

Review

A Framework of Resilience Development for Poor Villages after the Wenchuan Earthquake Based on the Principle of “Build Back Better”

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Received: 1 May 2020; Accepted: 17 June 2020; Published: 18 June 2020



Abstract: Under the current resilience development framework, which is mainly based on urban communities, it is difficult to meet the needs of the vulnerable populations in poor villages. This article aims to explore a specific and operable guidance framework suitable for the resilient development of Chinese poor villages after disasters from the perspective of social equity. The framework will help guide the sustainable development of poor villages after disasters and also provide a reference for the resilience of other similar vulnerable areas. When integrating climate change response and disaster risk management to explore sustainable development in poor villages, the essence is to explore the resilience development framework focused on the construction of resilient communities in poor villages. We take the recovery and reconstruction of poor villages after the Wenchuan earthquake in 2008 as an example. Through the analysis of the effects of post-disaster recovery and reconstruction, we found that although poor communities have made significant achievements since the earthquake, there are still many aspects that need to be improved, including social life systems, economic production systems, and natural ecosystems. Therefore, we comprehensively analyzed the characteristics of poor socio-economic conditions, the complex ecological environment, and the low cultural level of residents in poor villages. Furthermore, this study followed the principle of “Build back better” (BBB) and conducted an in-depth study of the framework for the resilience of poor villages. In terms of risk reduction, it is recommended to improve structural resilience from guarantee of preferential prices and selection of environmentally friendly materials, avoid risk and villagers’ participation in the formulation of general plans, and promote disaster prevention and mitigation capabilities from risk prediction and curriculum development. In terms of community recovery, it is suggested to promote community economics and victims’ livelihoods by promoting industrial transformation and sustainable livelihoods and promote social and psychological health development from social relations and psychological rehabilitation. In terms of efficient implementation, specific improvements include the improvement of public participation systems and the establishment of coordination offices and sound institutional mechanisms, the development of community standards and the introduction of financial support policies, the improvement of laws and regulations, and the improvement of monitoring and evaluation from dynamic monitoring and mass satisfaction surveys. It is important to guide the sustainable development of vulnerable communities by constructing a post-disaster resistant development framework based on BBB principles.

Keywords: natural disasters; poor villages; “Build back better”; resilience development; recovery and reconstruction

1. Introduction

With the intensification of global climate change and the frequent occurrence of natural disasters, post-disaster recovery and reconstruction have received widespread attention. “Build Back Better” (BBB) is the guiding principle of innovation in disaster recovery and reconstruction. We should collaboratively consider three strategic goals, including risk management, sustainable development, and climate change [1]. BBB is an approach that was formed during the construction of a safe community after the Indian Ocean tsunami in 2004. Clinton put forward ten key propositions of the concept in the report “Lessons Learned from Tsunami recovery: Key Propositions for Building Back Better” [2]. The Sendai Framework for Disaster Risk Reduction 2015–2030 adopted by the Third World Conference on Disaster Reduction in 2015 once again emphasized “build back better” as the guiding principle for post-disaster recovery and reconstruction.

The concept of resilience was introduced from the original natural sciences to the social sciences and now to economics, psychology, planning, and other fields. Among them, the focus is on improving the ability to respond to climate change and building resilient communities that are resistant to natural disasters [3]. As the concept of resilience is used by multiple disciplines, it gradually extends from technical vocabulary to multiple meanings. The research object has also expanded from the ecosystem to the social ecosystem. It has become an essential method for understanding the dynamics of the social ecosystem. The concept of resilience objectively describes the ability of the social ecosystem to self-organize, learn, and adapt. [4]. Community resilience, as a collection of a series of capabilities, is also a process of community capacity improvement and disaster adaptation, and can be used as a community development goal [5]. Francis believes that “resistance, absorption and recovery” are the main characteristics of the resilience system [6]. Resilience has undergone multiple revisions from engineering resilience to ecological resilience to evolutionary resilience in the development process. These changes reflect the leap in scholars’ understanding of the system’s operating machine, where evolutionary resilience has a more plausible theory than the previous two and has become the primary criterion for building resilient communities. At present, resilience has been widely used in various human settlements such as cities and villages, and resilience community construction has become a bridge from resilience to practice [7,8].

Post-disaster recovery and reconstruction require that people-oriented perspectives take into consideration the development of different types of communities. However, the current construction of resilient communities gives priority to urban communities, while poverty-stricken villages, due to their sparse population, backward economy, and scattered distribution, have been researched relatively less. Although the occurrence of natural disasters makes the development of poor villages more difficult, post-disaster recovery and reconstruction is a rare opportunity for the development and revitalization of poor villages. Poor villages have a unique resource and environmental characteristics. This article combines innovative resilience theory to research the resilience of these vulnerable communities separately in order to guide their subsequent restoration, reconstruction, and development. By comparing the resource and environmental characteristics of poor villages after disasters with other regions, the authors analyze the specific elements of the construction of resilient communities in poor villages, and specific measures for the construction of resilient communities are put forward in conjunction with the principle of BBB.

The resilience of different types of communities is unevenly distributed. Moreover, even the degree of resilience of the same resilient community is not uniformly, usually forming a “cannikin law”, which means one community’s resilience capacity is determined by its weakest aspect, such as finance, medicine, and education. Among the different types of communities, urban districts have more advantages in terms of financial income and medical education than poor village communities [9,10]. However, there is a lack of a specific and operable guidance framework for the development of post-disaster poverty-stricken villages. It is necessary to study the community resilience of poor villages from the perspective of social equity. The final proposal of the framework will help to guide

the development of post-disaster poor villages in a more targeted manner, and at the same time, provide a reference for the resilience of other similar vulnerable areas.

Improving the resilience of poor villages can effectively reduce disaster risk, so the construction of resilient communities has become the core content of post-disaster recovery and reconstruction in poor villages [11]. Communities respond first to disasters. The Second World Conference on Disaster Reduction in 2005 emphasized that resilience assessment and resilience community construction at the community level are essential strategies for disaster prevention and reduction, especially for vulnerable communities such as poor villages [12]. The “Sustainable Development Summit” in New York in 2015 adopted the United Nations Sustainable Development Goals (SDGs), of which the 11th goal requires the construction of inclusive, safe, resilient and sustainable cities and human communities [13]. The Paris Climate Change Conference held in the same year adopted the Paris Agreement, which called for strengthening communities’ ability to respond to global change as a priority for post-disaster recovery and reconstruction [14]. Disaster risk management and climate change response are the basis of regional sustainable development. Research on the resilient growth of poor villages based on the “BBB” principle can effectively coordinate the relationship between the three strategic goals (Figure 1).

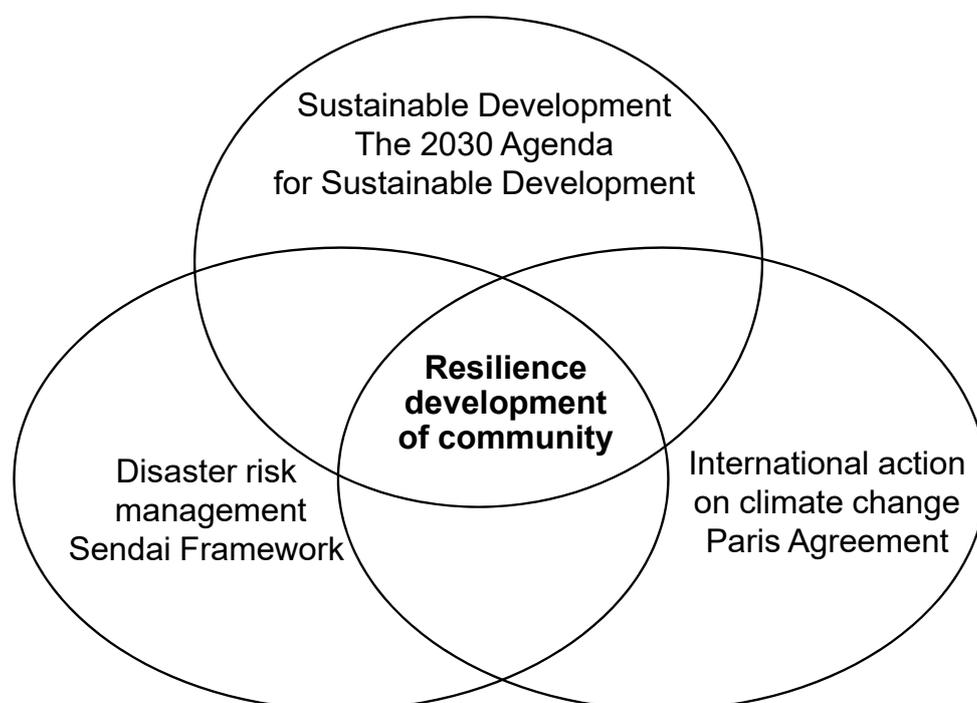


Figure 1. Requirements for the resilience development of community integrating climate change response and disaster risk management.

