seven floors) with high seismic standards and modern facilities [44]. The intention was to improve the rural dwellers' quality of life up to the standard of their urban peers [7]. However, duplication of the urban residential communities in rural areas largely ignored the unique rural features and triggered more challenges for LTSLR [7].

### *3.3. Characteristic 3: Excluding Grassroots Participation*

Several different housing reconstruction options were offered to disaster survivors (e.g., self-construction, government-led reconstruction, and joint reconstruction) in the STGLR plan [64]. However, most farmers chose the concentrated rural settlements, accommodating tens of thousands of disaster survivors, due to their low reconstruction capacities. These robust reconstruction projects were conducted through a counterpart assistance approach. Specifically, the national government arranged provinces, municipalities, and autonomous regions throughout China to support one city or town's reconstruction and recovery in Sichuan [65]. These sponsors coordinated and organized various resources nationwide, swiftly constructing living units and then handing the condominium keys directly to earthquake survivors. However, notably, survivors did not typically participate in the housing and community "key delivery" projects. In essence, their input was left out.

## **4. Case Study Design**

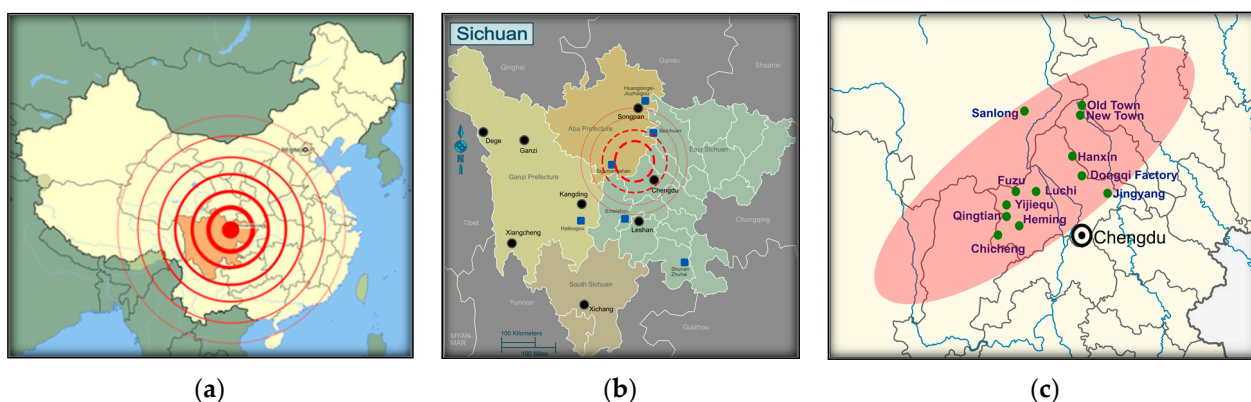
### *4.1. Case Study Period*

This case study was administered through two stages of fieldwork in the worst-hit and second-to-worst-hit areas of the Wenchuan earthquake. STGLR was officially completed within three years after the Wenchuan earthquake (2008–2011) [66]. Almost all housing-related projects in the rural areas were completed within the first two years (2008–2010) [67]. The first fieldwork stage was conducted from August 2012 through January 2013, the fourth anniversary of the Wenchuan earthquake. By then, almost all rural survivors had lived in their new housing and communities for at least two years. This period offered these

survivors enough time to engage with their new surroundings and to continue their daily activities of LTSLR, namely utilizing the physical foundation to resume their lives and rebuild their livelihoods. The second stage of fieldwork was conducted from 2014 to 2017. During this period, the author had four annual summer field trips to the same communities, tracking the local inhabitants' long-term recovery processes. The first stage of fieldwork was covered by the University of British Columbia Ethics Certificate (Number H12-00326).

