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# COBRA 2010

## The Construction, Building and Real Estate Research Conference of the Royal Institution of Chartered Surveyors

**Held at Dauphine Université, Paris, 2-3 September 2010**

ISBN 978-1-84219-619-9

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12 Great George Street  
London SW1P 3AD  
United Kingdom

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September 2010

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# Implementation of project risk management principles in community based post disaster housing reconstruction projects

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## Abstract

The large earthquakes occurrences have been increased significantly during the last decade. They have damaged millions of houses. Providing houses for survivors is not an easy task and the fail to deliver project on time, poor quality, low accountability and dissatisfaction among beneficiaries have become common problems. Community based post disaster housing reconstruction where community have power to control the reconstruction project has been proven to be one solution to minimise these problems. However, it is thought that without any experience and knowledge on construction, community involvement is exposed to high risk.

Risk management is common practice in construction industry. However the application of this best practice is rarely discussed on the post disaster housing reconstruction project, especially for the community based project. In this context, this paper tries to describes and analyse the rationale and the importance of the implementation of risk management process in the post disaster housing reconstruction project. A detailed literature review on post disaster housing reconstruction project and construction risk management was carried to achieve the objectives.

**Keywords:** community based, post disaster, housing reconstruction, risk management

## 1. INTRODUCTION

The occurrences of large earthquakes have rose significantly during the last three decades, especially earthquake with magnitude greater than 8.0 Richter Scale. This group has been double from 6 occurrences in 1990-1999 to 13 occurrences on last decade (USGS, 2010a). Figure 1 shows the worldwide trend of earthquakes higher than 6 on the Richter Scale between 1980 and December 2009.



This trend also happens in Indonesia. The number of big earthquakes has increased dramatically since the huge Aceh earthquake in 2004. It has been recorded that after the 2004 earthquake, there has been 35 big earthquakes compared to just 12 earthquakes between 1992 and 2004 (USGS, 2010b). The severity of earthquake is not just in terms of fatalities, but it also took significant numbers of damage to houses and economic losses. Aceh earthquake in 2004 and Nias earthquake in 2005 has made 120.000 new houses are needed by people and economic losses were US\$ 4.1 billion. Yogyakarta (Central Java) 6.3 Richter scale earthquake in 27 May 2006 destroyed 157.000 houses and estimated economic losses was US\$ 3.1 billion (BAPPENAS et al., 2006). The most recent two earthquakes in Tasikmalaya (7.0 Richter scale), West Java, in 2 September 2009 damaged 65.700 houses and took 81 lives, and in Padang (7.6 Richter scale), West Sumatera, in 30 September 2009 killed 1117 people and left 135.000 houses heavily damaged. With the increasing of earthquake occurrences and considering their affect to people and houses, then it becomes clear, a good strategy in housing reconstruction has to be developed.