Poverty is a global problem. In recent years, China has implemented the strategy of “targeted poverty alleviation” and “rural revitalization.” It hopes to achieve poverty alleviation for the rural poor in 2020 and to solve regional poverty. Poor villages in China have the characteristics of economic backwardness, traffic obstruction, a harsh environment, and the low cultural level of their residents. In addition to the impact of natural disasters, research on the resilience of vulnerable communities (e.g., poor villages) is more complicated than that on urban populations [15,16]. From a spatial scale analysis, there is a regional correlation between the frequent occurrence of natural disasters in China and the distribution areas of impoverished villages, causing these poor villages to experience a long-term vicious cycle of poverty-returning effects after recovery and reconstruction [17]. In addition, the degree and scale of poverty have significant regional characteristics, and generally present a spatial pattern of

“one belt and two areas.” The factors that cause poverty include landform types, natural disasters, road accessibility, and labor quality [18]. The poverty-stricken villages in the Wenchuan earthquake-stricken area selected by the study are located in the northwestern Sichuan plateau area, where the natural environment is harsh, and disasters occur frequently. The transportation facilities are also relatively backward, and the residents have low literacy levels. Due to the impact of the earthquake, more villages became weak and poor, and the problems of subsequent restoration and reconstruction of the original poor villages were also more severe. Short-term relief for poor villages can solve the current social problems, while development and reconstruction in the long run face constraints of poverty and disaster [19]. Since the Wenchuan Earthquake in 2008, this area has also witnessed the “August 14” Wenchuan debris flow in 2011, the “July 10” Wenchuan massive mudslide flood in 2013, and the “August 20” Wenchuan debris flow in 2019. The frequent occurrence of disasters in poor villages in the Wenchuan earthquake-stricken area once again highlights the urgency of researching the post-disaster resilience development of poor communities. The external pressure and the need for rapid reconstruction after the Wenchuan earthquake will cause inadequate risk assessment of secondary disasters and ignore the demands of vulnerable groups, which will increase the vulnerability of the community to a certain extent. Therefore, it is of considerable significance to adequately summarize the existing experience and lessons of post-disaster recovery and reconstruction and to conduct in-depth research on post-disaster resilience development in poor villages [20].

This study compares the model and content of the recovery and reconstruction of various poor villages after the Wenchuan Earthquake, analyzes the effects of post-disaster recovery and reconstruction, combines the problems which have been found, and reports research on the resilience development framework of poor villages based on the “BBB” principle. Moreover, this research could provide guidance for poor villages after the disaster. Case studies are mostly applicable to actual processes. They use qualitative and quantitative methods to analyze the effects in order to obtain a method with broad guidance value and are especially suitable for complicated situations that cannot be accurately and quantitatively analyzed. The post-disaster recovery and reconstruction of poor villages is essentially a systematic process of policy formulation and implementation. Therefore, for this study, the poor villages after the 2008 Wenchuan Earthquake were selected as a case, with the help of a series of monitoring and evaluation reports organized by the State Council Leading Group Office of Poverty Alleviation, as well as the survey results of the implementation effect of the State Overall Planning for the Post-Wenchuan Earthquake Recovery and Reconstruction [21,22]. In order to comprehensively understand the recovery and reconstruction status of the disaster area and to collect improvement suggestions, these survey reports use data analysis and semi-structured interviews to collect data. Poor villages are typically fragile social ecosystems. Through conventional case studies, we make a comprehensive analysis of the post-disaster recovery and reconstruction effects of various social, economic, and environmental subsystems. Based on understanding the state of post-disaster recovery and reconstruction and combining with the “BBB” principle, the author proposes a plan for building resilient communities in poor villages.

2. Analysis of Post-Disaster Recovery and Reconstruction in Poor Villages

The 2008 Wenchuan Earthquake-stricken area is located in a typical poor village distribution area in China. Among the 51 counties (cities and districts) included by the State Overall Planning for the Post-Wenchuan Earthquake Recovery and Reconstruction, there are 43 critical counties for poverty alleviation and development, and a total of 4834 poor villages. Nearly 60% of the impoverished communities coincide with the disaster area [23]. In the decades following the Wenchuan Earthquake recovery and reconstruction, these impoverished villages have continued to experience disasters, with torrents and landslides occurring one after another. The occurrence of these disasters has prompted human beings to reflect on the shortcomings of the post-disaster recovery and reconstruction by the State Council Leading Group Office of Poverty Alleviation. The specific investigation reports include the Report on Policy Effects of Rescue and Reconstruction for Post-Wenchuan Earthquake

in Poor Communities (15 villages), the Annual Comprehensive Assessment Report of Recovery and Reconstruction for Post-Wenchuan Earthquake in Poor Communities (19 villages), the Monitoring and Evaluation Baseline Survey Report of Recovery and Reconstruction of Experiment Poor Villages after Wenchuan Earthquake, and so on. These reports are based on social research methods, using qualitative and quantitative approaches such as questionnaire surveys, field interviews, statistical data reporting, and policy document collection. They have collected data in 29 impoverished villages of Sichuan, Shaanxi, and Gansu provinces, which have been most affected by the disaster. These villages include 19 types of experiment villages selected by the State Council's Poverty Alleviation Office from the planning areas and five types of non-experiment communities in the planning areas and five non-experiment villages in the non-planning areas. Based on the county, township, and village three-level sampling methods, the investigator dispensed and finally received 2009 validated questionnaire surveys and conducted a total of 400 interviews with the affected villagers, village cadres, and rescue workers. Statistics and related policy documents for the implementation of recovery and reconstruction planning in 29 villages were collected. Post-disaster recovery and reconstruction in poor villages as public policy implementation processes mainly include the process of policy analysis, the role of policies, and the process of suggestions and feedback. Policy formulation, implementation, and effects were explored through policy adequacy analysis, policy implementation process analysis, efficiency, and effect analysis. Through comparative analysis and expert judgment, the corresponding policy recommendations are proposed to promote the improvement of the policy formulation system and the implementation system. The BBB principles are also put forward to improve the resilience development of poor villages after the disaster (Figure 2).

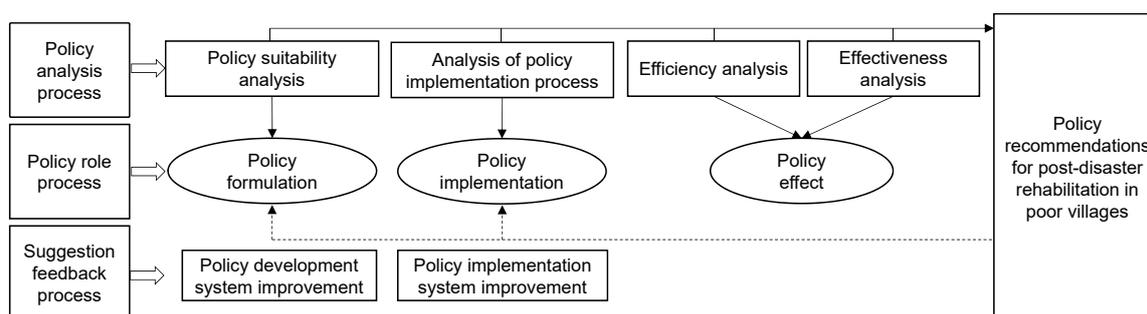


Figure 2. Analysis of recovery and reconstruction of poor villages after the Wenchuan Earthquake.

The surveys carried out in this study include farmer household questionnaire surveys, village surveys, and interviews with village cadres. The farmer household questionnaire survey mainly adopts the cluster sampling method to draw sample households. The questionnaires are all conducted by households. Each household surveys one person. The investigator asks the respondents one by one, and the control of men and women's sex ratio is generally appropriate; the village questionnaire is mainly filled by the village cadres according to the implementation of the restoration and reconstruction plans' main projects, and finally collected in a unified manner; the village cadre interview survey is mainly a semi-structured interview. It first lists several open questions related to the research theme, conducts meetings with the interviewee without setting options, and adjusts the interview theme in due course. The research used comparative analysis and rapid rural appraisal (PRA, Rapid Rural Appraisal) to analyze the results. Using the comparative analysis method to analyze the deviation between the actual situation of restoration and reconstruction and the planning objectives, to measure the effect of policy implementation and then summarize the corresponding experience model. PRA is a quick assessment method based on non-quantitative data such as anthropology and sociology, mainly for purposeful data collection and analysis in rural areas. It has the advantages of immediate results, low cost, and abundant data collection. First, it invites leaders from poverty alleviation departments, NGO staff, and other diverse subjects to participate in the survey to ensure the scientific

of the assessment from the organizational mechanism level. Secondly, it uses formal and informal methods to collect the same kind of information for disaster recovery and reconstruction and discuss the same topic through direct observation and group interviews to ensure the authenticity of the data. Finally, through in-depth investigations, it corrects the subjective bias with an uncompromising attitude and direct contact with the beneficiary groups through direct observation and group interviews to obtain objective conclusions.

2.1. Post-Disaster Recovery and Reconstruction Model Analysis

The post-disaster recovery and reconstruction model of poor villages directly determines the effectiveness of implementation and also defines the resilience of poor communities after reconstruction. The analysis of post-disaster recovery and reconstruction models of different types of poor villages can provide a reference for the post-disaster resilience development of poor communities. The recovery and reconstruction of the Wenchuan Earthquake lasted for a long time and involved many tasks. In the meantime, the rehabilitation and reconstruction process form a specific model. It took 10 years to restore and rebuild after the 1995 Hanshin earthquake in Japan. In 1999, it took six years to restore and rebuild after the Nantou earthquake in Taiwan. The 2008 Wenchuan Earthquake was more severe than these disasters, as mentioned above. The Chinese government proposed the overall goal of “Three years of recovery and reconstruction completed in two years,” but the actual recovery and reconstruction have gone on for decades. Due to different political systems, China and America have different modes of post-disaster recovery and reconstruction. America adopts a “bottom-up” approach whereby residents and local governments formulate plans and report to the federal government in an accumulative and integrated way. During the process of recovery and reconstruction, the local government and the affected people take the lead, and the federal government supports it. China’s post-disaster recovery and reconstruction adopt a level-by-level plan from the State Council to the affected provinces, cities, and counties, guided by government documents. The government takes the lead in the recovery and reconstruction process, and social organizations and residents actively participate (Figure 3). Due to the widespread distribution of poor villages in the Wenchuan Earthquake area, there are different types of poor villages which have various natural environment characteristics and damage conditions. Therefore, we need to use different post-disaster recovery and reconstruction models, including community construction models, urbanization models, cooperative industrial development models, and an integrated village promotion and continuous development model. Besides, as a complex social ecosystem (SES), including natural ecology, economic production, and social life, the poor villages are intertwined with each other. The construction of a weak village ecosystem guided by the resilient development concept advocates the use of the community’s resources and cyclic use, with different subsystems coordinating with each other (Figure 4). The recovery and reconstruction after the Wenchuan Earthquake need to adopt an appropriate organization and management model based on the structural characteristics of the social ecosystem of the impoverished villages. It also needs to prioritize the recovery and reconstruction of social living, to assure subsystems such as residential housing and infrastructure, and to strengthen the economic production subsystem and nature during the rehabilitation and development.