#### 4.2. Data Collection

This qualitative case study employed two data collection instruments: a tape-recorded individual walk-along interview and researcher observation notes (see Figure 2). The first fieldwork stage used both data collection instruments, while the data collected during the second fieldwork stage was generated through researcher observation only. The first fieldwork stage applied a snowball sampling approach, supporting community-based recruitment strategies (e.g., public announcements in community meetings, research poster distribution, and residents' referrals) to recruit rural disaster residents who had been relocated from their original rural-style houses into condominiums in the urban-style residential communities. Sixty residents (see Table 1) from 13 new residential communities (among six counties covered in the field trips) were invited for walk-along interviews (recruitment completed upon reaching 60 eligible participants). The walk-along interview, approximately 60–90 min, contextualizes the discussion in the participants' familiar environment to stimulate the interviewees' recall of their place-making experience and how these place-making activities influenced their lives and livelihoods [68,69]. Walking along with one interviewee, the author asked open-ended questions and took notes while touring both the new community and the old villages/houses (if they were structurally functional and visitable).



**Figure 2.** Research locations in Sichuan, China. (a) Epicenter in China by Mistman123/Wikipedia, retrieved from [http://commons.wikimedia.org/wiki/File:2008\\_Sichuan\\_earthquake\\_map.svg](http://commons.wikimedia.org/wiki/File:2008_Sichuan_earthquake_map.svg) (accessed on 7 November 2020). In the Public Domain; (b) Epicenter in Sichuan Province. The red circles showing the epicenter of Wenchuan were added by the author. Adapted from “Map of Sichuan’s regions and its major cities, China”, by (WT-shared) ClausHansen, retrieved from <http://commons.wikimedia.org/wiki/File:Sichuan.png#mediaviewer/File:Sichuan.png> (accessed on 7 November 2020). Used under Creative Commons Attribution-ShareAlike 2.0 (<http://creativecommons.org/licenses/by-sa/2.0/deed.en>, accessed on 7 November 2020); (c) Worst-hit and second-to-worst-hit areas. The red part in the map (added by the author) indicates the worst- and second-to-worst-hit areas. All the research locations (villages, towns, and cities) (see Table 1, as well) were marked with green dots (by author). Adapted from “China Sichuan location map” by NordNordWest/Wikipedia, retrieved from [http://commons.wikimedia.org/wiki/File:China\\_Sichuan\\_location\\_map.svg](http://commons.wikimedia.org/wiki/File:China_Sichuan_location_map.svg) (accessed 7 November 2020). Used under Creative Commons Attribution-Share Alike 3.0 Unported license (<http://creativecommons.org/licenses/by-sa/3.0/deed.en>, accessed 7 November 2020).

Table 1. Participants and locations.

Location		Number of Participants	Gender		Age Group		
Village/Town	County		Male <i>n</i> (%)	Female <i>n</i> (%)	18–39 <i>n</i> (%)	40–59 <i>n</i> (%)	60+ <i>n</i> (%)
1. Chicheng	Dujiangyan	5	1 (20)	4 (80)	1 (20)	3 (60)	1 (20)
2. Heming	Dujiangyan	4	2 (50)	2 (50)	1 (25)	2 (50)	1 (25)
3. Luchi	Dujiangyan	10	3 (30)	7 (70)	2 (20)	4 (40)	4 (40)
4. Qingtian	Dujiangyan	5	3 (60)	2 (40)	2 (40)	2 (40)	1 (20)
5. Yijiequ	Dujiangyan	3	1 (33)	2 (67)	1 (33)	0	2 (67)
6. Fuzu	Dujiangyan	3	2 (67)	1 (33)	1 (33)	1 (33)	1 (33)
7. Dongqi Factory	Mianzhu	2	1 (50)	1 (50)	0	1 (50)	1 (50)
8. Hanxin	Mianzhu	7	2 (29)	5 (71)	1 (14)	4 (57)	2 (29)
9. Old Town	Beichuan	3	3 (100)	0	1 (33)	2 (67)	0
10. New Town	Beichuan	3	1 (33)	2 (67)	0	2 (67)	1 (33)
11. Sanlong	Maoxian	7	2 (29)	5 (71)	3 (43)	4 (57)	0
12. Jingyang	Deyang	4	4 (100)	0	3 (75)	1 (25)	0
13. Chengdu	Chengdu	4	4 (100)	0	1 (25)	3 (75)	0
Total		60	29 (48)	31 (52)	17 (28)	29 (48)	14 (23)

During the walk-along interview in the new community, the interview questions concentrated on asking participants to describe the physical improvements the relocators had made—namely, “What is the difference between the new town and the old town?”, “What are the primary ways in which you would like to improve your new town?”, and “What would you do if you were the designer? What kind of community would you design?”. In the survivors’ original communities, the interviewees were encouraged to recall their original place-making experience of daily life and use of place, such as, “Did you participate in any activities that had to do with the changing of the physical environment of your community? If yes, could you please share some of these?”. This produced a comparison approach for participants to discover how their original place-making experience encouraged them to improve the STGLR outcomes to support LTSLR.

