

A LITERATURE REVIEW OF THE ROLE OF PROJECT MANAGEMENT IN POST-DISASTER RECONSTRUCTION

Benny Hidayat¹ and Charles Egbu²

School of Built Environment, University of Salford, Salford, Greater Manchester, M5 4WT, UK

The number of natural disasters has increased sharply in the past few decades, threatening human lives, and the built environment. Recent disaster management paradigms have, arguably, shifted from disaster relief to disaster preparedness, hazard mitigation, and vulnerability reduction. Reconstruction activities are those activities in recovery and rehabilitation phase of disaster risk management; actions taken to restore and if possible improve pre-disaster living condition of affected communities. While emergency relief which by providing food, medical treatment, and shelter in immediate after disaster is considered effective, reconstruction as medium and long term recovery activity is usually slow, expensive, complex. If not addressed effectively, opportunities for community development are often lost. Based on a comprehensive literature review of reconstruction projects and processes in a few countries affected by natural disaster, this paper investigates and documents the roles of project management, and the roles of key stakeholders in reconstruction projects after disasters. It identifies and documents the key challenges in post-disaster reconstruction projects and the main procurement strategies that are available and currently in use in the reconstruction projects. It concludes with the important role that project management plays in post-disaster reconstruction projects and the importance of managing interface issues, communication and stakeholders as part of effective project management.

Keywords: disaster management, post disaster reconstruction, project management.

INTRODUCTION

Natural and human induced disasters are not only threaten live but also threaten economies, business, and in some occasions may also threaten political regimes. Boshier (2008) has compiled data from EM-DAT (2007) and notes that estimated damaged caused by disasters between 1991 and 2005 are about US\$1,193 billion. The worst impact is in Asia and America, percentage of total estimated damaged are 48.4% and 36.1% respectively.

Disasters not only cause economic damages, but also affect human life. On average, based on data from EM-DAT (2007), 231 million people per year are affected by disasters. That figure is about 3.5 percent of the world population. The number of death in disaster is greater in least developed countries than medium and high development countries. Palakudiyil and Todd (cited in Boshier 2008) calculated between 1991 and 2001 average death per disaster was 1,052 lives in least developed

¹ b.hidayat@pgr.salford.ac.uk

² c.o.egbu@salford.ac.uk

countries. Meanwhile the average numbers of death for medium and high development countries are 143 and 23 live per disaster. (Bosher, 2008) notes that the statistic indicates people in low level development countries are the most likely to be affected by disaster.

DISASTER MANAGEMENT

Considering disasters as repetitive events, disaster management form cycle that can be divided into four phases: mitigation, preparedness, response and recovery (figure 1) (Alexander, 2002).

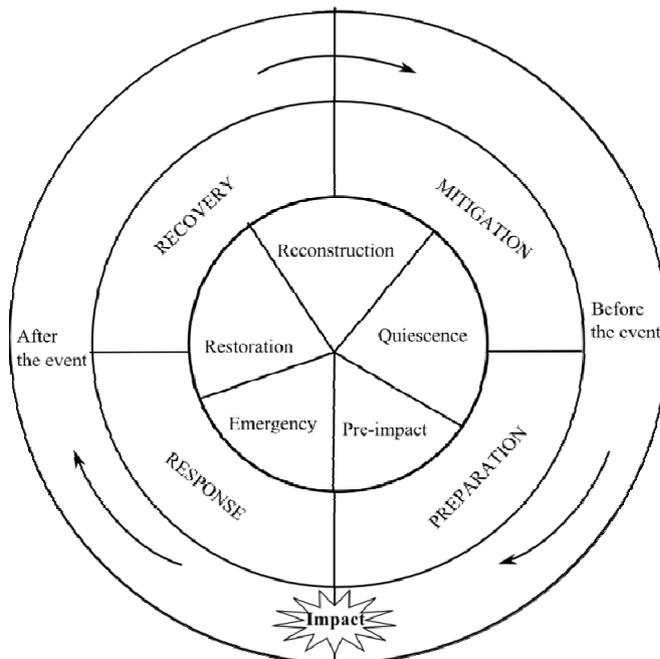


Figure 1: Disaster cycle (Alexander, 2002)

Mitigation and preparation phases are occur before disaster strikes. Mitigation is all activities planned to reduce the impact of future disasters, these activities usually divided into two categories: structural mitigation and non-structural mitigation. Structural mitigations are engineering solutions and non-structural mitigations include land-use planning, insurance, legislation and evacuation planning. Preparedness is activities designed to reduce the impact of disasters when they are forecast.