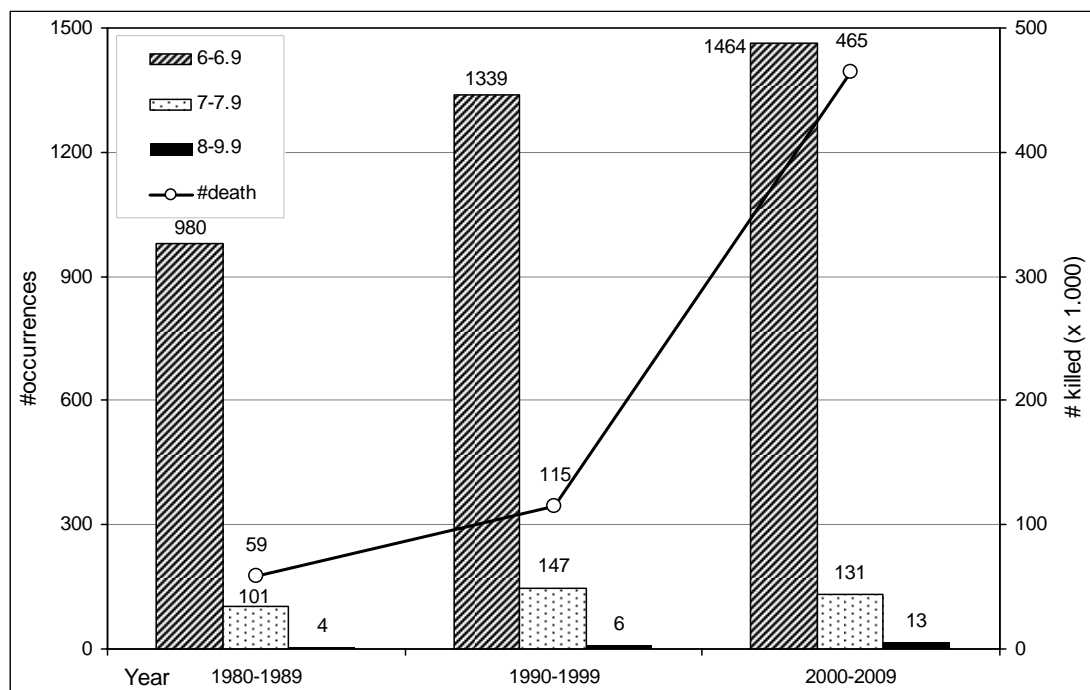


Figure 1. Earthquake occurrence in the world and estimated deaths (source: after USGS, 2010a)

In addition, housing reconstruction is probably the most important activity in reconstruction project. It is highly needed by the beneficiaries after the relief period. As a result, delivering a high quality house that can satisfy beneficiaries expectation is key factor of successful reconstruction programme. However, experiences have shown that the housing reconstruction project was not an easy task and face a lot of problems. One options of procurement method that can achieve high satisfaction among survivors is by doing a community based housing reconstruction project, where community has an important role in decision making process of the housing reconstruction. In this method, community can be a designer, supervisor or even contractor for their own project.

Moreover, although community based approach has been acknowledged to be a good option in delivering housing for survivors some problems still occurs. In Aceh reconstruction for example, the UNSYIAH 3<sup>rd</sup> party monitoring on housing reconstruction showed that a small number of community based housing reconstruction did not achieve high marks in quality, satisfaction and accountability index (UNSYIAH and UN-HABITAT, 2006). To improve this performance, it is thought that the implementation of construction risk management process can be a solution. In general construction project, risk management has been known as an important part of decision making process (Kangari, 1995). However, in post disaster housing reconstruction project the implementation of risk management process has not yet become a common practice (Silva, 2010).

Base on above findings, this paper tries to describes and analyse the rationale and the importance of the implementation of risk management process in the post disaster housing reconstruction project. To achieve these objectives, a detailed literature review on post disaster housing reconstruction project and construction risk management was carried out. In this context, the next section describes the problems of housing reconstruction in Aceh and Nias, Indonesia and the meaning of community based reconstruction.

## **2. HOUSING RECONSTRUCTION**

Different models of housing reconstruction strategies after earthquake disasters have been implemented around the world. Hayles (2010) suggests that it must find a balance between affordability, technical feasibility and quality of life. According to Silva (2010) the most appropriate method will be depend on the skills and capacity of the beneficiaries, the availability of local material, the complexity of the housing design and type of construction, the timescale for reconstruction and the availability of funding. However, its implementation is not easy as it requires inter-disciplinary strategies, tools and approaches (Haigh and Amaratunga, 2010).

Amin et. al., (2008) acknowledged that the recovery and reconstruction phase is a slow process of (re)development with a long term vision. Llyod-Jones (2006) raises the question of why reconstruction following major disasters takes so long. He discovered that there is a gap in funding and management and delivery, between short-term, effective humanitarian relief, and long-term reconstruction. Because of the different types of organization and interest involved, the link between immediate humanitarian relief and the longer-term reconstruction is often poorly managed.

Planning for long recovery does not have to wait until the relief phase is at an end. According to Llyod-Jones (2006), planning for medium and long-term recovery can occur before and after a natural disaster (Figure 2).