#### 4.3. Data Analysis

A thematic approach is well-known for its analytical and conceptual rigor and is well-suited to interpreting this case study’s qualitative data [70]. Qualitative data analysis software NVivo 10 was used to identify codes and organize themes. Merging the interview data with the fieldwork notes data supports the trustworthiness of this qualitative case study, contributing to a nuanced understanding of how disaster survivors improved their physical surroundings to help them adapt to their new communities and how their endeavors supported long-term sustainable community development.

The interview transcripts were coded through the following two rounds (see Figure 3). Based on the flow of each interview, the first round of coding identified the critical information presented in the sequence of the interview questions. This round used a deductive approach [71] to widely display the challenges survivors confronted within the new communities and their subsequent solutions at the individual, neighborhood, and community levels. Built on the first round of coding outcomes, the second-round analysis focused on unveiling the interconnections and embedding information by comparing the interviewees’ place-making experiences in the old communities alongside the new. Building themes concentrated on the interplay between the physical environment and long-term social



and economic recovery, how these challenges were identified, and how solutions were developed at the individual, neighborhood, and community levels. The researcher's field notes from both stages of the aforementioned fieldwork supported the two-round data analysis to confirm themes and uncover underlying meanings. The walk-along interviews were conducted in Mandarin or Sichuan dialect. Therefore, the interview data reported below were translated from the original local languages into English.

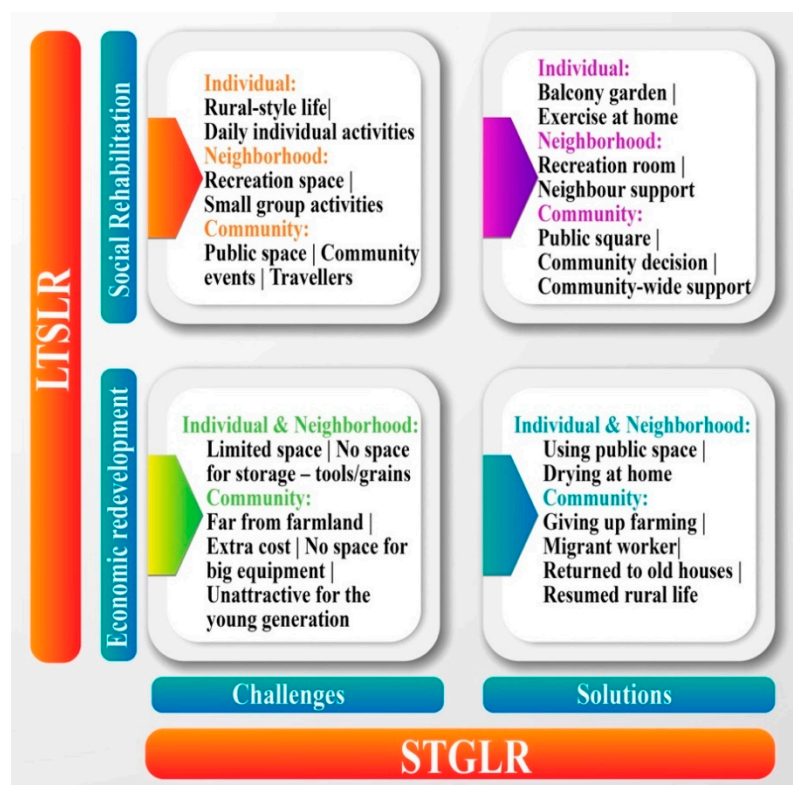


Figure 3. Codes and themes.

