

Post-disaster Relocating Plan for Aboriginal Tribes After Chi-Chi Earthquake

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ABSTRACT :

In order to suggest or to revise the policies for community reconstruction of aboriginal tribes, it is necessary to grasp the reconstruction situation involved in being at the same site and relocating of aboriginal tribes. It has been eight years passed since 921 Chi-Chi Earthquake occurred. By reviewing and compiling relevant literature on community reconstruction of aboriginal tribe, we may establish preliminary evaluation framework. The study through questionnaires to know the opinion of experts and local residents. However, the based on this understanding, tried to formulate an evaluation framework that would be appropriate for community reconstruction of aboriginal tribes. In this study, field survey and interviews are held in several aboriginal tribes which are named Sen-cha-ker, Shung-qi, Chung-yuen-kou, and Tanh-nan. To understand the real situation of aboriginal tribes' reconstruction, four aspects are revealed from the research to be the factor of assessment including safety, health, convenience, sustainability. The demonstration proves the main factors in the four aspects as follow: 1.in safety: (1) housing reconstruction of aboriginal tribes site selecting keep away the slope hill and the rivulet (2) Disaster Prevention Facility (3) Disaster Prevention reporting system (4) take advantage of the community course to increase Disaster Prevention consciousness. 2.in health: (1) beautification of community landscape (2) environment greening (3) Recreational Facility (4) community medical network system (5) developing community care network. 3. in convenience: (1) nearby market (2) promoting education resources (3) Internet popularizing. 4. in sustainability (1) architectural design of aboriginal totem (2) aboriginal craft inheriting (3) aboriginal language inheriting.

KEYWORDS: Chi-Chi Earthquake, Aboriginal-tribe Recovery, Community Reconstruction

1. INTRODUCTION

Taiwan is located on the seismic belt around Pacific Ocean, as the result, the earthquakes happen frequently. Based on the data collected from historic literatures, the disasters caused by earthquakes were normal and eternal in all natural plagues in Taiwan. For example, the Chi-Chi earthquake happened on 1999, September.21, at 1:47 AM, which earthquake magnitude was 7.3. In this serious earthquake, 2,415 people died and 11,305 people got injured. In addition, the completely destroyed houses were 52,712 and partly destroyed were 53,768 which according to the report of The 921 Earthquake Post-Recover Commission, Executive Yuan. Until now, the reconstruction of aboriginal tribes in 921 -Earthquake area has been processed for 8 years. The strategies of construction can be divided into two types. One is to process the reconstruction where the tribes were located, and the other is to process at other locations. The former were 16 tribes and the later were 7. The amounts in total were 23 aboriginal tribes under the reconstruction.

The issues relevant to aboriginal tribe construction can be summed up to several dimensions. First of all, the efficiency of implementation on reconstruction-policies, furthermore, identification of completely destroyed and partly destroyed buildings. Besides these, the geological evaluation on reconstruction-locations where traffic lines and buildings encountered seriously damages caused by mudflows and landslides should be under a careful consideration to adopt two kinds of reconstruction strategies: rebuilt in the same place and reconstructed in another. Nevertheless, there has been also a research question seldom regarded by experts besides mentioned-above dimensions. It is how to give an integrated comparison and evaluation for each case on the present status of aboriginal-housing reconstruction and living environment after reconstruction. For this reason, it is essential to do a proper evaluation and comparison on present status of reconstruction and living environment after the renovation. Based on the evaluation and comparison, suggestions could be given to facilitate the carry-out of housing reconstruction and to meet the specific demands when processing the renovation of aboriginal-housing. The research point in this study was focusing on living environment of aboriginal tribes after the reconstruction. Besides investigation on aboriginal people's living environment of post-reconstruction, another purpose is to review the efficiency of implementation of reconstruction policies for aboriginal residences under the evaluation of community-rebuilding.

