



# Farmers' risk perception of concentrated rural settlement development after the 5.12 Sichuan Earthquake

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## ABSTRACT

Rural housing reconstruction is critical in realizing sustainable recovery. Concentrated rural settlement (CRS) was widely promoted under the context of new countryside construction after the 5.12 Sichuan Earthquake in 2008. Farmers' risk perception of CRS and their corresponding actions affect realizing sustainable recovery. However, few studies have attempted to comprehend farmers' risk perception of such practices, and the impact factors of risk perception remain unknown. Therefore, this study investigates farmers' risk perception of CRS development using four cases in the hardest earthquake-hit area. ANOVA is employed to explore the factors that influence risk perception of CRS development, and in-depth discussions are conducted to explore the reasons behind such perceptions. Potential measures are proposed to reduce relevant risk factors. This study's findings can help local governments in understanding the concerns of farmers toward CRS and in identifying suitable approaches to mitigate risks in order to realize the sustainability of CRS development. This study also provides references for local government to address the specialized concerns when developing CRS within both disaster and non-disaster context.

## 1. Introduction

Concentrated rural settlement (CRS) development is vital to rural post-disaster recovery, as proven in the efforts made after the 5.12 Sichuan Earthquake. Scattered villages were clustered together to attain moderately concentrated accommodation through CRS development. Concentrated settlement is one of the prerequisites for improving rural public services along with the quantity and quality of public infrastructure (Zheng, 2014). In addition, appropriate concentrated settlement and good management measures can facilitate community diversity and prevention, strengthen social capital, and accelerate disaster recovery (Allenby & Fink, 2005; Dye, 2008; Glaeser, 1998). Compared with the resettlement among villages after disasters, CRS can reduce the cost of public infrastructure and services while preserving the existing social network to avoid tense social relations (Peng, 2013). Compared with in situ reconstruction, CRS maintains established land and social resources and facilitates the low-cost provision of public infrastructure and services (Peng, 2015). Therefore, CRS was promoted after the 5.12 Sichuan Earthquake, especially within the context of new countryside construction, which emphasized concentrated accommodation.

However, CRS development faces various challenges, especially for

new countryside construction under normal conditions. These challenges have been investigated based on economic, societal, and environmental perspectives (Li, Long, Liu, & Tu, 2015; Long, Li, Liu, Woods, & Zou, 2012; Wu, Ann, & Shen, 2017). Unreasonable CRS planning may result in high economic costs (Yu, Xiong, Li, Liu, & Li, 2008). For example, CRS situated away from farmlands increase the cost of agricultural production (Long & Li, 2012). Farmers who reside in four-to five-story apartments often find it difficult to carry on with their former agricultural livelihood. Moreover, farmers face poor income growth with the lack of a sustained non-agricultural industry near the CRS site (Zheng, 2009; Zhang & Zhang, 2009). Therefore, the key problem of how to re-employ surplus rural labors remains for the CRS development (Long, Liu, Li, & Chen, 2010).

Farmers who are accustomed to a dispersed settlement should adapt to new production processes and lifestyle. The sense of belonging and identity with the land and the community should be rebuilt, although social problems may arise during the process (Yu et al., 2008). Environmental problems also challenge CRS development. At present, rural China faces serious problems due to limited environmental provisions and public awareness compared with those in urban China (Wu, Ann, Shen, & Liu, 2014). Zheng (2014) reported that pollution is mainly

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caused by household garbage, township industrial development, farming and animal husbandry, and rural tourism industry development during the CRS development process.

Meanwhile, some studies have investigated the economic, social, and environmental problems of post-disaster reconstruction after the 5.12 Sichuan Earthquake. [Tan and Lu \(2014\)](#) verified that farmers spent resources for reconstruction, which increased their debt burden and vulnerability after the 5.12 Sichuan Earthquake. [Fan \(2015\)](#) validated that the lack of participation from local residents resulted in a misunderstanding between the farmers and the government, which triggered a series of social problems during the post-disaster reconstruction. [Yang et al. \(2014\)](#) affirmed that the ecological level remained unrecovered prior to the 5.12 Sichuan Earthquake despite the restoration of the ecological environment in 2013. Therefore, relevant stakeholders' implementation of the appropriate strategies is important during post-disaster reconstruction.

Farmers' risk perception affects their reconstruction strategies and, eventually, the sustainable post-disaster reconstruction. Risk perception is defined as the perception of the identified risks that one may face ([Bauer, 1960](#)). Individual risk perception is crucial in determining the response of a person to natural hazards ([Burn, 1999](#)). [Song and Kim \(2013\)](#) confirmed that risk perception can weaken the risk severity of natural disasters. [Rizalito \(2016\)](#) highlighted the importance of understanding risk perception and response to natural disasters to ensure public participation in building resilience and increasing adaptive capacity. Farmers may take measures to reduce their exposure to future disaster risks if they have relevant risk perceptions. Therefore, understanding how farmers perceive the risks for developing and communicating reconstruction policies is advantageous ([Hurley & Corotis, 2014](#)).

However, few studies have investigated farmers' risk perception of CRS after the 5.12 Sichuan Earthquake, which inhibits a thorough understanding of CRS reconstruction, potential problem solution, and sustainability achievement in China. Therefore, the current study investigates the factors that affect farmers' risk perception of CRS after the 5.12 Sichuan Earthquake. Section 2 provides a critical review of studies on farmer's risk perception and a solid basis is established for further analysis. Section 3 introduces the research method, which includes research logic, questionnaire design, and data collection. Section 4 presents the preliminary analysis and one-way analysis of variance to explore the impact factors of farmers' risk perception of CRS. Section 5 provides an in-depth discussion, and Section 6 concludes the research by specifying future research directions.