## 5. Feasibilities and Challenges of Utilizing STGLR Outcomes to Support LTSLR

Upon moving into the new residential communities, the earthquake survivors gradually identified challenges in their new physical surroundings and developed adaptive activities accordingly at the individual, neighborhood, and community levels [72]. These physical-environment-based adaptive activities empowered these dwellers to benefit from STGLR outcomes and continue their long-term social rehabilitation and livelihood-driven economic redevelopment. The findings presented in this section have comparatively cataloged these challenges and solutions into two streams: social rehabilitation and livelihood-specific economic redevelopment. The comparison stimulated the discussion regarding the grassroots feasibilities of utilizing STGLR outcomes to facilitate their social and economic LTSLR, potentially promoting rural communities' sustainable development in China and beyond.

### 5.1. Social Rehabilitation

#### 5.1.1. Challenge: Urban-Style Residential Communities Were Unable to Support Original Rural-Style Social Life

The rural residents' original rural lifestyle was rooted in their rural surroundings [41]. However, sudden life changes caused by moving into the urban-style residential communities triggered new lifestyle adaptation challenges. Compared with their original rural-style social life, participants identified needs that had not been effectively considered in the planning and design of their new communities.

#### An older woman—needed a tiny vegetable plot at home

*[In the city], you could grab some fresh vegetables from the supermarket at any time. Rural areas are not so convenient. So almost all families [in the old village] used to plant some vegetables in their yards. In the new community, only flowers are allowed. If you want to buy fresh vegetables, you have to take a bus to Dujiangyan City, very inconvenient . . . I miss my old house because I loved working in a yard, which made me feel happy and younger.*

#### An older man—needed a recreation room to socialize with neighbors

*Our new community did not have a recreation room. I know some [new] communities have. [In the original village], we had a small place for neighbors to get together to play chess and mah-jong [a Chinese game]. Now, everyone only has a small condo, [where] all family members squeeze together. When we first moved here, we took turns playing mah-jong in one another's condo, but it bothered their family members. Then we stopped.*

#### A middle-aged couple—needed a place for community social gathering:

*We missed the small public square in my old village. Adults, kids, and elders always got together to play and dance after the day's work. When the lunar new year came, or red-white (weddings–funerals) events, there were many activities in the square. People from other villages joined us. Some even from Chengdu [the capital of Sichuan province].*

### 5.1.2. Feasibility: Improve the Physical Environment to Better Serve the Social Life

Upon identifying these requirements, the inhabitants began improvement attempts. In the rural areas of Sichuan, several generations of a family lived in the same area [7]. This life-enriched interplay of maintaining harmony with their natural surroundings developed their place-based knowledge and skills, such as avoiding geophysical risks and adapting to climatological features [73]. This place-making expertise encouraged them to modify and improve their new communities to fulfill their social demands. The same participants proudly demonstrated their achievements to overcome their challenges.

#### The older woman—built a balcony garden

*I watched on a T.V. news show that some urban people planted vegetables on their balconies. I did the same. I know it is not big enough to plant big vegetables [as I used to in the yard], but I have green onions, pea seedlings, cherry tomatoes, and chili peppers, way more than enough for myself. Sometimes, I can give some to my neighbors. Working [in my small garden] makes my hands and legs more flexible.*

#### The older man—changed an empty rooftop into a recreation room

*We found out that the roof of our condo was never used. So we covered it with a rain canopy and made some stone chairs and tables. My neighbors and I, four people together, finished all the work in about a week. We reused some materials from our old houses. Now, my neighbors have a place to play mah-jong again. We did not build walls around because the summer is very hot here. [Natural] wind is better than air-conditioner.*

#### The middle-aged couple—converted a piece of barren land into a community public square

*There was a piece of barren land [in the community]. At the beginning, some [residents] wanted to use it for parking. Then, all residents had a meeting and decided to change it into a small public area for parking and daily activities. It was teamwork; almost everyone was involved. We have masons and carpenters. Some donated timber, cement, or cooked for us. We built a community kitchen in the corner of the plaza so that we could host visitors.*

These three physical improvement activities supported the dwellers' social recovery at the individual, neighbor, and community levels. The balcony garden enabled the inhabitant to resume her daily routine, supporting her health and well-being (e.g., her hands and legs became more flexible, and she feels happy). The rooftop recreation room and the

small public square provide space for social gatherings at neighbor and community levels. These social activities support the reestablishment of social connections and networks, prompting community organizing and cohesion, eventually advancing community-based social rehabilitation. Although these physical environment improvements are only a few examples, they illustrate evidence-based strategies that empower the residents' various capacities (e.g., traditional place-making knowledge and skills) to contribute to their community-based social rehabilitation.