2. SUMMARY OF LITERATURE REVIEW

In order to build the structure of evaluation on reconstruction of aboriginal tribe removing into new places rather than renovation of the original residences, the researcher reviewed studies and literatures on relevant reconstruction theories, community-rebuilding issues, policies of reconstruction for aboriginal housing, and evaluations on living environment after post-disaster renovation. The review of literature in this part was arranged as two parts, "Goals of reconstruction policies for aboriginal residences" and "Indexes for evaluation of aboriginal tribes' recovery" listed in the Table 2.1 and Table 2.2 below.

Table 2.1 Goals of reconstruction policies for aboriginal residences

Policies for Reconstruction	Item	Goal of Policies
Post-disaster Recovery Guideline	Public facilities, Living Industry, Community	Welfare, Safety, Various industry, Sustainability
Living Recovery Plan	Social security School Occupation training Medical service	Welfare system Medical system Knowledge system Safety, Cooperative system
Recovery Rule for Aboriginal Tribes	Public facilities Subsidies for housing recovery Housing recovery loan Style of housing recovery	Art and Culture Amenity and comfort Safety and High quality Nature and ecology
Subsidies for Aboriginal Tribes' Housing Reconstruction	Artistic design Green building	Art and Culture Nature and ecology

Table 2.2 Indexes for evaluation of aboriginal tribes' recovery

Index	Item	Sub-item for evaluation (Code name)
Safety	Building-safety for residences	S1: Disaster-prevention design
		S2: Tribes away from dip slope areas, streams, and ravines near the mountain
		S3: Under serious constructing check
	Community	S4: Facilities and instruments of disaster-prevention
		S5: System and channel for delivery of disaster-information
		S6: To maintain the safety by community organization
		S7: To go around and inspect for community security
	Individual consciousness of disaster-prevention	S8: Improving residents' alertness of disaster-prevention by taking part in community-curriculums and practicing activities for any emergency
		S9: To make sure evacuating routes
Health	Building environment	H1: Nature embellishment of communities
		H2: Planting areas
		H3: Ecologic ground design
		H4: Facilities for leisure and entertainment
		H5: Biodiversity
	Resource-usage and management	H6: Water resource
		H7: Light design
		H8: Ventilation design
		H9: Wasteplex
	The network of health-consulting	H10: Community based medical-treatment web
		H11: Community based social security system
Convenience	Living function	C1: Nearby school
		C2: Residences near the markets with daily-consuming goods
		C3: Nearby working place
		C4: Available transportation
		C5: Connected roads to outside
		C6: Driving route and pathway design
	Living resource	C7: Adequately educational resource
		C8: Convenient Internet-usage
		C9: Post office and electronic service
Sustainability	Facility of aboriginal cultural landscape	Su1: Archeological design with aboriginal totem
		Su2: Style of traditional roof
	Inheritance of traditional facilities	Su3: Traditional worship
		Su4: Traditional aboriginal arts
		Su5: Pass-down of aboriginal mother tongue

3. RESEARCH SCOPES AND METHODS

Dependent on the data provide by Council of Aboriginal Race, Executive Yuan, there were seven aboriginal tribes removing to other places for reconstruction. Until December, 2007, there were only five tribes reconstructed completely. However, one tribe has only one family finished relocating plan, and this tribe will be dismissed. Therefore, only four tribes served as research objects for investigation in this study. The progress of schedule for aboriginal tribe reconstruction was listed on Table 3.1. The main research methods in the study were review of literature, survey by conducting a questionnaire, and field investigation. By literature-review, the structure of evaluation on living environment was built in form of the table. About the survey by conducting the questionnaire, two kinds were given separately. One is scholar-questionnaire and the other is questionnaire of residents' satisfaction. The outcome of survey by questionnaire was analyzed in FAHP (Fuzzy Analytic Hierarchy Process) methods.