Response and recovery phases occur after disaster strikes. Response is emergency actions taken during disaster and short term after disaster, the main purpose of response phase is to save human lives in form of rescue and supply victim's need. Recovery phases takes longer time, occur after emergency actions in response phase, aims of recovery are to repair damage, to restore services, and to reconstruct facilities after disaster has struck (Alexander, 2002).

The standard duration for rescue, relief, and rehabilitation are defined as seven days, three months and five years respectively (Shaw, 2006). Rescue starts immediately after disaster, initiated by local resident than followed by trained and skilled staff from the search and rescue department of government. International relief team arrive later, usually after one day, depend on accessibility to disaster area and political situation in the disaster affected country. Relief phases follow immediate after rescue phase, may take duration from one to three months, depends on magnitude of disaster and government's resource. Recovery phase starts immediately after the end of relief

phase, short-term recovery activities are clearing debris, building house, restoring lifeline and infrastructure and long-term recovery activities' aim to build a safer and sustainable livelihood (Shaw, 2006).

Reconstruction phase plays important role in disaster management. Livelihoods of affected communities are restored by build new house units and infrastructures. It is an opportunity to re-plan the community, beginning new life from new start. Previous living condition can be restored and may result better living condition by reconstruction. Regarding disaster cycle, reconstruction is the key for mitigation and preparedness for next disaster by applying structural measures and non-structural measures. The quality of constructed houses and infrastructure during reconstruction phase will influence vulnerability for next disaster.

RECONSTRUCTION

Reconstruction process may be divided into two main programmes, first is building housing units and the second is restoring or building infrastructure: roads, ports, electricity, lifelines, railways, water supply and sanitation. Housing projects seems to be first priority in most post disaster reconstructions in many countries, needed by disaster's victim and become first priority for the government. In developing countries where disaster victims have no home insurance or financial access for rebuild their home government must provide permanent houses to homeless disaster victim citizens. Freeman (2004) investigates allocation post-disaster financing to housing and reveals that housing is favourite expenditure with 30-50% financial allocation.

There two common procurement methods of housing project. First, because housing project relatively needs less construction skills, equipments, and simple construction methods compare to infrastructure project, disaster victims or communities can build the houses by themselves. Second approach is government appointed private contractor to build the houses.

Nature of post disaster reconstruction project

Are there any difference between common project and post disaster reconstruction project? Mesurier *et al.* (2006) in their study in New Zealand concluded that the greater degree of coordination with policy and legislation required for large scale disaster, while routine construction processes have proved adequate for small-scale disasters. Existing legislation was not drafted to cope with an emergency situation and was not developed to operate under the conditions that will inevitably prevail in the aftermath of a severe disaster (Mesurier *et al.* 2006).

Post-disaster housing projects according to Davidson *et al.* (2007) have similar challenges with low-cost housing in developing countries, but disaster context adds additional challenges for post-disaster housing projects. The additional challenges are as follow: condition after disaster aftermath is under uncertainty condition, resources for the project are scarce. Many local and international organizations are simultaneously running same housing project, often they compete for scarce resources. Also donors who finance the project appear to get the result of project quickly. The reconstruction projects are expected to have sustainability, implemented in order to raise level of development and to reduce vulnerability for future disasters.

Moe and Pathranarakul (2006) considered disaster management as public project management, has aims to produce unique product in certain duration and to elevate living condition of people, not profit oriented which government as the client.

Key Roles in reconstruction

There are three main roles in reconstruction project: the government, disaster victims and NGO. Davidson *et al.* (2007) have studied community involvement in post-disaster housing project in four case studies and have summarized participants' responsibilities in the projects as follow.

Table 1: The Spread of responsibilities between project participants (modified from Davidson et al. 2007)

Activity	Government	NGO	Beneficiaries	Contractors	Private Firm
Program initiation	V	V			
Project initiation	V	V	V		
Project financing	V	V	V		
Design	V	V	V		V
Construction			V	V	V
Post-project modifications-additions			V		

Their study shown different community (beneficiaries) participation, the highest level participation is in Colombia case where communities have decision making power, involvement from beginning of the reconstruction. On contrast, communities in Salvador had no involvement in decision making process. Their study suggest having high level communities participation leads to positive results in term of building process and outcome.