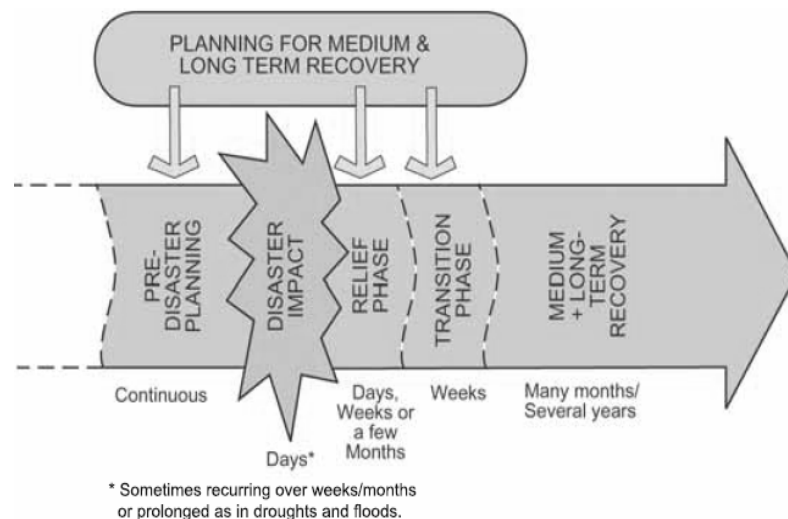


Figure 2. Where planning for medium and long-term recovery can occur before and after a natural disaster (source Llyod-Jones, 2006)

## 2.1. Aceh Reconstruction

The reconstruction of Aceh and Nias Indonesia after tsunami in 2004 and earthquake in 2005 was carried out by a special agency established by the government of Indonesia called the Reconstruction and Rehabilitation Agency of Aceh and Nias (BRR). The task was to restore livelihoods and infrastructure and strengthen communities in Aceh and Nias by directing a coordinated, community-driven reconstruction and development program (BRR, 2006). From a total of 120,000 houses, BRR has a target to construct 48,000 houses and responsible for coordinating the construction of 72,000 units built by NGOs and international agencies (BRR, 2007).

The massive reconstruction of houses in Aceh and Nias, Indonesia has not been an easy task for governments, donors, international agencies and NGOs who are involved in the reconstruction task. ACARP (2007) states that permanent housing was the most problematic aspect of the entire tsunami recovery effort in Aceh, and the most challenging sector for international NGOs working in Indonesia (World Vision, 2008). UNHCR (2007) reports that the permanent shelter operation in Aceh experienced a lot of problems and delivery has been far lower from the original targets. BRR (2007) admits that the target to construct 120,000 houses on the half of term of its assignment has not been achieved. As per 31 March 2006 only 41,730 houses have been constructed, rose to 57,000 units at the end 2006 and as per April 2007 the number reached almost 65,000 units.

ACARP (2007) finds that the most common complaint on the reconstruction has been over delays in housing delivery, followed by issues of quality and design, often worsen by poor coordination and poor communication between the housing providers and intended beneficiaries. In few communities, families have refused to move into their new houses because they believe they were promised superior models, or because they find the design unacceptable. The delay on housing delivery is caused by many factors. It cause by shortage of human resources, logistical problems, bureaucratic and institutional problems, and difficulties in coordinating the

multitudes of organizations (Vebry et al, 2007), land acquisition problems, particularly for the relocation villages (ACARP, 2007), and lack of road access (OXFAM , 2006). According to BRR (2006), in general, the low contractor capacity and poor supervision has led to poor construction quality. It was also worsen by NGOs which took the reconstruction process without any supporting background, knowledge and experience in post-disaster housing reconstruction and rehabilitation, and many of them did it for the first time (Dercon and Kusumawijaya, 2007 and Vebry et al, 2007). Dercon and Kusumawijaya (2007) adds that many organisations, especially the smaller ones, started building without a clear overall concept. They worked in the limelight and often failed. In the best of cases, they then dropped out, halted or stopped their programmes. Other postponed their start-up endlessly and the worst cases they built many bad houses and had to acknowledge costly defeats.

In 2005, BRR encouraged Universitas Syiah Kuala (UNSYIAH), the Banda Aceh based State University, to provide 3rd party monitoring and evaluation on housing reconstruction. During Aceh and Nias reconstruction, generally there are two procurement methods adopted, contractor based approach and community based approach. The survey which conducted from 2005 until 2006 monitored settlement recovery of 805 homes of about 61 organizations in 161 locations. It uses 3 key indicators to benchmark the success of each project. They are construction quality index, satisfactory index, and accountability index. The accountability index and satisfaction index were based on the beneficiaries opinion of their benefactor, whereas the construction quality is measured through direct on-site observation with a building inspector, architect and civil engineers, that refer and comply to the Aceh Building Code standard. All results were made public in full (Table 1). It can be seen from table 1 that community based housing reconstruction has proven to be a better way in reconstruction compare to contractor based approach.