The possibilities of place-based improvements, such as the balcony, the condo building empty roof, and the barren land in the community, play a vital role in the social rehabilitation process. If STGLR offers more similar possibilities, the residents would effectively manage their new housing and communities to support their long-term social rehabilitation. In further engagement with their housing and communities, the inhabitants may recognize other challenges, triggering the next round(s) of improvement in the physical environment. These ongoing grassroots physical environment modifications initiate a positive cycle as residents continue to improve their physical surroundings to serve their continuous social needs. Thus, the physical and social dimensions reinforce each other to promote LTSLR and support sustainable development. As the last participant mentioned, the public square would attract prospective visitors and generate new income sources. The following section will address how physical environment improvements would support livelihood-specific economic redevelopment.

## 5.2. Livelihood-Specific Economic Redevelopment

### 5.2.1. Challenge: Urban-Style Residential Communities Were Unable to Support the Original Agricultural-Based Livelihood

Almost all the participants indicated that living in condominiums, as opposed to their original rural life, significantly increased their living costs, such as utilities, condominium fees, and food purchasing, which used to be very low or no-cost issues (e.g., rural utility rates were low, no condominium fees, and producing their vegetables and grain). Moreover, as shown in the older woman's case above, even if some residents could plant simple vegetables in their condominiums, it would only be enough for a single person rather than an entire family with multiple members. Thus, the increased living cost became the first barrier to their livelihood-specific economic recovery.

Furthermore, the livelihood of most disaster survivors in the rural areas of Sichuan depended on agriculture and agriculture-related incomes. As previously described, these farmers lived close to their farmlands, orchards, and other farming resources. However, the post-earthquake concentrated resettlement housing policy collectively relocated farmers from adjacent villages together, causing some farmers to be an unmanageable distance away from their original farmlands and agricultural facilities (see below). Some even lost their farmlands (e.g., their farmland was used for building residential communities and other infrastructure). Failure to maintain their original agricultural-based livelihood in residential communities directly resulted in a decrease or even loss of their only income source. As farming was the most convenient way for these farmers to initiate their livelihood recovery, they first identified the following challenges regarding their new, agriculture-unfriendly communities.

#### A middle-aged woman—no storage space for grains

*Every family only has a small 'cage' [condo]. We had to sell all the grain, only kept a little for ourselves because [there was] no space to store them. There is no elevator (according to the local building code, an elevator was not required for a condominium building with six floors or less). It is not easy to move them up and down. You can see, I have to keep all my farming tools in my condo as well. It is not enough space for people, let alone for store grains and tools. It is very humid here, and we need to dry grains frequently. But we do not have space to do it.*

#### A middle-aged man—unsupportive for daily farming activities

*I have to carry all my tools and ride a bicycle to my farmland. I could not leave the tools and equipment on the farmland. They would get stolen. Very inconvenient. If you have a lot of work to do, you can drive. Sometimes, you just have to frequently check, not worth it to drive. It increases other costs, [such as] gas and vehicle maintenance. There is no space in the community for storage. I can carry the tools home, but I cannot move the equipment to my condo every day. Parking space is also very limited, only for small cars but not designed for the trucks.*

#### 5.2.2. Feasibility: Adapting to Urban-Style Residential Living and Developing Solutions

As aforementioned, when transplanting urban-style residential community living into rural areas, a lack of careful consideration of rural–urban differences triggered various challenges for earthquake survivors. Indeed, the space- and distance-related issues presented above had become one of the most extraordinary and ordinary challenges for upholding agricultural-based livelihoods. Accordingly, the participants identified temporary solutions for these challenges.