Post-disaster reconstruction problems

Previous scholars have presented problems during post-disaster reconstruction project and summarized in Table 2. The disasters problems are identified from 1976 Friuli (Italy) earthquake (Alexander, 2004), 1985 Mexico City earthquake (Johnson, 2007), 1986 Kalamata (Greece) earthquake (Johnson, 2007), 1994 Northridge (USA) Earthquake (Wu and Lindell, 2004), 1995 Kobe (Japan) earthquake (Hirayama, 2000; Johnson, 2007), 1999 Marmara and bolu (Turkey) earthquake (Johnson, 2007), 1999 Armenia earthquake (Johnson, 2007), 1999 Chi-chi (Taiwan) earthquake (Wu and Lindell, 2004), 2001 Gujarat (India) earthquake (Barenstein, 2006), 2004 Tsunami in Indonesia (Kennedy, Ashmore, Babister, and Kelman, 2008; Steinberg, 2007; Takahashi, *et al.*, 2007), 2004 Tsunami in Sri Lanka (Kennedy, *et al.*, 2008; Koria, 2009; Nakazato and Murao, 2007; Ratnasooriya, Samarawickrama, and Imamura, 2007), and 2005 Hurricane Katrina in New Orleans (Green, Bates, and Smyth, 2007).

The common problems found in beginning of reconstruction are funding for reconstruction and finding location for relocate the disaster-affected communities. These two problems may be exacerbated by absence of policies on disaster management. Geological disasters such as earthquake caused heavily damage to building, made houses were unliveable, and the government has to find new location for temporary or permanent housing. As noted by Johnson (2007) finding the new location is challenging, as the new location should be in convenient distance to jobs and services. Facilities also have to be provided in new location, which are shops, schools, religious buildings that are necessary to support affected communities to back to pre-disaster daily live.

Table 2: Identified reconstruction problems

Disaster	Policies	Funding	Relocation	Land ownership	Construction material	Construction cost	Construction labour	Construction quality	Contract abandonment	local capacity	Aid Agency capacities	Coordination	communication	Temp. Facilities	Political environment
Friuli EQ		X						X							
Mexico City EQ		X													
Kalamata EQ	X				X			X		X	X				
Northridge EQ	V	V													
Kobe EQ			X	X	X			X							X
Turkey EQ			X												
Armenia EQ			X												
Gujarat EQ								X							
Indian Ocean Tsunami (Indonesia)	X		X	X	X	X	X	X	X	X	X	X	X		
Indian Ocean Tsunami (Sri Lanka)	X		X					X		X		X	X		X
Katrina Hurricane					X		X								X

Changing in policies in reconstruction also may delay reconstruction process. In Sri Lanka changing 200m buffer zone in housing reconstruction has delayed commencement of reconstruction programme by six months (Nissanka, Kurusena, and Rameezdeen, 2008).

Reconstruction process may be started when there is adequate money available to fund it. Funding for reconstruction is mostly from insurance coverage in developed country and from grants or aids from donors in developing countries. Home owners with insurance will rebuild their home quickly and reconstruction process will begin immediately. On contrast, insurance coverage is not available or not affordable for home owners in developing countries, reconstruction effort will not begin without aids from outside. The 2004 Tsunami funding is probably the best funded emergency in the world. Minimum required fund to rebuild Aceh and Nias after 2004 Tsunami was calculated US\$6.2 billion, US\$5.6 billion had allocated to specific projects by donors, NGOs, and government and another US\$2.1 billion had been committed but not allocated (McKeon, 2008). The other challenges regarding funding are how to allocate the funding wisely and minimize corruption which common in developing countries. Agencies may spend excessive money in emergency relief to built shelters and its might be lead to difficulties of funding in permanent reconstruction. Often there is inadequate or no finance and human resource left for permanent reconstruction (Lloyd-Jones, 2006).

During construction stage of reconstruction, common problems found in reconstruction are cost escalation, inadequate supply of material and labour and quality of construction. Koria (2009) in her study of reconstruction in Sri Lanka find competence issues, field staff have not had the relevant experience or training to manage large and complex project. Inadequate of worker’s skill may leads to poor quality of constructed facility.