Table 1. Housing reconstruction index in Aceh (source Dercon and Kusumawijaya, 2007)

Organisations	Construction Quality (0 to 4)	Satisfaction Score (-9 to 9)	Accountability Score (0 to 10)
All organizations in 2006	2,58	1,2	6,0
All community organizations program	2,67	2,1	6,7
All contractor-built program	2,55	0,8	5,9

With respect to high construction quality, satisfaction and accountability, the housing delivery using community based approach is also faster than contractor based approach. ACARP (2007) reveals that few housing projects which involved homeowners in the construction process have been completed more quickly, with far fewer problems, than the majority of projects that took a turnkey approach. Moreover, Dercon and Kusumawijaya (2007) also states that in Aceh reconstruction the community based approach has proven to be faster and to deliver results of higher quality and satisfaction than other reconstruction methods. MDF (2008) states that the community driven approach has proven an efficient means not only to rebuilt houses but also to create a sense of ownership and pride among beneficiaries. The spirit in which the community-based approach was applied has resulted in a high level of beneficiary satisfaction.

The implementation of community based approach in other affected countries by earthquake disaster, such as Sri Lanka, India, Iran, Turkey and Maldives also has

proven that this method achieved high satisfaction among communities and become one of the key success factor in reconstruction project (Ratnayake and Rameezdeen, 2008; Fallahi, 2007; Lawther, 2009; Barenstein, 2008; Arslan and Unlu, 2006).

## 2.2. Community Based Reconstruction

The word ‘Community’ has different meanings and people define it in different ways. Hillery (1955) cited Kumar (2005) states that ninety-four different definitions of community in the scientific literature had been found. All definitions used some combination of space, people and social interactions. In term of disaster management, Abarquez and Murshed (2004) defines community as a group that may share one or more things in common such as living in the same environment, similar disaster risk exposure, or having been affected by a disaster. Common problems, concerns and hopes regarding disaster risks may also be shared.

Kumar (2005) states that community participation projects are often found to be vague, whether the community is meant to be a means or end to the development programme and it was also easier said rather than implemented (Davidson et al., 2007). To explain the level of community participation in housing reconstruction project, a model developed by Davidson et. al. (2007) can be adopted (Figure 3).

It can be seen that the level of control of community reduces from the top ladder to the bottom ladder. If the level of participation goes to the bottom rung of the ladder, community has little or no power to control or manage the reconstruction. In this case, they may be consulted about what their needs and expectations with no assurance that these concerns will be taken into account, or merely informed about the shape the housing project will take or even manipulated into taking part in the project (Davidson et al., 2007). On the top ladder, empowerment and collaboration can offer communities to have a control on the housing reconstruction project. These two levels should be the minimum level where housing reconstruction program could be called ‘Community Based’ or ‘Community Driven’ approach (Ophiyandri, 2010). In practical, beneficiaries can act as the owner, as the supervisor or even as the contractor of their own housing reconstruction project.

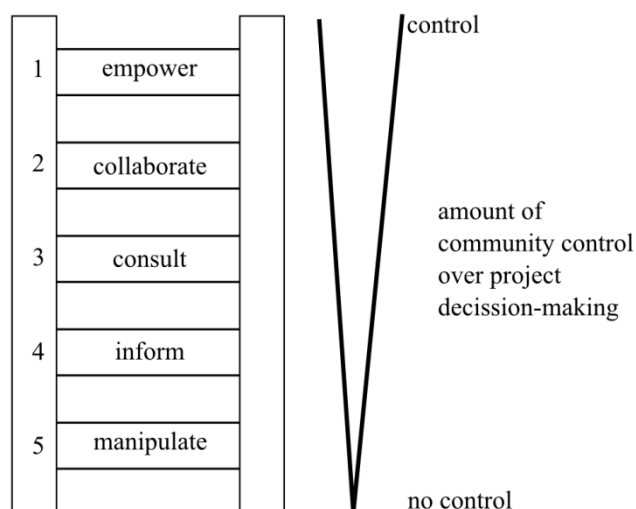


Figure 3. Ladder of community participation (Davidson et. al., 2007)

According to Dercon and Kusumawijaya (2007), there are three important lessons from Aceh that need to be learned in implementing community based reconstruction: a need for a standard definition for the terms participation and community based as this can make confusion, implementer should provide enough time for the participatory process as giving short time can lead to failure, and as well as the shortage of facilitators. The lack of understanding on community participation also happened in housing reconstruction in Sirinkoy, Turkey, after earthquake in 1999 (Ganapati and Ganapati, 2009). There are also a doubt the success of community based post disaster reconstruction method if applied in the large scale (Dercon and Kusumawijaya, 2007).