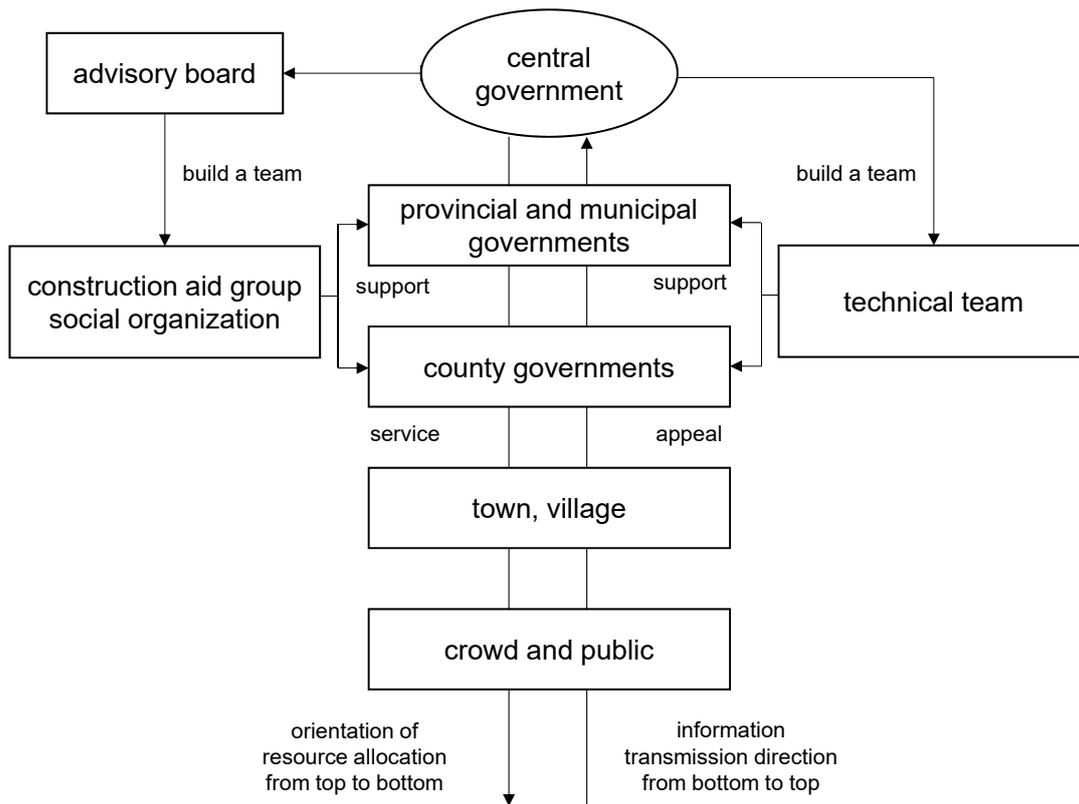


Figure 3. Post-disaster recovery and reconstruction model of poor villages in the Wenchuan Earthquake region.

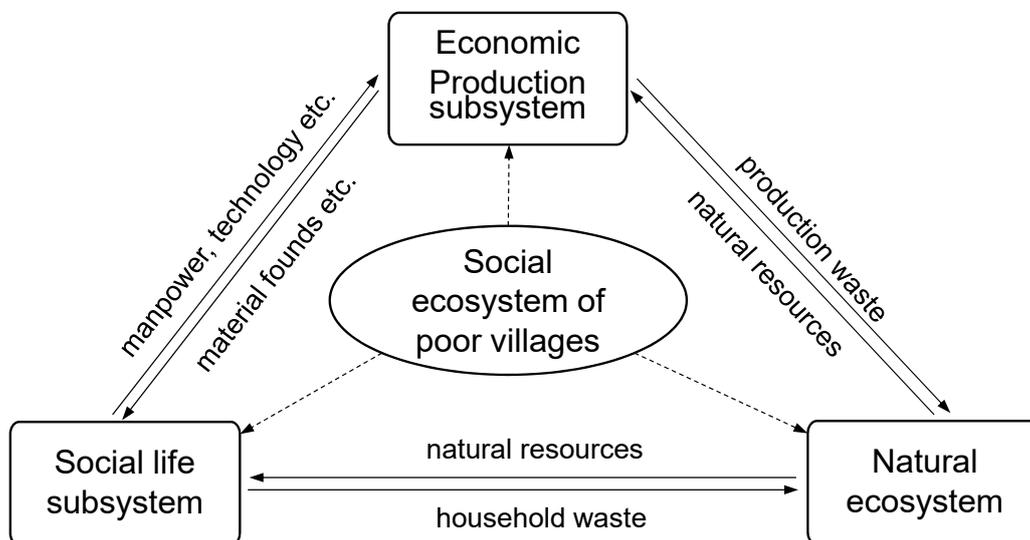


Figure 4. Social ecosystem structure of poor villages.

2.2. Effect Analysis of Post-Disaster Recovery and Reconstruction

Starting from the “BBB” principle, the post-disaster recovery and reconstruction effects are analyzed based on the policy analysis process, policy action process, and policy feedback process in combination with the social ecosystem structure of the poor villages. The final step is proposing reasonable system improvement suggestions based on the problems that have been found. From the social living subsystem, economic production subsystem, and natural ecological subsystem,

the experiences and problems of recovery and reconstruction of poor villages after the Wenchuan Earthquake are summarized as follows (Table 1): (1) In terms of social life subsystem, the Chinese government and stakeholders carried out the reconstruction of urgent projects such as residential living after the disaster, established a multi-level organization and management mechanism for counties and villages, and guided mutual social assistance to strengthen social relationships. However, there is a lack of attention to the livelihoods of residents. Although reconstruction activities will temporarily increase employment, the livelihoods of residents in the later stages still face challenges, especially the livelihoods of vulnerable groups and farmers whose farmland has been occupied for reconstruction. After the disaster, it is critical to strengthen cultural construction and psychological counseling. Residents are still anxiety during the recovery and reconstruction process, and some survivors will even suffer from mental illness. Because of the unified resettlement, it is easy to ignore the pigs and animal breeding activities of villagers, food, and other living needs. (2) In terms of economic production subsystem, poor village communities have a more straightforward industrial structure than urban communities. Although the government has issued an industrial development plan based on the characteristics of local resources and environment and has carried out skills training for villagers, many poor village residents continue to follow the “living at the mercy of the elements” production method. The market order was affected by the disaster, and the increase in raw material prices and material shortages caused difficulties in production reconstruction. The current loan policy requires that there is only one way to obtain the industrial recovery loan after repaying the housing loan, resulting in restricting production recovery. The poverty reduction effect of the projects already invested in construction is not significant enough, and it is difficult to effectively improve the “hematopoiesis function” of the disaster area. (3) In terms of natural ecological subsystem, the government has issued a series of ecological recovery plans and carried out environmental cycle projects such as biogas digester construction in conjunction with rural environments. However, due to some unreasonable planning, the subsequent project construction caused “secondary damage” to the already fragile ecological environment. Furthermore, poor villages have less available land, and farmers lack awareness of environmental protection and are often passively involved because of policy constraints.

Although the tasks of recovery and reconstruction of poverty-stricken villages after disasters are numerous, housing recovery and rebuilding are the core work. In total, 63.5% of the rural households in the poor villages surveyed need to rebuild their houses. Still, it is difficult for the unified reconstruction policy formulated by the government to meet the diverse needs of victims. The state provides tents or temporary prefabricated houses and housing maintenance funds to guarantee the victims’ living needs. However, there is a “one size fits all” phenomenon in financial assistance. According to the national policy documents, all houses rebuilding households can receive an RMB 20,000 housing reconstruction subsidy, but the actual rebuilding process requires more funds than this. Furthermore, because the state subsidy of RMB 20,000 is paid in three installments, the first subsidy can only be obtained after completing the foundation of the new house. It is still difficult for many poor households to obtain the first subsidy. Only 88.6% of the rebuilt households in the survey received a certain amount of subsidy; moreover, rebuilt households can apply for discounted loans for house reconstruction under RMB 30,000, but prerequisites require guarantees, and rebuilt households cannot guarantee each other, resulting in many farmers, especially poor households, actually having difficulty in enjoying the preferential policy. Only 55.8% in the survey obtain loans, and many special groups such as the elderly, bachelors, and other families cannot get loans. Besides, due to the simultaneous large-scale housing reconstruction in various places, the price of building materials increased, the supply of building materials and the shortage of skilled workers, and the disorder of the market after the disaster caused the speed of house reconstruction to be much lower than the planning requirements. The overall satisfaction of farmers in the survey with the state’s housing reconstruction and maintenance subsidies was 59.7%.

Table 1. Analysis of recovery and reconstruction effects of poor villages after the Wenchuan Earthquake.