The other challenges in reconstruction are coordination and communication among agencies involved in reconstruction. Donations from many foreign countries or agencies are also with additional technical expert, equipment and material, also need to coordinate with local government and agencies. In Indonesia, 124 international non-governmental organizations, 430 local NGOs, 30 national and multilateral donors, and more than a dozen UN agencies are involved. In addition, many government departments at district, provincial and national level are also involved. The experience of BRR in Aceh Indonesia and TAFREN in Sri Lanka suggest the feature a reconstruction needs to coordinate reconstruction process effectively (McMahon, Nyheim, and Schwarz, 2006).

Successful post-disaster reconstruction

Moe and Pathranarakul (2006) consider disaster management as public project management and define 10 critical success factors (CFS) that must be taking into consideration into disaster management as follow.

- Effective institutional arrangement. Clear responsible governmental unit and authority line will speed up decision making in recovery. In national level, specified governmental department and specific responsible unit must have fully authorization for disaster management.
- Coordination and collaboration. Effective coordination and collaboration among stakeholders are the key factor in managing disaster management at international, regional, national, organizational, and project level.
- Supportive laws and regulations.
- Effective information management system. Sharing important information among key stakeholders and effective information management system are important for successful outcomes of disaster management.
- Competencies of managers and team members. Administrative, conceptual and technical skills are important for planning, implementing, and managing disaster project successfully.
- Effective consultation with key stakeholders and target beneficiaries.
- Effective communication mechanism. Effective communication will result to trust and cohesion among stakeholders in the project and therefore will lead to successful project.
- Clearly defined goals and commitments by key stakeholders.
- Effective logistic management. People, expertise and technology are also logistics for disaster management. Using new technology such as GIS and remote sensing will enhance capacity to coordinate among organizations and more effective logistic management.
- Sufficient mobilization and disbursement of resource. Inadequate of resource (people, equipment, and material) and poor or no risk analysis may result problems in the project and may lead to project termination or suspension (Moe and Pathranarakul 2006).

Furthermore, Silva (2010) has developed key considerations in pots-disaster reconstruction, was based on Disaster Emergency Committee (DEC) member agencies' experience during post-tsunami reconstruction in Aceh. He arranges reconstruction process into three sections: planning, design and construction.

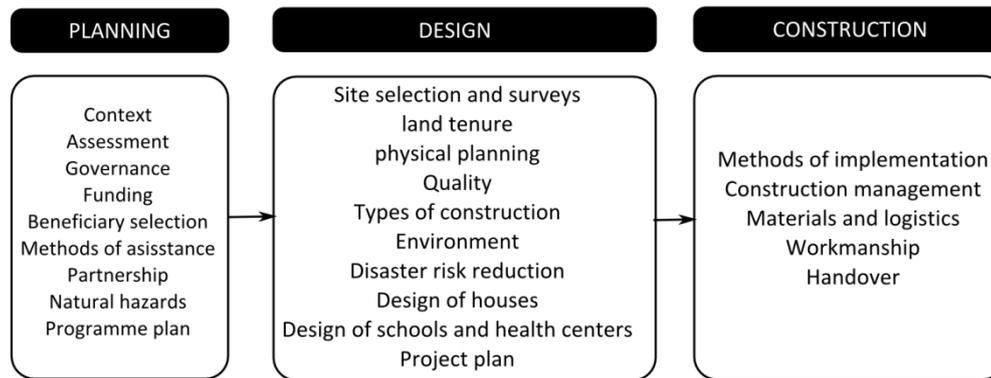


Figure 2: Key considerations in post-disaster reconstructions (Silva, 2010)

The planning section is about everything that should be considered before beginning of reconstruction, in order to develop a response that appropriate to the needs on the ground. Key considerations in planning sections are.

- Understanding the context and impact of disaster
- Understanding the local governance structures, regulatory framework and establishing methods of coordination
- Understanding funding steams and timescales
- Identifying beneficiaries
- Determining which method of assistance is most appropriate
- Establishing partnership with other stakeholders in order to provide assistance
- Recognizing natural hazards which pose a future risk
- Capturing the objectives, timescales, resources and risk in the programme plan (Silva, 2010)

Design sections is about design of reconstruction project, the key consideration in this sections are.

- Selection of appropriate sites for reconstruction
- Resolving issues of land tenure
- Physical planning of settlement
- Definitions of appropriate quality for reconstruction
- Identifying appropriate types of construction
- Minimizing the environmental impact of reconstructions
- Incorporating disaster risk reduction strategies
- Design of houses, schools and health centres
- Capturing the scope of works, programme, human resource, cost plan and risk management plans into detailed project plan to inform constructions (Silva, 2010).