### **3. RISK MANAGEMENT**

#### **3.1. Definitions**

According to PD ISO/IEC Guide 73:2002, risk is combination of the probability of an event and its consequence. It is generally used only when there is at least the possibility of negative consequences. It can affect productivity, performance, quality, and budget of a construction project (Kangari, 1995). Although risk thought to have a negative impact, some see it as an opportunity. Moreover, BS 31100:2008 states that risk management is the systematic application of management policies, procedures and practices to the tasks of establishing the context, identifying, analysing, evaluating, assessing, treating, monitoring and communicating risks in a way that will enable organizations to minimize loss and maximize opportunity in a cost-effective way.

Scholars group risk management process in different way, risk analysis and risk management (Thompson and Perry, 1992), risk assessment and risk management (Boothroyd and Emmett. 1996), risk identification, risk analysis, risk evaluation, risk response and risk monitoring (Baker, et. al., 1999), and risk assessment, risk treatment, risk acceptance, and risk communication (PD ISO/IEC Guide 73:2002). However, it is generally the process of identification, classification, evaluation, treatment and communication of risk.

In more detail, BS IEC 62198:2001 states that the project risk management process starts by establishing the context in which the project is undertaken. This includes identifying the interested parties, understanding the objectives and outputs of the project and defining the scope and boundaries of the risk management activity. Risk identification is the next step of the risk management process. Each identified risk should be subjected to subsequent project risk management activities of risk assessment, risk treatment and review and monitoring. Risks should be managed at each phase of the project and risks to the project itself and to its product should be reviewed (BS IEC 62198:2001). The concept of the project risk management process is illustrated in Figure 4.

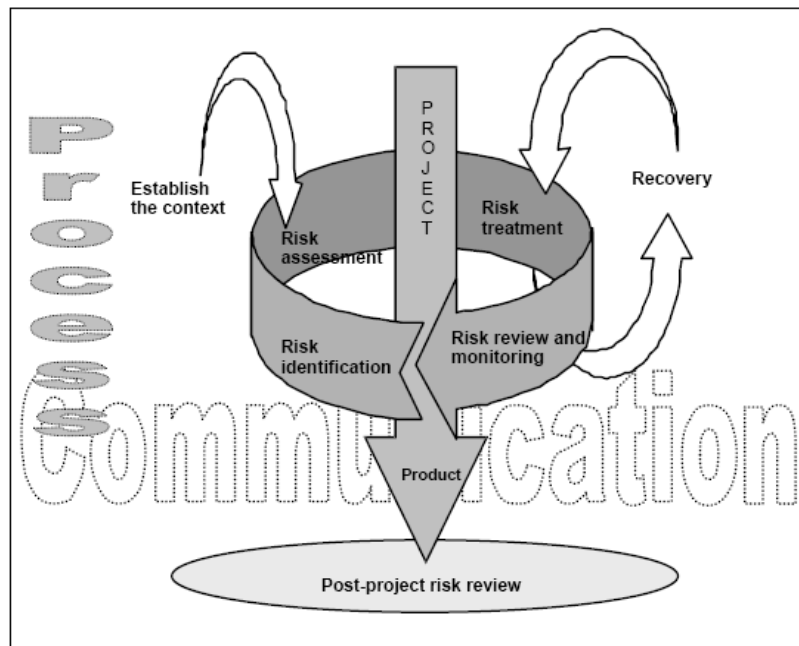


Figure 4. Project risk management concept (BS IEC 62198:2001)

According to Boothroyd and Emmett (1996) risk identification is the most important phase of the risk management process as no action can be taken on a risk if it has not been recognised. The purpose of risk identification is to find, list and characterize risks which may affect the achievement of the agreed project or project phase objectives. This process may also reveal opportunities (BS IEC 62198:2001). There are a number of methods of risk identification (BS IEC 62198:2001): brainstorming, expert opinion, structured interviews, questionnaires, checklists, historical data, previous experience, testing and modelling, and evaluation of other projects.