The middle-aged woman—identified a temporary and unsafe storage space

*I put some of my harvests in the space under the [outside] staircase on the ground floor. I feel very embarrassed because I used the common space. It is not safe, but it is the only way I can figure it out now. I only have small farmland, so I also dried the fresh corn on my balcony. I heard that some farmers in the city of Dujiangyan dried their grains on the street [see Figure 4]. It was very dangerous.*

The middle-aged man—becoming a migrant worker

*Most young people hate rural labor work and pursue jobs in the cities. But my son wanted to return home after his college, but it is really difficult [to continue the farming]. He finally gave up [this plan] and found a job in Chengdu. I am also thinking about selling my farmlands and finding a job in the city, as my body is still good. I do not want to leave my countryside home because it is our roots, but I have to survive.*

Adapting to a new way of life, the middle-aged woman found temporary storage space. She pointed out her ongoing issues (e.g., occupying public space and safety) and identified long-term challenges for others (e.g., those who have more farmlands and need more space). At the same time, the unsupportive built environment pushed the younger generation (the son of the middle-aged man) away from his rural home, forcing him to pursue urban area employment. This also motivated his father, a traditional farmer, to leave his agricultural roots and choose to work as a metropolitan area migrant laborer. The woman's temporary solution and the man's plan to move away from the rural area still reflect their desire to maintain their lives in their new communities. The following case, however, shows some farmers giving up their new condominiums and returning to their damaged houses to resume their original livelihoods:

A middle-aged couple—returned to their original home

*We are too old and do not have other skills [to find a job in the city]. I just had major surgery last year, and my wife is not healthy either. We do not have other choices, but we have to survive. After seeing some of my neighbors move back [to their old houses], we followed them. We fixed our damaged house and resumed our previous rural life. We have vegetables, goats, and ducks. My wife also sells them in the local market.*



**Figure 4.** Dried grains on the street. A farmer was collecting grains she dried on the street.

The new residential community was unable to support this couple's livelihoods. Ageing, unfavorable health conditions and a lack of transferrable skills represent significant and ultimately insurmountable barriers to potential urban migrant work. Survival needs forced them to abandon their urban-style condominium and return to their old house. Unlike the physical improvement interventions, as discussed in the social rehabilitation section, transforming their new housing and communities to support their livelihood-specific economic development may not always be easy, further confirming Daly and colleagues' argument mentioned above [52]. Finding a small storage space under the stairs could be a temporary solution; however, unmanageable distance from farmlands caused unsolvable issues. Creating ample storage space would likely not be possible in a residential community with minimal space. Since the new physical structures did not provide enough possibilities for improvement, some inhabitants chose to return to their original home sites, fixing their damaged houses and resuming their previous rural lives.

## 6. Discussion: Bridging STGLR and LTSLR

Successfully rehabilitating disaster survivors' lives and livelihoods once the physical foundation is stable and secure indicates the triumph of long-term recovery [74]. However, in the Wenchuan case, certain aspects of STGLR produced various challenges for disaster survivors (farmers) to smoothly settle into urban-style residential community life. Merging challenges and solutions from both social and economic dimensions generates the following two recommendations, which could be considered in government-led STGLR planning and design stages to support grassroots adaptive activities to better promote LTSLR and sustainable development in China and beyond.

### 6.1. Involving the Grassroots Place-Making Expertise in the Official Plans

The case study demonstrates a variety of rural disaster survivors' place-making expertise in successfully modifying their new physical environment to support long-term recovery. The place-making capacity enabled survivors to convert unused spaces into functional places at the home, neighborhood, and community levels. This ability reflects their traditional experience using local resources, taking the local climate and other conditions into consideration (e.g., utilizing natural wind), and protecting their traditional culture (e.g., hosting traditional activities). Furthermore, the local inhabitants' improvement activities at the neighborhood and community levels also displayed their leadership and collaboration in coordinating various resources and motivating community members to contribute to community improvements.



The expertise produced various benefits that promoted sustainable community development, powerfully contributing to the existing literature regarding grassroots efforts to utilize STGLR outcomes for LTSLR [75]. At the individual family and neighborhood levels, the balcony garden reduced dwellers' living costs, and the recreation room enriched the dwellers' daily activities. Working in the small garden and socializing with neighbors enhanced the inhabitants' physical health, mental wellness, and overall well-being. The community-wide collaboration for building the public square united most residents in the new community, who had been relocated from different villages and may not have had the opportunity to know one another. This teamwork established new community-wide social connections and social networks that will continue to stimulate potential partnerships, support one another's recovery, and prepare the community for future extreme events, eventually building resilience capacity at various levels [76]. Moreover, the community events and/or festivals in this newly designated space attract tourists, increase income, and generate other opportunities, further promoting community cohesion and eventually contributing to the community's sustainable development [77].

