

### Abstract

House reconstruction is an important foundation of disaster recovery. However, in addition to structural reconstruction, nonstructural reconstruction also plays a vital role. This study uses the Hierarchical Linear Model (HLM) to consider the impact of structural and nonstructural reconstruction on life satisfaction of the impacted households. Result found that after considering the structural reconstruction, the nonstructural reconstruction is still affect the life recovery. Households with better nonstructural reconstruction will have better life recovery. This implies that the disaster recovery plans should not only focus on the structural reconstruction. Even if the houses have been reconstructed, subsequent nonstructural reconstruction should continue.

### INTRODUCTION

2009, Typhoon Morakot hit Taiwan, causing severe damage to the central and southern Taiwan. According to the statistics, Morakot typhoon caused 699 casualties and damaged houses of 1,766 households, and the economic loss is estimated around 198.83 billion NTD, accounting for 1.6% of GNP of Taiwan in 2009. In studies on disaster recovery, there are four stages of housing reconstruction which are emergency shelter, temporary shelter, temporary housing and permanent housing (Phillips, 2009). Permanent housing is a place from which households will not have to move again as a result of the original disaster, and thus it is regarded as the final stage of house reconstruction.

After Typhoon Morakot, in order to : 1) Providing impacted households with a stable place to live as soon as possible, 2) Avoiding the dispersion of reconstruction resources by temporary housing, the government skipped the stage of temporary housing to construct permanent housing directly. According to the statistics, 3,346 permanent houses should be built after Typhoon Morakot, with the help of NGOs (Non-governmental Organization), the goal was reached in the third year after the disaster. By reviewing house reconstruction cases, this policy has its own particularity. House reconstruction is an important foundation of disaster recovery (Comerio, 1998). However, in addition to structural reconstruction, the other nonstructural reconstruction also plays a vital role. This study uses the Hierarchical Linear Model (HLM) to consider the impact of structural and nonstructural reconstruction on life satisfaction of the impacted households, attempting to propose quantitative data for the topic.

### METHOD

The subjects are questionnaire respondents of "Social Impacts and Recovery Survey of Typhoon Morakot"; they are house-destroyed households. The survey time is from July 4, 2011 to July 31, 2011. The number of samples for analysis was 1442 people. The HLM is used to analyze the impact of nonstructural reconstruction on life satisfaction. The higher life satisfaction suggests that the respondent current living status is close to ideal standards. The demographic variables as the control variables include number of household members, gender (male, female), race (aboriginal or non-aboriginal) and age. Higher Living condition suggests living quality (cooking, bathing, privacy, bedroom, and space size) is better. The higher family emotion suggests that the respondent's family emotions compared to the year before are better. Higher numbers of household workers imply more stable economic states. Living conditions, family emotions and number of household workers are indicators of nonstructural reconstruction. Higher score indicates that the level of nonstructural recovery is higher. Housing patterns can be divided into six types including the original living space, rent house, shelter, another self-owned house, temporary housing, permanent housing, friend's house, and informal house.

### HLM EQUATION

#### MODEL 1

$$\text{level1: } LS = \beta_0 + \gamma$$

$$\text{level2: } \beta_0 = \gamma_{00} + \mu_0$$

#### MODEL 2

$$\text{level1: } LS = \beta_0 + \beta_1(\text{NHM}) + \beta_2(\text{gender}) + \beta_3(\text{race}) + \beta_4(\text{age}) + \gamma$$

$$\text{level2: } \beta_0 = \gamma_{00} + \mu_0; \beta_1 = \gamma_{10} + \mu_{10}; \beta_2 = \gamma_{20} + \mu_{20}; \beta_3 = \gamma_{30} + \mu_{30}; \beta_4 = \gamma_{40} + \mu_{40}$$

#### MODEL 3

$$\text{level1: } LS = \beta_0 + \beta_1(\text{NHM}) + \beta_2(\text{gender}) + \beta_3(\text{race}) + \beta_4(\text{age}) + \beta_5(\text{LC}) + \beta_6(\text{FE}) + \beta_7(\text{NHW}) + \gamma$$

$$\text{level2: } \beta_0 = \gamma_{00} + \mu_0; \beta_1 = \gamma_{10} + \mu_{10}; \beta_2 = \gamma_{20} + \mu_{20}; \beta_3 = \gamma_{30} + \mu_{30}; \beta_4 = \gamma_{40} + \mu_{40}; \beta_5 = \gamma_{50} + \mu_{50}; \beta_6 = \gamma_{60} + \mu_{60}; \beta_7 = \gamma_{70} + \mu_{70}$$

\*LS: life satisfaction; NHM: number of household members; gender: 0=male, 1=female; race: 0=non-aboriginal, 1=aboriginal; LC: living conditions; FE: family emotions; NHW: number of household workers.

Table 1. HLM analysis results

	Model 1	Model 2	Model 3
<b>Fixed effect</b>	3.688***	3.683***	3.751***
Intercept ( $\gamma_{00}$ )		-0.003	-0.028*
NHM ( $\gamma_{10}$ )		0.065	0.046
Female ( $\gamma_{20}$ )		0.103	0.080
Aboriginal ( $\gamma_{30}$ )		-0.002	<0.001
Age ( $\gamma_{40}$ )			0.878***
living conditions ( $\gamma_{50}$ )			0.211***
family emotions ( $\gamma_{60}$ )			0.070**
NHW ( $\gamma_{70}$ )	3.688***	3.683***	3.751***
<b>Random effect</b>			
level 2	0.135***	0.122***	0.048***
level 1	1.194	1.193	0.941
Deviance	4368.478	4387.223	4055.091

Note 1: \*p<.05, \*\*p<.01, \*\*\*p<.001.

Note 2: NHM= number of household members; NHW= number of household workers.

### RESULT

The intercept of Model 1 has reached the significant level, suggesting that the life satisfaction varies in different housing patterns. Model 2 further adds the demographic variable as the control factor. As the results have shown, the demographic variables have not reached the significant level, indicating that life satisfaction has no variation subject to number of family, gender, race and age. Model 3 added the variables of nonstructural reconstruction and reached the significant level, suggesting that the post-disaster nonstructural reconstruction may still affect the life satisfaction of the disaster victims after considering the housing patterns (hardware reconstruction) and demographic variables.

### CONCLUSION

This study found that after considering the structural reconstruction, the nonstructural reconstruction is still affect the life recovery. Households with better living conditions, family emotions and number of household workers will have better life recovery. This implies that the post-disaster reconstruction should not only focus on the structural reconstruction. Even if the houses have been reconstructed, but it does not mean the reconstruction of home has been completed. If the subsequent nonstructural reconstruction is not continued, the households may not be able to adapt to the new environment, resulting in long term suffering from the disaster.

### References

- Comerio, M. C. (1998). Disaster hits home : new policy for urban housing recovery: University of California Press.
- Phillips, B. D. (2009). disaster recovery. New York, NY: Taylor & Francis.