Table 3.1 Goals of reconstruction policies for aboriginal residences

County	Name of Village	Units for relocating	Progress of relocating
Taichung	Shung-qi	9	Completed
	Sen-cha-ker	45	Completed
	Wu-she-ker	22	Under construction
Nantou	Chung-yuen-kou	16	Completed
	Shang-mei-yuen	1	Completed
	Jwei-yen	139	Non-relocating
	Tanh-nan	35	Completed

3.1 The Standpoint of FAHP (Fuzzy Analytic Hierarchy Process)

FAHP is the method developed from Analytic Hierarchy Process (AHP). Traditional AHP has shortcomings on evaluation for uncertainty, for example, means lack the distributions of weight, and increase of hierarchy leads decrease of efficiency, indistinct meaning, and uncertainty of decision-situation as well as environment (Saaty, 1980). In this study, the researcher used AHP with Fuzzy Theory by calculating the triangular fuzzy number to get the mean of scholars' opinions, and then got the anti-triangular fuzzy number by which to decrease fuzzy predictions and make the fuzzy numbers clear, finally used the distinct numbers to process fuzzy ranking.

3.2 Evaluation Model by FAHP

Liang (1991) found the calculating methods of triangular fuzzy number based on its attributions and Zadeh's (1965) expanding theory. After mathematic operations, such as addition, subtraction, multiplication, and division with triangular fuzzy numbers, the value is also kept in form of triangular fuzzy numbers. The study used this method as the foundation to process AHP and fuzzy ranking. For instance, supposing that there are two triangular fuzzy numbers, $\mu T1(x)=(l1, m1, u1)$ and $\mu T2(x)=(l2, m2, u2)$, the algebraic operations could involve:

1. The addition of triangular fuzzy numbers:

$$\mu T1(x) + \mu T2(x) = (l1+l2, m1+m2, u1+u2) \quad (3.1)$$

2. The subtraction of triangular fuzzy numbers:

$$\mu T1(x) - \mu T2(x) = (l1-l2, m1-m2, u1-u2) \quad (3.2)$$

3. The multiplication of triangular fuzzy numbers:

$$\mu T1(x) \times \mu T2(x) = (l1 \times l2, m1 \times m2, u1 \times u2) \quad (3.3)$$

4. The division of triangular fuzzy numbers:

$$\mu T1(x) / \mu T2(x) = (l1/l2, m1/m2, u1/u2) \quad (3.4)$$

Furthermore, the study used description of language-meaning which leded experts to make their judgments by the

evaluation-value in subjective ways. The triangular fuzzy numbers can explain each sentence in evaluation-values and distinguish the fuzzy functions. The 9-point scale in the study can be identified in the fuzzy meaning of “equally strong,” “slightly strong,” “medially strong,” “very strong,” “exceedingly strong,” and contingent value between two scales. Through the operation of 9-point scale, the researcher analyzed the data from scholar-questionnaire and accomplished the evaluation model.

4. ANALYSIS OF EXPERTS’-QUESTIONNAIRE AND RESEARCH CASES

4.1 Experts’ Questionnaire

The Experts’ questionnaire was delivered to twenty specialists during April 1st to May 8th, and eleven ones were retrieved. The result of analysis is arranged as follows. From the calculation in first dimension of evaluation, the outcome showed the weight-value of safety index (0.487) was significantly larger than it of sustainability index (0.128). The second dimension of evaluation could be divided into safety index, health index, convenience index, and sustainability index. About safety index, in order to achieve the efficiency of safety on reconstruction for aboriginal residences, the weigh-value of “Building-safety for residences” was 0.381 which was significantly higher than 0.289 of improvement of “Individual consciousness of disaster-prevention”. About health index, in order to get the achievement of health, the weigh-value of “The network of health-consulting” was 0.421 higher than 0.182 of “Resource-usage and management.” For convenience index, in order to achieve the efficiency of convenience for reconstruction, the weigh-value, 0.535, of “Living resource” was higher than the value, 0.465, of “Living function.” On sustainability index, in order to achieve the efficiency of sustainability for reconstruction, the weigh-value, 0.573, of “inheritance of aboriginal tradition” was higher than the value, 0.427, of “Facility of aboriginal cultural landscape”.