## 2. Literature review

### 2.1. Rural housing reconstruction

Housing reconstruction is a top priority given that housing damage affects the lives of victims ([Peng, 2015](#)). Rural areas face more reconstruction disadvantages compared with urban areas due to insufficient infrastructure, lack of disaster mitigation education and social inequality ([Peng, Shen, Tan, Tan, & Wang, 2013](#)). Post-disaster reconstruction is a key link in natural disaster management, and aims to restore the community or society destroyed by natural disasters to its pre-disaster condition. Realizing the sustainability of housing reconstruction in developing countries is an important concern in light of the imbalanced development between urban and rural areas ([Mileti, 1999](#)).

In situ reconstruction, resettlement, and CRS reconstruction are considered when rebuilding houses in rural areas. In situ reconstruction emphasizes the replacement of damaged houses with new ones on the original site ([Jha, Barenstein, Phelps, Pittet, & Sena, 2010](#)). Resettlement refers to the building of new houses on a new site, usually in another village with a lower risk of being hit by natural disasters ([Badri, Asgary, Eftekhari, & Levy, 2006](#); [Peng, Shen, Zhang, & Ochoa, 2014a](#)).

Facts have proven that in situ reconstruction is the most cost-effective approach that can recover post-disaster production and daily living at the fastest possible time ([Badri et al., 2006](#)). Therefore, in-situ reconstruction is widely adopted in post-disaster reconstruction. However, it is argued to waste land resources, undermine livelihoods, and sustain poor living conditions ([Peng, Shen, Shen, Lu, & Yuan, 2014b](#)). In addition to security considerations, resettlement increases employment opportunities for farmers and allows them to gain better access to public services. [Araya, Chotai, Komproe & Jong \(2011\)](#) reported that the victims' quality of life significantly improved after resettlement. Yet, resettlement may result in unequal distribution of benefits and costs among relocated people, disrupted social network, and competition for limited resources, which generate resistance to resettlement ([Arnall, 2014](#); [Cronin & Guthrie, 2011](#); [Oliver-Smith, 1991](#)). Developing CRS in a village can increase resilience and provide a basis for sustainable recovery after natural disasters ([Peng, 2015](#)). Two approaches help deliver CRS: unified planning/self-reconstruction and unified planning/unified-reconstruction ([Peng, 2015](#)). Unified planning is adopted to ensure better planning of the CRS site and housing layout. Self-reconstruction means that farmers reconstruct houses on the CRS site by themselves, whereas unified-reconstruction means that a village invites a professional construction company to conduct unified reconstruction. [Zheng \(2014\)](#) pointed out that CRS is the trend in rural reconstruction under the condition of new countryside construction in China. Guided by the policy of land consolidation in rural China, CRS has been actively promoted in rural areas after the 5.12 Sichuan Earthquake. At present, CRS is still a new concept; hence, its theory and implementation measures are not yet mature. This means that, in the process of CRS development, the economic, social, and ecological problems generated should be carefully investigated. The rural production ways and ecological space can be reshaped or even changed. Meanwhile, farmers participating in CRS spend most of their savings and also face changed production modes, which can increase their economic burden ([Tan & Lu, 2014](#)). Some farmers may lose their lands and may even lose their identities of farmers after CRS. This vague identity orientation affects the change of their lifestyle ([Wang, Tian, Wang & Guo, 2011](#)). For the new community, all living activities are concentrated in one area, which increases the ecological pressure. Whether disaster prevention and mitigation after CRS strengthens the community is still unknown, and this uncertainty can be a potential risk to villages and peasants ([Wang, Tian, Ma, Su & Han, 2010](#); [Wang et al., 2011](#); [Li & Shen, 2011](#)). Facing benefits and potential risk, it is critical to comprehend farmers' risk perception of CRS, which affect the implementation and sustainability objective of CRS in post-disaster reconstruction.

### 2.2. Risk perception in disaster research

Risk perception is a hot topic in disaster management research ([Butsch, Kraas, Namperumal, & Peters, 2016](#); [Naomi, 2016](#); [Walters & Gaillard, 2014](#)). Traditional disaster management research see the physical world as an externality that causes damage to the human environment; thus, disaster management reduces the losses caused by disasters ([Orhan, 2015](#)). However, such an approach has shortcomings. Hence, contemporary approaches emphasize that pre-disaster policies not only result in the rationalization of resource allocation but also in increased investment efficiency for reducing risks. Risk perception plays a major role in effectively responding to disasters and facilitates decision-making in risk management and disaster mitigation ([Lindell & Hwang, 2008](#); [Lindell & Perry, 2000](#)). [Gangalal, Ryuichi, Ranjan, and Netra \(2015\)](#) corroborated that large human casualties and the loss of properties in Nepal during natural disasters are caused by inadequate public awareness and technical knowledge in mitigating natural disasters. [Song and Kim \(2013\)](#) verified that risk perception can weaken the risk severity of natural disasters (e.g., storm and flood). [Rizalito \(2016\)](#) highlighted the importance of understanding risk perception and response to natural disasters from the social, economic, political,

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