The construction section is implementation of reconstruction programmes. Key considerations in this section are.

- Different methods of implementation
- Management of construction projects
- Specifications, procurement and transportation of materials
- Management of labour and workmanship
- Handover, maintenance and post-occupancy evaluation of completed projects (Silva, 2010).

DISCUSSION AND CONCLUSIONS

While emergency reliefs immediate after disaster are considered effective, reconstruction projects are considered slow, complex and expensive. Indeed, to recover disaster victims or communities back to pre disaster standard life (or better) is very complex job and need huge amount of funding regarding to scale of the disaster. Planning stage of reconstruction is commonly take lengthy time to understand the context of disaster, to coordinate among agencies, to identify disaster victims or beneficiaries and resolve land problem.

Furthermore, previous large disasters suggest that having disaster management plan may have great impact on reconstruction's speed. Disasters are not common monthly or yearly events, but when it strikes will may damages the disaster area and paralyses local government structure and system. It seems to be a need for special laws or policies to cope with the disaster as being suggested by various scholars. Policies in term of planning for disaster before disaster occurrence, or disaster mitigation, are likely have great influence of speed of reconstruction. Wu and Lindell (2004) compare how city of Los Angeles and Taichung County in Taiwan manage reconstruction; suggest that having a pre-impact recovery plan appears to increase the speed of housing reconstruction. The central government in Taiwan and city government in Los Angeles adopted similar policies for housing reconstruction, but adoption time in Taiwan was one week to two month later than in Los Angeles and officials in Taiwan took an even longer time to familiar with policies and implementation procedure (Wu and Lindell, 2004).

In addition, organizational of reconstruction is also need to be considered and planned. Roles of parties involved in post-disaster reconstruction should be carefully arranged. In recent disasters NGO play increasingly important roles in reconstruction that may not significantly found in common construction. But Hayles (2010) notes that permanent housing projects funded by NGOs are considered to be improper due to limited knowledge of local climatic condition, local material, how people in communities live and work, and often the NGOs have inadequate experience in reconstruction.

Coordination and communication are also may play vital roles in successful reconstruction, as seen in 2004 tsunami reconstruction where it was a great challenge to coordinate hundreds of NGOs and agencies involved in reconstruction together with their experience. Their often compete for scarce resources and sometime there is rivalry among them. McMahon and his colleagues (2006) suggest that agencies, NGO and government involved in reconstruction should work as partners, successful of reconstruction depend on all participants play their proper role in reconstruction. The central government must give authority and support to the construction agency and help it overcome bureaucratic problems. (McMahon, Nyheim, and Schwarz, 2006).

International NGOs have experiences in previous similar operation, but structure of recovery organizations made communication difficult and effectively disable the tacit knowledge sharing between parties (Koria 2009). Koria's finding emphasis Alexander's (2008) that first problem in disaster risk management is failure to implement existing knowledge.

Management of construction process of post disaster reconstruction may be similar with common project but with more emphasis on inadequate resource, quality and coordination. Some critical success factors, inputs to the management system that lead

directly or indirectly to the success of project (Cooke-Davies 2002) should be taken into consideration to have a successful post disaster reconstruction project as mentioned by Moe and Pathranarakul (2006) and Silva (2010) in previous section. Even though the definition of 'project success' may be different among stakeholder in the reconstruction because it dependent on perspective (Lim and Mohamed 1999). For disaster victim may the project success as they were fulfilled their need, have back their house and back to their work and social live as before disaster stroke. From contractor's perspective projects success is as achievement of predetermined goals, planned time, cost, schedule, quality and safety. Government should look project success from macro view, reconstruction project success is as affected community back to pre disaster live condition and constructed facilities have resilience toward next disasters. Project management play role to ensure the reconstruction projects finish successfully.