4.2 Analysis of Residents’ Satisfaction on Community Reconstruction

There were four tribes finishing the relocating to other housing places, which included Sen-cha-ker, Shung-qi, Chung-yuen-kou, and Tanh-nan. These four tribes were main research objects in the study. The questionnaire delivered to these four tribes according to the units for relocating which were 105 ones on April 27th and 28th. All questionnaires were retrieved within two days. The total achievement-value of residents’ evaluation on living environment after reconstruction were based on the multiplication among weigh-value on each item built by scholars and evaluation value of residents’ satisfaction. The data of four tribes were collected in form of residents’ satisfaction-value which was used to process the whole achievement-evaluation on community environment after reconstruction. The evaluation on four indexes: safety, health, convenience, and sustainability. Based on four indexes, safety, health, convenience, and sustainability, the evaluation on environment for four tribes is listed from Figure 4.1 to Figure 4.4 below which showed by code name in Table 2.2 previously.

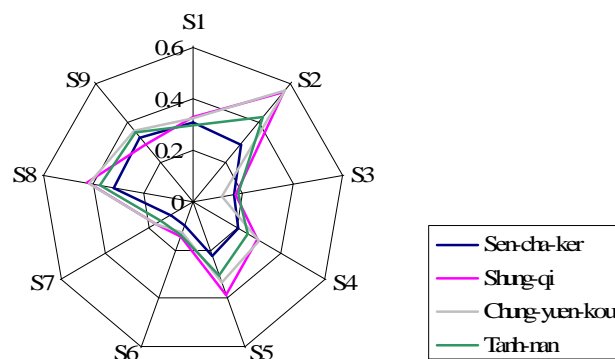


Figure 4.1 Evaluation for index of safety

4.2.1 Index of Safety

The factors influencing the evaluation of safety dimension were “S2: Tribes away from dip slope areas, streams, and ravines near the mountain,” “S4: Facilities and instruments of disaster-prevention,” “S5: system and channel for

delivery of disaster-information,” “S8: Improving residents’ alertness of disaster-prevention by taking part in community-curriculum and practicing activities for any emergency.” After 921, residents living around mountains suffered the direct damage from the earthquake and heavy-rain as well as mudflows and landslides coming after the earthquake. Consequently, the location of reconstruction for aboriginal-residences should keep away from dip slope areas, streams, and ravines near the mountain. From aboriginal-residents’ experience, abundant facilities such as instruments for lighting, broadcasting, evacuating, and so on, will decrease the damages significantly caused from nature disasters. The most serious disasters encountered by the aboriginal residents living in Taichung mountain areas are mudflows and landslides, in order to evacuation in advance, the informing system is essential as well vital by which to evacuate residents to refuges and shelters. The community-curriculum and activities for disaster-prevention can make residents understand basic knowledge and skills for evacuation and disaster-prevention. By taking part in the curriculum and activities, residents’ alertness and preparedness to nature disasters will be strengthened, as the result, as disasters come, the damages of lives and properties can be decreased effectively.

