

# 論文審査の結果の要旨

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Increasing number of severe natural disasters have been affecting developing economies and countermeasure is gaining importance as an essential issue. These countries were rendered to experience insufficiency of capital to replace or repair, and damaged assets and restore livelihoods can further hamper the countries' future development. Among various aspects of disaster management, recovery phase of the built environment is one of the crucial factors to provide greater resilience to future disaster risks. In the community level, it is necessary to ensure that housing assets are quickly and safely reconstructed, and decision-making in such approaches is one of the emerging research trend recently being explored. However, lack of research on systems to assess the financial resilience in the household-level decision-makers and highlighted the need to shift the focus on less conventional approach in measuring resilience to capture the effect of processes of social, cultural and psychological elements. It should be recognized that there is an increasing complexity in decision-making after extreme disasters compared to low-impact events and that existing behavioral theories have limited application in developing countries where cultural characteristics are different than developed nations.

Based on the discussion above, the main objective of this research was to develop a conceptual framework for post-disaster housing residency behavioral decision-making in the context of financial resilience and temporal choice through empirical investigation of affected communities, taking the Philippines as a target country. More specifically, this study sought (1) to determine the factors that affect the rebuilding-relocation decisions over time by comparing cases of rebuilding-relocation approaches by modeling the behavioral mechanism; (2) to examine the challenges encountered by analyzing if the program assistances matched the needs of the beneficiaries by valuating the housing recovery program; and (3) to assess the feasibility or the willingness of the community to participate in a risk sharing property insurance program.

For that purpose, case studies were conducted in two cities in the Philippines: (1) Tacloban City, Leyte Island, which had been hit by the storm surge caused by super typhoon Haiyan last 2013, focusing on relocation cases; and (2) Muntinlupa City, Metro Manila, which had been hit by extreme flooding caused by Typhoon Ketsana in 2009, focusing on rebuilding cases. In these project sites, housing reconstruction approaches were identified as (a) owner-driven on-site rebuilding in Leyte, (b) owner-driven on-site rebuilding in Manila and (c) off-site relocation sites in Leyte. For each of these cases, analyses were conducted separately and the results were compared.

In the first section of the work, paper-based questionnaires (n=575) were administered in March 2015 and 2016 in these regions through two-stage cluster sampling to determine the factors affecting housing recovery rate. This was supported by key informant interviews of community leaders and government officials. Based on the literature review, concept of local or community-based resilience and theories of migration was done to establish the variables to be measured. Statistical analyses including structural equation modeling were performed to explore the relationships of the variables and compare the different case sets. Then in the latter section, solution-testing was carried out in Manila case through the discrete choice experiment (n=201) to assess the feasibility of a proposed risk-sharing property insurance plan. Emphasis was put on the types and providers of the insurance. Discrete choice logit modeling was used.

The main achievement of his work can be summarized as follows.

First, the factors that triggered and supported the reconstruction duration as dependent variables (i.e. time to start, transfer and finish) were determined. The integrated behavioral model was used as theoretical framework basis. For sample stratification-checking, group comparison test using one-way analysis of variance (ANOVA) and independent samples t-test verified that location-based reconstruction approaches affected the reconstruction rate which required stratification of the samples into 5 cases (i.e. Leyte-rebuild-start, Leyte-rebuild-finish, Manila-rebuild-start, Manila-rebuild-finish and Leyte-relocate-transfer). Next, in the data pre-processing stage aiming to reduce the dimension and address multi-collinearity of the multiple independent variables, principal component analysis (PCA) and stepwise multiple regression using backward elimination were employed to assist in the construction of the final model. Then, as the core method, the structural equation modeling (SEM) was performed to find the not directly observable latent variables (characterized with independent variable indicators) which affected the reconstruction duration. The SEM-based analysis showed that the latent constructs of (1) risk perception, (2) place attachment, (3) financial assistances, (4) rebuilding assistances, (5) relocation assistances, (6) community initiatives and (7) indirect impacts had significant and distinct influences to the time

duration to decide. These results revealed the following three findings (1)-(3). (1) The assistances as “behavioral control” component including financial and non-monetary assistances triggered and reinforced the rebuilding behavior in Leyte, while Manila case was not influenced significantly. The household expectancies on the behavioral outcome motivated them to rebuild and also acted as behavioral reinforcement which assisted or discouraged the behavior. (2) Risk perception as cognitive response or “instrumental attitude” was found to affect the recovery in Leyte case as triggering factor, while place attachment as emotional-affective response or “experiential attitude”, was largely affecting the Manila case. This indicated higher risk accepting behaviors of households in Manila compared to the Leyte case. And (3) both community initiatives as “subjective norm” component and financial assistances represented significant migration drivers in Leyte.

The second part of his work showed that after modeling the behavioral mechanism of the duration of housing recovery decisions in the case study areas, the research investigated the challenges to housing recovery by analyzing the gaps between beneficiary needs and the recovery program assistances. The level of beneficiary satisfaction was introduced as the parameter to evaluate the project performance in the household-level. Using one-way ANOVA, the rebuilding case in Manila was observed to have significantly lower level of satisfaction compared to the rebuilding and relocation case in Leyte. Hence, the underlying factors which contributed to the low satisfaction level were further explored. Based on the stepwise regression using backward elimination approach, the dissatisfaction in Manila case was attributed to low personal savings, and lower financial aid amount received. Hence, the insufficiency of financial assistance was found to be one of the critical factors affecting dissatisfaction level in Manila case in terms of the assistances offered.

The third part of his work showed that the barriers to insurance acceptance in the Manila case included lack of budget, lack of trust in insurance system, low risk perception of future flooding events and dependence to external government assistance. Moreover, the decision to purchase the property insurance was significantly affected by 5 household characteristics— past flood frequency, estimated property value, monthly income, monthly savings capacity in percentage and educational attainment. Among these, the strongest predictor was the educational attainment signifying that more literate households will be 3 times more likely to purchase. The discrete choice experiment revealed that the average respondent was (1) more willing to pay from the base values of the private insurance if the assessment type was changed to the index type with faster settlement of claims, but (2) less willing to pay from the base values to change the service provider from private to risk sharing type. For the proposed risk sharing property insurance between the public and private sectors, an uptake rate of 30-39% can be expected if

this insurance type will be offered in the market, indicating the feasibility of the insurance scheme.

These findings described above indicated that the presented methodology for the clarification of latent factors that affect the affected peoples behavior after the extreme disasters. These finds are roughly consistent with the past findings, but revealed several characteristics that are unique to the target areas. He also proposed insurance-based scheme as one of the solution and discussed the feasibility of that scheme. These achievements of the study can be expected to make a significant contribution to the enhancement of the sustainable of the communities affected by severe natural disasters.

Therefore, the committee hereby confirms to confer a degree of the Doctor in Sustainability Science to Mr. Ong, James Michael Lacanaria.

(1321 words)