Type of System	Experience	Problem
Social life subsystem	<ol style="list-style-type: none"> 1. Priority is given to the urgently needed projects. Increase the speed of housing reconstruction to avoid winter weather 2. Establish a working mechanism with the county as the organizational unit and village committee implementation unit, closely linking the reconstruction work 3. Promote mutual assistance among residents after the disaster, improve social relations, and interact more frequently 	<ol style="list-style-type: none"> 1. Insufficient investment in cultural facilities; psychological counseling needs to be strengthened 2. Centralized resettlement emphasizes unity and scale, neglecting the need for convenient living 3. Insufficient attention paid to recovery of victims' livelihoods, especially with vulnerable groups, such as women
Economic production subsystem	<ol style="list-style-type: none"> 1. Actively formulate industrial development plans based on local resources and environmental characteristics 2. Strengthen technical training for the victims, and use recovery and reconstruction projects to realize the industrial transformation 	<ol style="list-style-type: none"> 1. Community industry recovery loans are challenging to implement due to the impact of previous housing loans 2. The market order is affected, causing material shortages and increasing raw material prices 3. The effect of post-disaster reconstruction on poverty alleviation is not apparent, and developmental reconstruction projects start slowly
Natural ecological subsystem	<ol style="list-style-type: none"> 1. Realize the ecological cycle through biogas digester construction 2. Issue the corresponding ecological recovery plan, focusing on the combination of ecological recovery and industrial adjustment 	<ol style="list-style-type: none"> 1. The ecological environment of some poor villages is fragile and has been damaged by reconstruction during road and housing construction 2. Villagers have weak environmental protection consciousness, are often only restricted by policies and passively participate

After the earthquake, the Chinese State Council has required government at all levels to strive to complete the post-disaster recovery and reconstruction work within three years. Still, there were some deviations in the implementation process. To complete the task within a limited time, all levels of government require the lower-level government to complete it in advance based on the national time. The burden on the grassroots government has increased, and the planned reconstruction time-compressed to two years or less in some areas. Many problems occurred as a result. The survey found that the most typical problem is that some reconstruction projects have quality problems and lack of follow-up maintenance. The quality of the house in Matiwan village has deteriorated to the early completion of the occupancy. Problems such as leaking roofs and cracks in the wall have occurred. Furthermore, the drinking facilities of the village have lost many functions due to insufficient maintenance. The residents in Douzuizi Village are not satisfied with the construction of the canal because retaining walls are relatively thin and is prone to leaks after soaking. Makou Villagers were dissatisfied with the drinking water facilities after the earthquake, mainly due to the poor quality of the water pipes leading to frost damage in winter. People in Fuba village were not satisfied with

the quality of the centralized resettlement houses and slope protection, mainly because according to the design requirements for construction, the cement used for slope protection is insufficient. Many of these problems are the result of “time-limited” policy inefficiency.

In addition to the primary housing reconstruction, the poor villages in the disaster area have differences in the recovery and reconstruction of infrastructure, production facilities, capacity building, psychological assistance, and village environment in the year after the disaster. The restoration and reconstruction of infrastructure is the guarantee for the other parts, but the demand for funds is tremendous and needs regular management and maintenance. Among them, the farmers’ satisfaction with the restoration and reconstruction of electricity facilities, roads, drinking facilities, and energy facilities such as solar energy and biogas digesters, respectively, is 78%, 66.7%, 68.3%, and 68.8%. Production recovery is the driving force for the regular operation of the disaster area, but its economy is relatively weak. Among them, the farmers’ satisfaction with essential farmland restoration and reconstruction is high, nearly 76.1%, and the farmers’ satisfaction with the restoration and reconstruction of irrigation facilities is 62.9%. The satisfaction of the start-up funds was 61.9%. Capacity building is the key to improving the quality of farmers, but farmers have a low level of education, and there is a problem of streamlining ability training. Among them, the satisfaction of farmers with related technology training is 67%, and the satisfaction of farmers with labor transfer training is 59.6%. In addition, the interview found that farmers generally have a strong sense of anxiety, especially the pressure of loan repayment and future livelihoods. The satisfaction of farmers with psychological assistance is 71.3%. The improvement of the village environment is an external display of the effectiveness of restoration and reconstruction. However, some villagers do not pay enough attention to the village environment, and the satisfaction of farmers with the village environment’s improvement is 64.6% (Figure 5). In short, the post-disaster poverty-stricken villages still need to be improved in the above aspects. The improvement measures need to be put forward in light of the problems reflected.

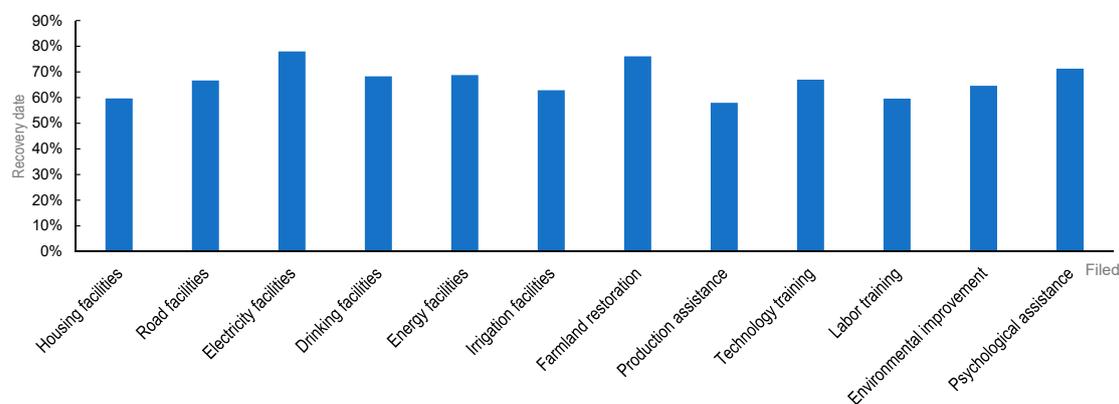


Figure 5. Resident satisfaction survey of the restoration and reconstruction of various contents of poor villages after the disaster.

Post-disaster poverty-stricken villages include disadvantaged households, severely affected households, women, and other vulnerable groups. All kinds of vulnerable groups are generally underestimated in the restoration and reconstruction and lack corresponding assistance policies. Regarding poor households, people generally believe that it is reasonable to give poor households more subsidies under the same conditions. The government has paid more attention to poor households in the disaster area. However, from the actual situation, the surveyed sample households believe that 57.8% of the post-disaster reconstruction “have preferential treatment” to poor households. In comparison, those with “no preference” accounted for 20.4%. Another 21.9% of farmers indicated that they were unclear about preferential treatment, making it difficult for some poor households to recover and rebuild. Regarding the severely affected households, farmers generally believe that subsidies

for housing reconstruction should be given according to different disaster situations. Only 21.7% of the households indicated that the severely affected households received more subsidies, and 64.1% of the households believed that the severely affected households did not get more subsidies, another 14.2% of farmers said that they are not clear about affected households received subsidies, many subsidies are only directly paid according to the number of people in the actual distribution, and the degree of damage to the severely affected households has not been paid attention to. Regarding women's assistance, the government and relevant departments have carried out corresponding physiological health guidance for women. Only 20.6% of farmers believe that women in disaster areas have received corresponding health guidance; 58.6% of farmers believe that women in disaster areas have not received corresponding health guidance. Another 20.8% of the farmers think they do not know, showing that the assistance of women's physiological hygiene would be generally less effective (Figure 6).

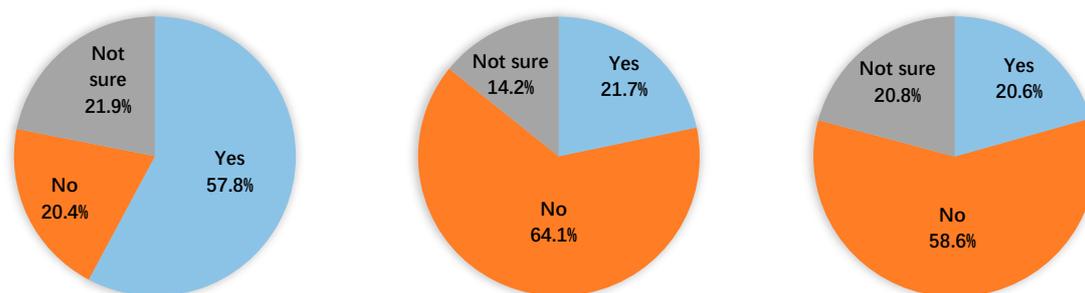


Figure 6. (a) Analysis of the benefits situation of poor households in disaster areas; (b) Analysis of the benefits situation of the severely affected households in the disaster area; (c) Analysis of the benefits situation of women in disaster areas.

In addition to the specific issues of each subsystem, there are also overall systemic problems, including low awareness and incomplete implementation of government policies. The challenges of bulky hardware and light software construction generally exist, and consistency of reconstruction policy for disaster areas is challenging. It is difficult to unify people's differences. By comparing the effects of three types of villages among the experiment villages in the planning area, non-experiment villages in the planning area, and non-planning communities, it was found that there is a wide disparity in resource allocation between different types of poor villages. The production capacity of the experiment villages has been valued, and confidence is reliable. Among them, Makou Village in Guangyuan City used the mobilization meeting to encourage the masses to participate in post-disaster reconstruction activities, which not only improved residents' satisfaction but also helped to monitor the quality of the project. Mazuwan Village in Lueyang County stipulates that village cadres are obliged to provide volunteer farming labor for the destitute households so that farmers can focus more on house reconstruction. However, funds for post-disaster reconstruction in some poor villages are still limited. There is a "shrinking" trend in the allocation of post-disaster funds in Luojiazui Village in Ningqiang County. It reflects that the matching index of policy and resources is not high. However, the non-experiment villages and non-planned villages have the low level of the reconstruction fund and weak infrastructure construction, the people are relatively divided, and there is a lack of integration of and attention to the material assistance and psychological rehabilitation of residents. Among the villages, the reconstruction fund of Hongdou Village in Deyang City can only be resolved by the local finances, which are already in a state of debt. This has resulted in a lack of supporting measures such as roads and sewage. The differences between these different types of poor villages' recovery and reconstruction policies are likely to cause social problems in the later period due to uneven distribution. The emergence of these problems also shows that it is unreasonable to divide the disaster standards according to the administrative area and implement the different policies. The regional goal setting of the reconstruction policy should be according to the actual disaster level. Based on the above analysis of the effects of the various subsystems of the poor village community and the overall impact,

and the comparison of the effect of different types of poor villages, combined with experience and problems, it is essential to research the post-disaster resilience development of poor communities based on the BBB principle.