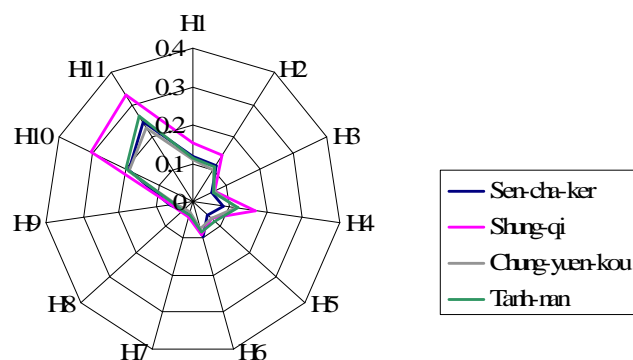


Figure 4.2 Evaluation for index of health

4.2.2 Index of Health

The main factors influencing health dimension were “H1:Nature embellishment of communities,” “H2:Planting areas,” “H4: Facilities for leisure and entertainment,” “H11: Community based medical-treatment web,” “community based social security system.” Taking medical-treatment for example, the residents living in the countryside near the mountains always have a problem of geographic distance to enjoy the medical service and resource, especially for elder people’ medical treatment. Long distance between residences and hospitals could delay the chance of saving any life; therefore, it is also the reason that building a community-based medical treatment is necessary for aboriginal residents. Some residents reflected that social security system only worked during the period of reconstruction after 921, when finished completely, all social security resources retreated and local department of social welfare seldom paid attention to residents’ living status.

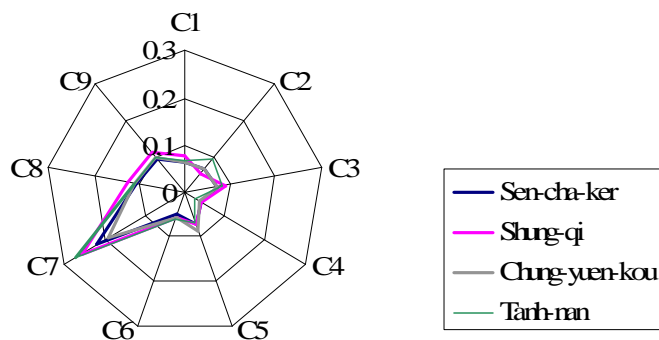


Figure 4.3 Evaluation for index of convenience

4.2.3 Indexes of Convenience and Sustainability

The factors affecting the convenience dimension were “C2: Residences near the markets with daily-consuming goods,” “C7: Adequately educational resource,” “C8: Convenient Internet-usage.” About the factored involved in sustainability dimension were “Su1: Archeological design with aboriginal totem,” “Su4: Traditional aboriginal arts,” “Su5: Ppass-down of aboriginal mother tongue.”