REFERENCES

- Alexander, D. (2002) *Principles of emergency planning and management*. Hertfordshire, England: Terra Publishing.
- Alexander, D. (2004) *Planning for post-disaster reconstruction* Retrieved 9 November 2009, from <http://www.grif.umontreal.ca/pages/papers2004/Paper%20-%20Alexander%20D.pdf>.
- Alexander, D. (2008) Mainstreaming disaster risk management. In L. Boshier (Ed.) *Hazard and The Built Environment, attaining built-in resilience*. Taylor and Francis.
- Barenstein, J. D. (2006) *Housing reconstruction in post-earthquake Gujarat*. London: HPN, Overseas Development Institute.
- Boshier, L. (2008) Introduction: the need for built-in resilience. In L. Boshier (Ed.), *Hazard and The Built Environment, attaining built-in resilience*. Taylor and Francis.
- Davidson, C. H., Johnson, C., Lizarralde, G., Dikmen, N., and Siliwinski (2007) Truths and myths about community participation in post-disaster housing project. *Habitat International*, **31**, 100-115.
- Freeman, P. K. (2004) Allocation of post-disaster reconstruction financing to housing. *Building research and information*, **32**(5), 427-437.
- Green, R., Bates, L. K., and Smyth, A. (2007) Impediments to recovery in New Orleans' Upper and Lower Ninth Ward: one year after Hurricane Katrina. *Disasters*, **31**(4), 311-335.
- Hayles, Carolyn S. (2010) An examination of decision making in post disaster housing reconstruction. *Journal of disaster resilience in the built environment*, **1**(1), 103-122.
- Hirayama, Y. (2000) Collapse and reconstruction: housing recovery policy in Kobe after the Hansin great earthquake. *Housing Studies*, **15**(1), 111-128.
- Johnson, C. (2007) Strategic planning for post-disaster temporary housing. *Disasters*, **31**(4), 435-459.
- Kennedy, J., Ashmore, J., Babister, E., and Kelman, I. (2008) The meaning of 'build back better': evidence from post-tsunami Aceh and Sri Lanka. *Journal of Contingencies and Crisis Management*, **16**(1), 25-36.
- Koria, M. (2009) Managing for innovation in large and complex recovery programmes: tsunami lesson learned from Sri Lanka. *International Journal of Project Management*, **27**, 123-130.

- Lim, C S and Mohamed, M. Zain (1999) Criteria of project success: an exploratory re-examination. *International journal of project management*, **17**(4), 243-248.
- Lloyd-Jones, T. (2006) *Mind the gap! post-disaster reconstruction and the transition from humanitarian relief*. RICS.
- McMahon, P., Nyheim, T., and Schwarz, A. (2006) *After the tsunami: lesson from reconstruction*, from <http://www.ieco.clarin.com/2008/05/12/afts06.pdf>.
- Mesurier, J. L., Rotimi, J. O. B., and Wilkinson, S. (2006) A comparison between routine construction and post disaster reconstruction with case studies from New Zealand. *22nd ARCOM conference on current advance in construction management*.
- Moe, T. L., and Pathranarakul, P. (2006) An integrated approach to natural disaster management: Public project management and its critical success factors. *Disaster Prevention and Management*, **15**(3), 396-413.
- Nakazato, H., and Murao, O. (2007) Study on regional differences in permanent housing reconstruction process in Sri Lanka after the 2004 Indian ocean tsunami. *Journal of Natural Disaster Science*, **29**(2), 63-71.
- Nissanka, N. M. N. W. K., Kurusena, G., and Rameezdeen, R. (2008). Study of factors affecting post disaster housing reconstruction. *BEAR 2008*, Sri Lanka.
- Ratnasooriya, H., A.R., Samarawickrama, S. P., and Imamura, F. (2007) Post tsunami recovery process in Sri Lanka. *Journal of Natural Disaster Science*, **29**(1), 21-28.
- Shaw, R. (2006) Indian ocean tsunami and aftermath. *Disaster Prevention and Management*, **15**(1), 5-20.
- Silva, J. d. (2010) *Lessons from Aceh: key considerations in post-disaster reconstruction*. ARUP and Disasters Emergency Committee.
- Steinberg, F. (2007) Housing reconstruction and rehabilitation in Aceh and Nias, Indonesia--Rebuilding lives. *Habitat International*, **31**(1), 150-166.
- Takahashi, M., Tanaka, S., Kimura, R., Umitsu, M., Tabuchi, R., Kuroda, T., *et al.* (2007) Restoration after the Sumatra Earthquake tsunami in Banda Aceh: based on the results of interdisciplinary researches by Nagoya University. *Journal of Natural Disaster Science*, **29**(2), 53-61.
- Wu, J. Y., and Lindell, M. K. (2004) Housing reconstruction after two major earthquake: the 1994 Northridge in the United States and the 1999 Chi-Chi Earthquake in Taiwan. *Disasters*, **28**(1), 63-81.