3. Resilience Development Challenges under the “Build back Better” Principle

3.1. Interpretation of the “Build back Better” PRINCIPLE

BBB is a new concept of post-disaster recovery and reconstruction which aims to create a safe and resilient community after the disaster [24]. Its international definition refers to reducing pre-disaster vulnerability and incorporating disaster risk reduction concepts into regional development during the post-disaster recovery and reconstruction phases so that countries and communities can resist disasters while improving production, living, and ecological environments [25]. Disaster management is often conceptualized as including four stages: Reduction, Readiness, Response, and Recovery. The last phase is more comprehensive than other steps. Its focus is also on traditional waste management, project quality, and vulnerability establishing sustainable and resilient transitions [26,27]. Post-disaster recovery and reconstruction are not merely to restore the disaster area to its pre-disaster state conditions, but to repair the damage caused by the disaster. It is also necessary to make up for the existing loopholes and reduce the vulnerability of the disaster area so that losses can be reduced when the disaster is encountered [28,29]. The concept of “build back better” seeks to deepen the connotation and requirements of post-disaster recovery and reconstruction. It focuses on creating a sustainable community through a series of actions after the disaster, including improving social, economic, and environmental factors, and improving the resilience of the disaster area [30,31].

The BBB has become an essential guiding principle for post-disaster recovery and reconstruction, which was widely used in the recovery and reconstruction after the Indian Ocean tsunami in 2004. Mannakkara and others combined the relevant cases to build a BBB framework to guide specific actions. They tested it in post-disaster recovery and reconstruction situations, such as the Indian Ocean tsunami and Victoria bush fire, to determine the applicability of these principles in different environments [25,32]. Based on this idea, Khasalamwa and others analyzed humanitarian interventions in Sri Lanka after the Indian Ocean tsunami in 2004. They believed that although the concept was excellent, post-tsunami reconstruction did not change existing weaknesses [33]. Kennedy et al. further combined the post-tsunami shelter reconstruction work in Sri Lanka and Aceh to verify whether the concept was effectively implemented and proposed that “safer” should be given priority among the many goals included in “better” [34]. BBB requires that the disaster area not only recover from the disaster but that the system is also made more resilient than before the catastrophe through structural and non-structural measures. The implementation of the BBB strategy depends on specific improvement goals. Based on this principle, guiding the post-disaster recovery and reconstruction of poor villages is conducive to solving the current dilemma.

3.2. Evolution of Resilience Theory under the “Rebuild Better” Principle

The BBB principle promotes the improvement of the theory of resilience. Traditional resilience has undergone a transition from “balance” to “adaptability.” Resistance, absorption and recovery are the main characteristics of the resilience system [35–37]. The concept of resilience initially originated from mechanical engineering and was later introduced into the fields of ecology, economics, and social sciences. Today, researchers use the concept of resilience that is widely used in the field of disaster risk management [38,39]. Engineering resilience emphasizes that the system is restored to its original stable state after being disturbed. Ecological resilience systems are transformed into new stable states after being disturbed; evolutionary resilience has abandoned the pursuit of steady-state and sees resilience as a property of the system itself. Whether there is an external disturbance or not, internal dynamic evolution will occur. Evolutionary resilience is based on the “adaptation cycle theory,” which proposes that the development of system resilience will go through stages of utilization, preservation, release,

and reorganization. It emphasizes that after the system is disturbed, it continuously adapts and learns to obtain reorganization opportunities in the reorganization stage and enters the utilization stage to achieve the adaptive cycle (Figure 7). Evolutionary resilience focuses on the ability to respond to disaster risks during the evolution of the system, enabling the system and the external environment to co-evolve and “bounce to a better state.”

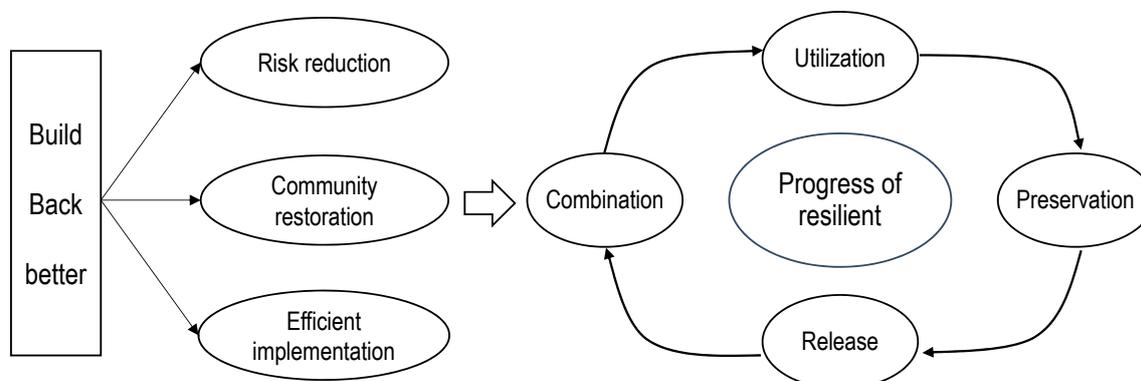


Figure 7. Resilience evolution under the BBB principle.

The evolutionary resilience is in line with the goals of the BBB principle, emphasizing respect for the fundamental laws of the social ecosystem from an evolutionary perspective. The social ecosystem can self-organize, learn, and adapt, and can provide guidance for post-disaster resilience in poor villages. The evolutionary resilience and BBB principles are often bridged by the construction of resilient communities from theory to practice. Since disaster risk was first perceived at the community level, the 1999 World Conference on Disaster Reduction Management Forum proposed “considering the community as the basic unit of disaster reduction.” The BBB principle requires the construction of resilient communities to fully mobilize multi-participation and regard the victims as the main driving force. This requirement also conforms to the fact that the stricken area relies on the extensive participation of the victims. Resilience theory can be applied to various living environments such as cities and villages, and the construction of resilient communities has become an essential area of resilience research [7,8]. The principles of risk reduction, community recovery, and efficient implementation based on BBB will promote poor villages to develop better according to the concept of evolutionary resilience.

4. Research on the Post-Disaster Resilience Development Framework in Poor Villages

4.1. Inspiration from Community-Based Resilience Building

There are many differences in the construction of resilient communities of poor villages and cities. The BBB principle advocates a holistic approach to improve the social, economic, and ecological conditions of communities in post-disaster recovery and reconstruction of poor villages to create a more resilient community. Community is the basic unit of human activities. Resilience in poor villages can be understood as the manifestation of “resilience” attributes in specific “community” spaces. The 1999 World Conference on Disaster Reduction Management Forum earlier stated that “community is regarded as the basic unit of disaster reduction.” Subsequently, the Hyogo Declaration issued by the World Conference on Disaster Reduction in 2005 included community disaster reduction as valuable content. In 2010, UNISDR promulgated *How to Make Cities More Resilient: A Handbook for Local Government Leaders*, in which the tenth element proposed strengthening the construction of resilient communities in post-disaster recovery and reconstruction to improve the community’s ability to prevent and mitigate disasters [40]. The 2015 Sendai Framework listed resilience construction and local disaster reduction as one of five key areas. Besides, the Sustainable Development Goals (SDGs) in

Goal 11 require that by 2020, the number of cities and inclusive human settlements, resource efficiency, adaptation to climate change, and resilience to disasters will significantly increase [41]. Therefore, actively carrying out community-based resilience construction is an effective way for post-disaster resilience development in poor villages. Based on the BBB principle, community recovery is the core of post-disaster recovery and reconstruction. Promoting disaster reduction in the early stage and effectively implementing policies in the later stage will encourage the development of disaster areas.

At present, cities are the base area filled with the construction of resilient communities in many countries, such as resilient community planning: *Managing Risks and Increasing Resilience for London*, *A Stronger, More Resilient New York for New York City*, etc. [42–44]. However, the specific study of vulnerable communities such as poor villages remains rare. Moreover, after the Great Hanshin Earthquake, Japan promoted the “BOKOMI Disaster Prevention Welfare Community Plan” to strengthen community disaster prevention capabilities through disaster prevention publicity, education and training, and disaster prevention plan formulation [45]. Hamnett and others proposed a sustainable disaster reduction policy system to build resilient communities. In this system, FEMA is responsible for implementing sustainable development policies at the federal level. The Federal Emergency Management Agency assists and monitors state and local level disaster reduction work and capacity building. State and local agencies are responsible for developing specific mitigation plans and conducting mitigation actions [46]. To ensure the sustainable development of poor villages after the Wenchuan Earthquake, the International Poverty Reduction Center in China and the United Nations Development Program have evaluated the reconstruction and resilience development of poor communities after the earthquake [47]. Poor village communities face more difficulties in post-disaster recovery and reconstruction than urban communities. Actively developing resilient communities in post-disaster poor villages is conducive to the integration of short-term disaster relief and long-term poverty alleviation [48]. The concept of resilient community construction advocated by the BBB Principles requires continuous learning and adaptation to promote the evolution of community resilience in the post-disaster recovery and reconstruction and to promote the development of resilient communities in impoverished villages in combination with the interaction mechanism between various subsystems of the social ecosystem.

As Shuimo Town, the severely affected area of the Wenchuan Earthquake in 2008, reencountered severe mudslides in 2019, it is necessary to reflect on the effectiveness of the construction of resilient communities after the disaster in light of the lessons. Due to the natural disasters’ concurrency and coupling, in those circumstances in which hazards are difficult to control, improving the resilience of the affected body is an effective way to reduce disaster risks. In the area of resilient community construction, policy standards have been introduced. Since disaster risk reduction has always been a priority in disaster recovery and reconstruction, community disaster risk management has become a prerequisite for the creation of resilient communities after the disaster. At present, China is actively carrying out the National Comprehensive Disaster Reduction Demonstration Community activity. The implementation of this activity has summarized a wealth of experience in disaster reduction work systems, shelter construction, disaster reduction publicity and education, etc. It has provided a basis for the development of resilient communities in poor villages after disasters [49]. Among them, the “National Standards for Comprehensive Disaster Reduction Demonstration Zones” provide 10 essential elements, including improving management mechanisms, assessing disaster risks, conducting disaster reduction education, and improving disaster reduction facilities. Moreover, the concept of “Community-based Disaster Risk Management” (CBDRM) advocated by Japan, Thailand, and other countries focuses on disaster reduction and preparedness, encourages the broad participation of the community, and includes disaster risk management in the process of community development [50, 51]. Although these two models have explained the “hardware” and “software” strength building of different subjects of individuals, families, and communities, they lacked particular research for the development of vulnerable populations such as poor villages (Table 2). This activity is widely distributed in areas with higher socioeconomic levels and relatively poor communities in poor villages

with frequent disasters. There is an urgent need to improve “software” such as the livelihood of the residents, psychological culture, etc., in China’s impoverished villages during the construction of resilient communities. Building resilient communities based on the BBB principle is an effective way to achieve sustainable development in poor villages [52–54].