The expertise and benefits of the rural residents' efforts identified in the Wenchuan case only represent a small portion of different grassroots endeavors. These grassroots place-making capacities may be unique to the rural earthquake survivors of Wenchuan; however, the capacities reflect their cumulative engagement with their local physical, human, and social environments. Likewise, disaster survivors in other nations have their unique expertise [4,52]. In other words, if these grassroots expertise capacities could be engaged in the official built environment planning and architectural design, the physical environment weaknesses would be reduced [51]. In doing so, the inhabitants would more easily adapt to their new communities, enhancing long-term recovery and advancing sustainable community development. Therefore, the lessons learned from the Wenchuan case could inform international post-disaster initiatives. The next step would be identifying how the STGLR outcomes could inspire disaster survivors' place-making endeavors, supporting sustainable LTSLR.

## 6.2. *Embedding Improvement Possibilities in STGLR*

The case study demonstrates the potential for sustainable recovery arising from embedding targeted improvements into official reconstruction plans, aiming to more holistically support disaster survivors as they adapt to their new surroundings and re-establish their livelihoods and social functioning. Although the empty rooftop and barren land were definitively undesignated spaces, these spaces inspired the local dwellers' improvement efforts to better serve their social rehabilitation. Comparatively, livelihood-specific economic redevelopment may need extra support from the physical environment. Identifying temporary solutions (e.g., storage room under the staircase) would not solve the ongoing needs. However, it would at least retain some residents in the new communities so that they might discover other options in time. When identifiable solutions are difficult, or even impossible, barriers to thriving in the new communities arise, compelling some residents—the middle-aged man and the couple, for example—to leave. Hence, if the STGLR outcomes could provide potential improvement opportunities, the grassroots endeavors would quickly amend some weaknesses, fulfilling their long-term needs.

The post-Wenchuan earthquake rural reconstruction and recovery was administered under China's national rural redevelopment policy [62]. Building the urban-style residential communities in rural areas while neglecting urban–rural differences may not fully support the rural redevelopment goal [78]. The potential improvement opportunities may hint at possible solutions, enabling rural residents to manage their new communities, developing “new” rural lives and livelihoods. More importantly, as one participant indicated, these opportunities should encourage younger generations to return to and develop their rural communities. Negligence and/or failure in providing these opportunities triggered some residents to abandon their new housing, returning to their old houses or pursuing employment in urban areas, which may further impact their long-term recovery and even

threaten sustainable community development. Providing improvement opportunities could stimulate grassroots efforts to improve government interventions, better supporting the LTSLR.

## 7. Conclusions

This two-staged STGLR and LTSLR intervention, associated with top-down disaster management systems, aims for swift, large-scale built environment reconstruction. Some of the STGLR outcomes supported the disaster survivors' social rehabilitation and livelihood-specific economic redevelopment. Some created unintended challenges. The Wenchuan case study highlights grassroots responses to these challenges, revealing related solutions for LTSLR. From identifying the challenges and determining solutions, the local residents' place-improvement activities exhibited their various capacities in modifying the physical reconstruction outcomes to benefit their social rehabilitation and livelihood-specific economic redevelopment. These activities further suggest that engaging local place-making expertise and providing potential improvement possibilities in the STGLR planning and design stage could empower grassroots efforts to synthesize social, economic, and physical components, facilitating long-term sustainable development at the individual, family, and community levels.

From the perspective of human settlement-specific post-earthquake reconstruction and recovery, this case study only qualitatively examined grassroots stakeholders' long-term recovery behaviors associated with their new housing and communities, as well as proposed recommendations for governmental authorities to empower the grassroots efforts to improve their official plans, promoting community-based, long-term recovery. A quantitative approach could provide more precise measurements of LTSLR, especially in measuring the economic and related dimensions. Furthermore, since the governmental interventions usually serve as LTSLR external support, prospective studies could thoroughly explore how this external support could advance the dwellers' efforts, integrating the physical environment and other societal dimensions of human settlement. Finally, since hazards and disaster research and practice are multidisciplinary, future research may address the inter-/trans-disciplinary frameworks and identify key stakeholders and their challenges and solutions in LTSLR. These efforts will eventually contribute to the same goal: promoting a post-disaster agenda of reconstruction and recovery and supporting sustainable community development.

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