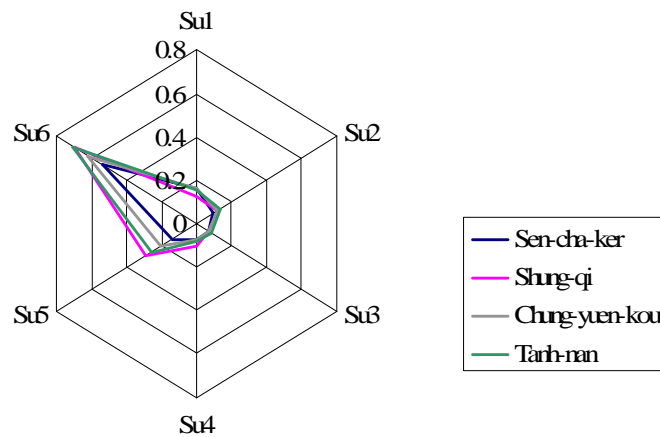


Figure 4.4 Evaluation for index of sustainability

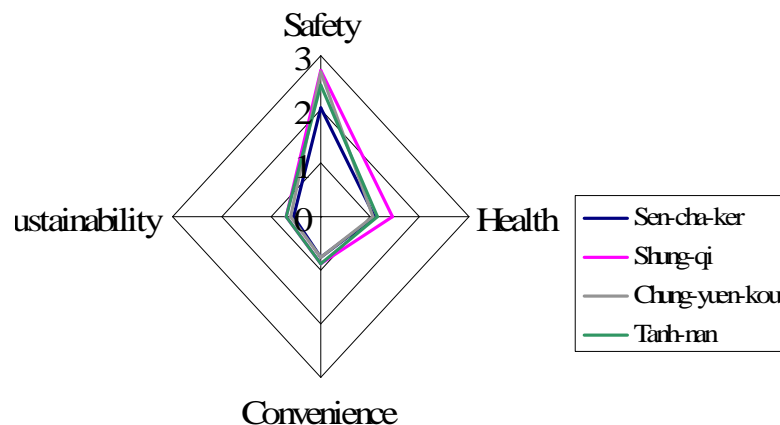


Figure 4.5 Evaluation for four indexes

4.2.4 Total Evaluation on Achievement (Efficiency) of Environment-reconstruction

From the research findings, Shung-qi tribe and Chung-yuen-kou tribe were significantly better than Sen-cha-ker and Tanh-nan in the safety index (see Figure 4.5). The reason might be on the new locations where Shung-qi tribe and Chung-yuen-kou tribe moved have the buffer-zones away from dip slope areas, streams, and ravines near the mountain. On the other hand, Sen-cha-ker tribe and Tanh-nan tribe moved to the places with buffer-zones. However, the locations of these two were also on the dip slope areas. Of two tribes, Sen-cha-ker tribe was worse. The distance from original homelands to new residences was only 50~150 meters, the reconstruction location was still near streams and dip slope areas. For the reason, the evaluation on safety index was the worst.

When coming to health index, Shung-qi tribe was significantly better than the rest three. It was because that Shung-qi tribe had completely medical service and treatment better than other tribes. For instance, Taiwan United Way Organization, provided social service, such as nursing of elder people, meal-shipping service, family looking-after service, and son to Shung-qi trib. In the community, there were two private clinics and one nursing center. Comparing to other tribes, the medical treatment and service got most residents' approval and praise.

About convenience and sustainability index, from radar-graph, four tribes showed the approximate efficiency and achievement on most factors. The point worth mentioning is sustainability index which showed that Sen-cha-ker tribe was significantly lower than others. From the analysis, the point may be related to the pass-down of traditional culture. The aboriginal mother-tongue dismissed by new generation and modern-industry encouraged by the village head gave aboriginal residents in Sen-cha-ker a crisis of losing traditional culture and language. Consequently, after immigration, the sustainability dimension performed a weak level on pass-down of aboriginal culture.

5. CONCLUSION AND SUGGESTION

5.1 Conclusion

The study summed up the evaluation-indexes of reconstruction for aboriginal residences by review of literatures, and collected the attributions (indexes) of efficiency and achievement from opinions of public departments in the government, scholars, NPO of reconstruction for aboriginal residences, and village heads. By processing FAHP, the research can build the structure of evaluation model on reconstruction for aboriginal residences. The evaluation model can make clear residents' satisfaction to reconstruction, safety evaluation on their housing environment, facilities used for disaster prevention, community-curriculums and activities for disaster-preparedness; health evaluation on nature embellishment of community, medical treatment for elder people, community-based social security system; convenience evaluation on distance away to markets with daily-consuming productions, adequately educational resources; sustainability evaluation on development of tribe industry and pass-down of tribe culture as well as spirit.

5.2 Suggestion

The research findings are listed as several points below:

1. The residents should reflect their opinions on reconstruction of environment actively to relevant authorities. Adopting "bottom" way will be proper and effective.
2. For shortage of medical resource in boundary areas near mountains, local community association in every tribe should have cooperation with local medical-service groups and clinics to take care of elder people and provide them medical treatments and nursing affairs regularly. Building local medical-service web is as important as making a circuit of medical treatment and nursing service.
3. The traffic lines from internally narrow roads among local residences to outside provincial highway should be widened and spread to other mainly outside-linked transportation lines by which to accelerate the speed of relieving victims of a disaster.
4. To improve the original industry of the tribes, developing aboriginal-culture based industry, such as artistic goods, painting, arts, and crafts which can make tribe industries thrive and keep as well as pass down original culture to next generation at the same time.

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