Table 2. Comparison of Disaster Risk Management Models in Chinese and Foreign Communities.

Model	National Standards for Comprehensive Disaster Reduction Demonstration Zones	Community-Based Disaster Risk Management
Country	China	Japan, Thailand, Vietnam, etc
Objective	Improving the hardware and software capabilities of communities in response to disasters; Reducing community vulnerability; Building a sustainable community	Promoting the participation of residents in the community; Strengthening the ability of residents and communities to respond to disasters, especially the strength of the software
Subject	Individual, family, community	Individual, family, community
Decision	Participate in all aspects of community disaster reduction capacity building throughout the process	Community members participate in the decision-making process to determine their own priority needs and disaster risk reduction measures
Element	<ol style="list-style-type: none"> 1. Organization management mechanism 2. Disaster risk assessment 3. Emergency response plan for disaster response 4. Disaster reduction education and training activities 5. Disaster prevention and mitigation infrastructure 6. Residents’ awareness and skills in disaster reduction 7. Community disaster mobilization and participation 8. Management assessment system 9. Archive management 10. Community Features 	<ol style="list-style-type: none"> 1. Community organization/institution 2. Community disaster risk reduction fund 3. Maps of community hazards, vulnerability, and capabilities 4. Community disaster management planning 5. Community training system 6. Community disaster drill system 7. Community learning system 8. Community disaster early warning system

4.2. Elements of Resilient Construction in Poor Villages

At present, the research on the elements of resilient community construction is plentiful but is dominated by urban communities, including both the resilience construction at the international level and the resilience construction at the local level. In 2009, the Rockefeller Foundation established the Asian Urban Climate Change Resilience Research Network. The research network researches resilient cities for ten cities in four countries—Thailand, Vietnam, India, and Indonesia—and proposed that resilient cities include four elements: redundancy, flexibility, restructuring ability, and learning ability (Figure 8). Redundancy indicates the support that can be provided in the event of a system crash, as well as the need for additional supplies and long-term vision to supplement redundancy. Flexibility means adapting to external uncertainties and learning from mistakes. Learning ability indicates abandoning measures that do not work, learning from other cities and within cities, and being good at learning about successful interventions. The ability to restructure means having an independent political system and respecting existing experience. The framework summarizes the key elements of the resilient construction of cities’ climate change. Still, these elements take urban communities as

the core and are difficult to replicate in the development of resilient communities in poor villages. Besides, the United States Agency for International Development developed the “Guidelines for Resilience of Coastal Communities” after the Indian Ocean tsunami in 2004. It attempts to expand the sectoral plan to establish a more comprehensive planning framework to promote the resilience of coastal communities. This guideline comprehensively considers tsunami and storm surge, coastal erosion, sea-level rise, coastal resource degradation, and other coastal community disasters. Eight coastal communities are listed that have improved governance, socioeconomics, coastal resource management, land use planning, risk reduction, warning and evacuation, emergency response, and disaster recovery—eight factors that enhance the resilience of coastal communities (Figure 9). However, these resilience construction elements are mainly proposed based on the characteristics of the resources and environment in the coastal areas, and there are also problems of applicability.

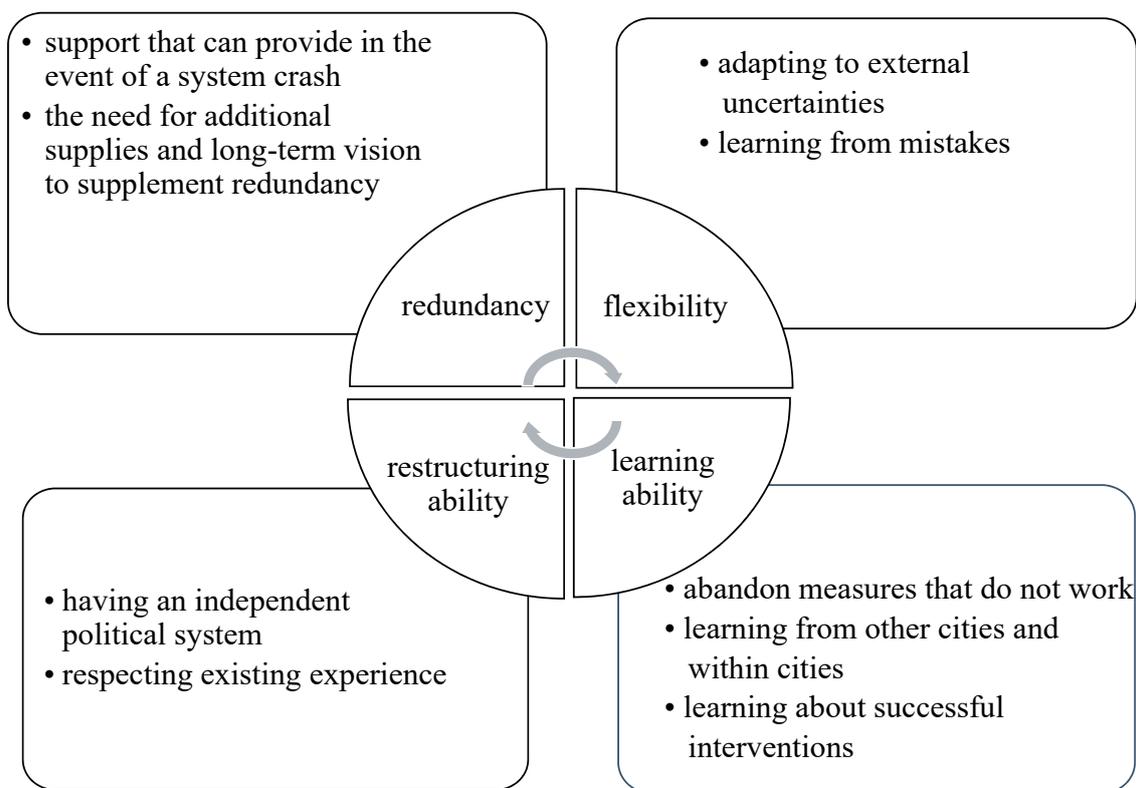


Figure 8. Elements of resilient cities based on climate change.

The construction of resilient communities in poor villages should not only draw on the more mature, resilient urban construction elements, but should also select the experience of local resilient community construction elements in coastal areas. The features that fit the resistant village resilient community construction from the local scale should be chosen based on the BBB principle. The “National Earthquake Science and Technology Innovation Project” promulgated by China in 2017 proposed the Resilient Urban-Rural plan, and the resilience of communities such as cities and villages has received overall attention. However, there is still a vast difference in the theory of urban and rural resilience communities [55]. The system resilience of poor villages is an integral feature formed by the organic coupling of the various subsystems of the social ecosystem of the poor villages. As the basic unit of the social ecosystem of the poor villages, the development of resilient communities has become an important entry point for the adjustment and control of system resilience. In general, for vulnerable communities such as poor villages, there is a lack of resilient construction elements selected from local scales based on their characteristics. This study refers to resilient construction elements such as urban

communities and coastal communities, combining the experience and problems of poor villages after the Wenchuan Earthquake. It analyzes three aspects from BBB principles—risk reduction, community recovery, and efficient implementation. It focuses on resilient community construction, including overall planning, structural resilience, disaster prevention and mitigation, economics and livelihoods, society and psychology, institutional mechanisms, laws and regulations, monitoring and evaluation. Specific measures are put forward to build resilient communities in poor villages after disasters and to more specifically guide the resilience development of poor villages after disasters.

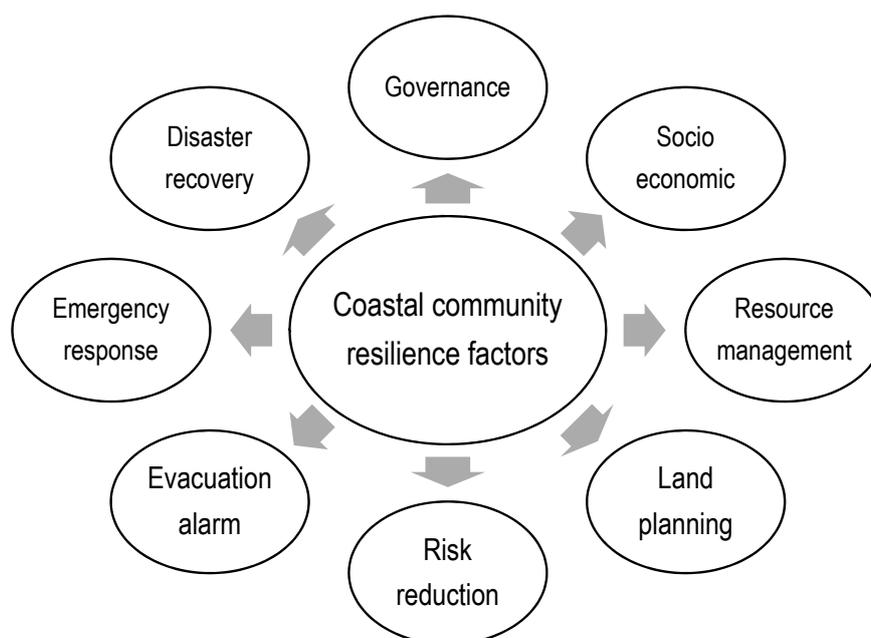


Figure 9. Resilience factors of coastal communities.

4.3. Resilience Development Framework for Poor Villages

Community development refers to a process whereby residents themselves and government agencies work together to improve the social, economic, and cultural conditions of the community, link the city to the life of the entire country, and promote them to contribute fully to the progress of the country. Poor village communities, as a typical fragile social ecosystem, need to strengthen social ecosystem construction from the perspective of community development. Through comprehensive analysis of the problems in post-disaster recovery and reconstruction of poor villages, based on BBB principles, resilience development with resilient community construction as the core is a useful model for post-disaster community development in poor villages. The creation of resilient communities in impoverished villages under the BBB principle must fully consider the frequency and intensity of various random disturbances to ensure the community's adaptability. At the same time, it must establish a comprehensive system to protect stakeholders and have the ability to predict and prepare for future impacts, eventually changing the community base in a creative way [56]. At present, some theoretical frameworks are guiding the construction of resilient communities. The more mature theories include Norris' resistant community model and WISC model [57,58]. However, these resilient community models are relatively macroscopic, and the internal composition of poor villages is complex and affected by a variety of external factors. The construction of resilient communities in poor villages after disasters requires the development of appropriate strategies. China's poor villages are significantly different from western societies in terms of natural conditions, social structure, and administrative management. Furthermore, the recovery and reconstruction processes of poor villages after the Wenchuan Earthquake have the characteristics of counterpart support, a combination of

poverty alleviation and disaster relief, and the need to build resilient communities in poor villages after the disaster. Based on the combination of BBB principles and the experience of traditional resistant community construction, we can propose a comprehensive study on the resilient development of poor villages and a specified path suitable for the resilient growth of poor villages.

Although the construction of resilient communities in poor villages faces disadvantages such as frequent disasters and weak economies, poor village communities also have their advantages of resistant construction compared to traditional urban communities. First, the land in China's poor villages is collectively owned rather than state-owned, and residents have higher decision-making power over land development. Second, China's poor communities are based on kinship and geographical acquaintance societies and have substantial social capital, a sense of belonging and cohesion. The concept of evolutionary resilience under the BBB principle not only focuses on the short-term performance of the social ecosystem after being impacted, but also includes long-term system evolution. For example, after the Hanshin earthquake in 1995, the Hyogo Prefecture was committed to "creative renaissance," requiring communities to not only return to their pre-disaster state but also to be able to cope with social issues such as an aging society and industrial transformation. In order to achieve these goals, Japanese government made the "Three-year Plan for Emergency Rehabilitation" and the "Reconstruction Plan for the Great Hanshin Awaji Earthquake". After completing the necessary recovery and reconstruction for three years according to the "General Plan for Recovery and Reconstruction after the Wenchuan Earthquake," the local government formulated the "Development and Revitalization Plan for the Wenchuan Earthquake-affected Area 2011-2015" to guide the long-term development and reconstruction of the disaster area. The problems encountered in the event of vulnerable communities did not come up with specific solutions. Research on post-disaster resilience development in poor villages needs to diagnose problems first and identify vulnerable areas through survey interviews with stakeholders, disaster risk experts, and policymakers to understand disaster risk levels and affected areas. Once again, the social and economic bases of the poor villages after the disaster, the complex ecological environment, collective land ownership, and mature interpersonal relationships, are the basis for resources and the environment to provide a reference for strategy formulation. In the end, the framework diagnosed the development of poor villages by identifying vulnerable areas and resource and environmental bases, combined with the principles of risk reduction, community recovery, and efficient implementation of BBB to propose specific measures for the resilience development of poor villages (Figure 10).

1. Risk reduction

Risk reduction can be understood as taking measures to improve the community's ability to recover from natural disasters, from the original "Disaster Risk Reduction" (DRR) to "Disaster Risk Management" (DRM), emphasizing the government's organization of disaster risk. First, it is necessary to identify risks through professional risk assessment agencies, to optimize post-disaster recovery and reconstruction master planning management and control to avoid risk-prone areas, and to reduce the probability of disasters. In particular, in combination with the scattered distribution of the residential regions in poor villages, the difficulty of rescue in the event of an emergency in the later period will be reduced by establishing a centralized refuge place in the countryside. Second, in combination with the socio-economic weakness of poor villages, the construction of infrastructure such as residential housing requires the introduction of expert guidance. In terms of material selection, it is necessary to select as many local environmentally friendly and earthquake-resistant materials as possible and to use price intervention to meet low-income groups' purchase demand. Third, emergency publicity training in poor villages is an effective way to enhance residents' ability to prevent and mitigate disasters. It is necessary to compile corresponding emergency training courses based on the characteristics of poor villagers with low cultural levels and to focus on the development of risk early warning systems suitable for the environmental attributes of poor villages. Residents should be encouraged to participate in risk data collection.

2. Community recovery

Community recovery is the basic unit of disaster management and regional development. This in poor villages needs to focus on external and internal unity. First, the external recovery of the community includes the development of the industrial economy and the continued livelihood of residents. The economic level of the poor villages is weak, and most of the residents are mainly engaged in “farm-dependent” agricultural planting and breeding. Post-disaster recovery and reconstruction will increase employment in the short term, and in the longer term, agrarian cooperatives can develop rural tourism and unique species breeding to promote industry transformation in the following period. Villages can improve the poverty alleviation function of recovery and reconstruction projects and get out of the poverty traps of “poor by disaster” and “return to poverty due to disaster.” Second, the internal recovery of the community includes the psychological rehabilitation and social relationship development of the victims. Poverty-stricken villages have natural capital for social relations. The unified resettlement of residents in the same town will strengthen the community’s sense of identity, which will also help the victims achieve mutual assistance and achieve long-term development. Collective social activities and psychological aid can be organized to alleviate the villagers’ mental anxiety and enhance their development confidence. Moreover, many impoverished villages have many buildings representing local culture. The sense of belonging of newly built communities can be enhanced by relocating or rebuilding the village’s symbolic buildings before the disaster.

3. Efficient execution

An efficient implementation is a guarantee for reducing risks and community recovery, but the organization and implementation models of recovery and reconstruction in different countries and regions are significantly different. First, for recovery and reconstruction after the Wenchuan Earthquake, China has implemented a “counterpart support” recovery and reconstruction model. The central government leads and formulates policies. Local governments set up coordination offices to apply the implementation from the top down and lack the active participation of the grassroots public. The efficient implementation of post-disaster recovery and reconstruction in poor villages requires the introduction of a bottom-up model involving the participation of diverse groups such as village collectives and the general public, which is conducive to the efficient use of resources and can increase public satisfaction. Second, the effective implementation of post-disaster recovery and reconstruction in poor villages also needs to formulate supporting laws and regulations, restrict the responsibilities of different participants, and protect the participation rights of each participant. The establishment of financial strategies such as loan support and catastrophe insurance can effectively enhance residents’ ability to recover and rebuild after a disaster. Third, the establishment of a comprehensive monitoring and evaluation mechanism can ensure the effectiveness of the recovery and reconstruction of poor villages, and regular feedback evaluation can be performed in conjunction with surveying of residents’ satisfaction, to ensure the efficient implementation of the repair and rebuilding of poor communities.

The resilience development measures for poverty-stricken villages based on the “BBB” principle have applied in varying degrees in the restoration and reconstruction of the poverty-stricken villages after the Wenchuan earthquake, which has promoted their development effects compared to other villages. Since the post-disaster recovery and reconstruction of poor villages adopted the “experiment-promotion” model, the national poverty alleviation department conducted recovery and reconstruction plans and experiments for the poor villages in the severely affected areas, and then promoted and implemented them in other planning areas. Among them, due to the strong support of national policies, the experiment villages have implemented the resilience development measures proposed by the “BBB” principle to a certain extent, so that better results have been obtained in various aspects such as housing reconstruction, infrastructure, and production recovery during the post-disaster recovery. Among them, Xiaojiaba Village formulated the “Post-disaster reconstruction and poverty alleviation development plan of Xiaojiaba Village,” which carried out scientific planning for residential houses, roads, schools, health centers to avoid geological risks and improve building earthquake resistance.

In terms of financial support, the local government’s policy on farmers’ interest-bearing loans is more reasonable, prompting villagers to build houses with RMB 30,000 discount loan opportunities, and the vast majority of residents have achieved housing reconstruction. In terms of institutional mechanisms, the county implements the supervision of the county party secretary and the village cadres are responsible for the implementation of the management system and has special assistance measures for solar stoves, roads, biogas tanks, which promotes the recovery and reconstruction speed of the village compared to other villages faster and higher residents’ satisfaction.

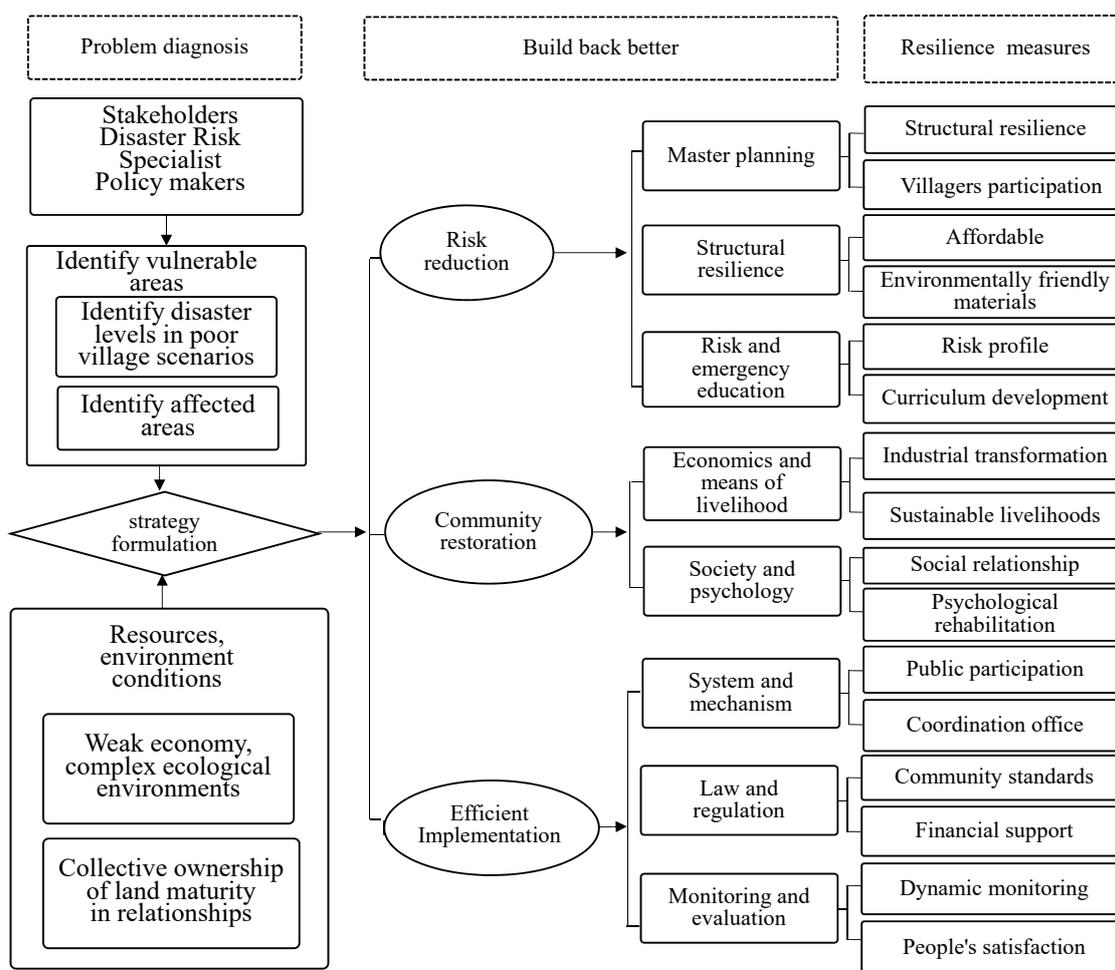


Figure 10. Resilience development framework for poor villages under the “BBB” principle.

The experience of post-disaster recovery and reconstruction in Makou Village further verified the operability of the proposed resilience measures. After the disaster, the village’s roads, water conservancy projects, and other infrastructure were quickly rebuilt, ensuring other aspects in the later period of recovery and reconstruction. In terms of industrial transformation and sustainable livelihoods, after surveying by the technical staff of the agricultural department, the previous barren hills were planted with more than 600 acres of pear trees. The fungus planting was combined with the geographical conditions of the village. The village actively organized more than 200 agricultural technology training. Furthermore, the animal husbandry department designs animal housing under the standards to ensure the living needs of residents. In terms of institutional mechanisms, the village cadres actively promoted earthquake knowledge and self-rescue knowledge to the victims after the disaster, eliminated the panic of the victims, and transferred more than 100 households—located in 4 severely cracked mountain areas, such as Tululing and Wujiali— to a safe zone. Seismic self-rescue helped prevent the village from causing casualties due to aftershocks, and also boosted farmers’ confidence. Overall, the resilience

development framework for poor villages based on the “BBB” principle provides scientific and operable guidance for disaster recovery and reconstruction. However, in practical applications, it is necessary to fully integrate the socioeconomic, resource, and environmental characteristics of specific poor villages, as well as to carry out adjustment and optimization to achieve the purpose of BBB and realize the sustainable development of the disaster area.

5. Discussion and Conclusions

5.1. Discussion

1. Application range

At present, the construction of resilient communities is mainly occurring in urban communities in various countries, while there is a lack of research on the resilience development of vulnerable populations in poor villages. Internationally, there are many related types of research on resilient cities on a macro-scale, as well as resilience studies on the local community and other regional scales. However, there is a lack of research on resilience development that combines the post-disaster recovery and reconstruction process of specific poor villages. At present, international research on vulnerable communities has gradually begun to focus on vulnerable groups, community identification, and psychological rehabilitation, but it is relatively scattered. Many countries face similar problems in post-disaster recovery and reconstruction of poor villages in different countries. The proposed framework can provide a reference for the post-disaster resilience development of poor villages in various countries. The BBB Principles can be seen offering solutions to problems arising from post-disaster recovery and reconstruction and promoting the construction of a more resilient community. Although the framework is based on the BBB Principles and is in line with the flexible development framework of poor villages in China, poor villages need to adjust their measures in the process of resilience development due to the reasons of the different characteristics of the resources and environment of poor towns as well as poverty differences.

2. Content focus

China’s research on the resilience development of poor villages has focused on infrastructure construction, livelihood recovery, and poverty alleviation, but it is not comprehensive enough. It lacks a comprehensive guidance framework that combines the characteristics of resources and the environment in poor villages. The problems arising from the recovery and reconstruction of the town provide a relatively complete guiding framework. China already has a “National Comprehensive Disaster Reduction Demonstration Community” activity that pays relatively little attention to backward areas. At present, post-disaster recovery and reconstruction in poor villages focuses more on short-term material assistance and infrastructure construction. Due to measures such as counterpart support and centralized resettlement after the Wenchuan Earthquake, there is a lack of attention to the actual needs of residents and the maintenance of previous social relationships, and it is challenging to retain the cultural characteristics of different types of poor villages. Based on the current problems encountered in the development of poor communities in China, there is a detailed analysis of the resilience development measures of poor villages based on the BBB principles. This framework guides the resilience development of poor communities in China after a disaster. However, the implementation environment and guarantee mechanism of these measures need to be studied in order to test the applicability and effectiveness of these measures.

3. Framework optimization

This study focuses on the analysis of particularly vulnerable communities, such as poor villages. The most apparent feature of poor village communities is economic backwardness. In the construction of resilient communities, special attention should be paid to material prices, financial assistance, and sustainable livelihoods of residents. By solving the most pressing economic problems, the recovery

and reconstruction of poor villages after the disaster will be improved. In addition, the vulnerability of poor village communities is formed by a combination of various factors. For example, some poor villages are in a harsh geographical environment, and disaster risks are frequent. The whole village can be relocated to reduce disaster risks and build communities. Some poverty-stricken villages have useful resources and environmental foundations, but they are only affected by a specific disaster. While reducing disaster risk during disaster recovery and reconstruction, they should focus on industrial transformation and economic development, and realize regional revitalization through disaster recovery and reconstruction. Therefore, although this study proposes a flexible development framework for the recovery and reconstruction of poor villages after disasters, it is necessary to optimize the framework in combination with the poverty factors and resource and environmental characteristics of poor villages, so that they can more effectively guide the development of poor villages after disasters.

4. Facing challenges

Post-disaster poverty-stricken villages are faced with multiple tasks such as restoration and reconstruction and poverty alleviation and development. The project construction needs to adhere to the principles of “combining reconstruction and poverty alleviation” and “combining reconstruction and development.” Although the tasks of restoration and reconstruction are different, they are mutually restricted in the actual operation. For example, some recovery and reconstruction projects have an economical leading role. In the post-disaster recovery and reconstruction, it is necessary to actively improve the economic function of reconstruction projects, improve the efficiency of the use of recovery and reconstruction funds, and promote them from “blood-transfusion poverty alleviation” to “hematopoietic poverty alleviation.” The various measures proposed in the framework need to balance mutual relations during the implementation process effectively. For example, many affordable materials are not necessarily environmentally friendly, and road construction will cause a certain degree of damage to the ecological environment. Therefore, it is necessary to weigh the interrelationships of various measures to promote comprehensive improvement in the recovery and reconstruction of poor villages after the disaster, maximize the development of the disaster area, and ensure the sustainable development of the disaster area.

5.2. Conclusions

As a typical representative of vulnerable communities, this research carried out effect analysis under the BBB principle for poor villages after the Wenchuan Earthquake. From the perspective of social equity, we can explore the specific and operable guidance framework suitable for the resilient development of poor villages after disasters. Research findings can provide ideas for the resilience development of other vulnerable areas and can also help build comprehensive urban and rural resilience. The development framework provides a useful reference. Therefore, starting from the requirements of the BBB principles, we have designed a flexible development framework for poor villages and put forward suggestions for improvement in three areas: risk reduction, social recovery, and implementation. (1) Reducing risk is a prerequisite for the resilience development of poor villages. Villagers can combine the characteristics of the risk-prone nature of poor communities by improving the resilience of building structures and can focus on the cost-effectiveness of construction costs and environmental protection in the selection of materials. Moreover, stakeholders can formulate reasonable land plans to avoid potential disaster risks and guide villagers to participate in the practice of a design risk and emergency education system and develop a disaster early warning and emergency education curriculum. (2) Community recovery is the core of the resilience development of poor villages. Combined with the characteristics of single industry structure and the low skill level in poor villages, the research on industrial transformation and the sustainable livelihoods of residents should be strengthened; meanwhile, the advantages of poor villages can be used to promote the development of social relationships and residents' community recognition. (3) An efficient implementation is a guarantee of the growth of resilience in poor villages.

The disaster area coordination office can work in conjunction with the national emergency management mechanism to improve the public participation mechanism. Improving the standards for building resilient communities in poor villages, implementing financial support policies, and carrying out the dynamic monitoring and evaluation of post-disaster recovery and reconstruction in poor villages to track the progress of resilience development are all recommended. The post-disaster resilience development framework constructed based on BBB principles can provide theoretical guidance for the development of vulnerable areas after disasters.

Author Contributions: Conceptualization, L.Z.; Data curation, L.Z. and C.Z.; Methodology, L.Z. and F.H.; Funding acquisition, F.H.; Investigation, L.Z. and C.Z.; Supervision, F.H.; Writing—Original Draft, L.Z.; Writing—Review and Editing, L.Z. and F.H. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the National Key Research and Development Program of China (No.2017YFC1502903).

Acknowledgments: The authors also thank Yaru Gao and Catherine Harrington for providing language help; At the same time the authors thank two reviewers and editors for their valuable comments and work.

Conflicts of Interest: The authors declare no conflict of interest.

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