### 3.2. Community Based Risk management

Although community based housing reconstruction has been proven to be a better way of carrying out reconstruction activities, it is obvious that without having any experience and knowledge on construction, community involvement has greater risks than the contractor based method. The employment of unskilled labour on construction projects can lead to poor quality, and cost over runs (Tabassi and Bakar, 2009), affect the level of productivity and may also lead to injuries (Nasir et al, 2003). Moreover, research by Thevendram and Mawdesley (2004) reveals that the level of importance of human risk factors in construction project compared to the other factors (financial risk, environmental risk, political risk, construction related risk and physical risk) was significant (56%).

Considering that construction projects are unique, the risk in involving a community in the disaster circumstances must be very specific and they would be very different compared to the risk on contractor base reconstruction activities. Detailed literature reviews carried out on community based housing reconstruction projects has revealed that most of the research emphasis is on the stages of housing reconstruction and its achievements (Shaw et al., 2003; Davidson et. al., 2007; Dercon and Kusumawijaya, 2007; Fallahi, 2007; Barenstein, 2008; Ratnayake and Rameezdeen, 2008). There is still very limited research that relates to reconstruction

projects using community based approaches, taking into consideration the risks involved in terms of construction project management.

Accordingly, this research is based on the need to develop a project risk management approach for community based post disaster housing reconstruction. Risk management for community based post disaster housing reconstruction is important to ensure the success of the reconstruction project. In the construction industry risk management has been acknowledge to be an essential activity in minimizing losses and enhancing profitability (Akintoye and MacLeod, 1997). However, applications of these concepts in practice are less common in post disaster reconstruction. As a result, there is a need to carry out the risk management process during the entire life cycle of the project, from conceptual phase to operation and maintenance phase.

However, by considering that risk management for the whole reconstruction process is a very broad area with a very broad scope, the next step of this research focuses on the application of risk management principles during the pre-construction phase of the community based post disaster housing reconstruction projects. The other reason to focus upon the pre-construction phase of a community based post disaster reconstruction project is that this phase is identified as one of the most important phases which contributes immensely towards the success of community based post disaster housing reconstruction project.

Many problems of community based post disaster housing reconstruction project also exist at this stage. Dercon and Kusumawijaya (2007) highlight that failures in community based approaches are caused by the delay in the start up process where there is little time for the participatory process. In addition, Uher and Toakley (1999) states that the conceptual phase of a new construction project is most important and has highest degree of uncertainty. Although it is viewed as the most important stage, in contrast, Lyons and Skitmore (2004) founds that risk management usage in the execution and planning stages of the project life cycle is higher than in the conceptual or termination phases.

Moreover, research by Manelele and Muya (2008) on community based construction projects reveals that many of the critical risk identified during the pre-construction stage. Some risks identified are unconfirmed sources of funds, lack of technical advice, lack of consensus, lack of cooperation, non-conformity to standard specification, incompetency to recruit skilled labour, unavailability of skilled labour, incompetent labour, lengthy tender processes, and lack of work schedules (Manelele and Muya, 2008).

According to Jha et. al. (2010), risks that might arise in implementing community based housing reconstruction project are high overheads because of agency involvement, agency leaves little room for individual preferences by imposing standard design and materials, local contractors capture community committee, and limited real participation of community.

### **3.3. Risk Classification**

Risk can be categorized in many ways. On larger projects, Wood and Ellis (2003) states that risks are often grouped either within different phases or in line with the



project work breakdown structure. However, Perry and Hayes (1985) claims that the differentiation of risk or its classification are usually unnecessary and may be even unhelpful.

In this context, risk categorization will be based on the sequences of project task. Some tasks identified during the pre-construction stage of community based housing reconstruction project are establishment of project definition and strategy, funding resource, building assessment, beneficiaries identification, project socialization, housing design, community training and community action plan.

#### **4. CONCLUSION**

The conclusion of this research is:

- There is a need to carry out the risk management process during the entire life cycle of the housing reconstruction project.
- The application of risk management process in community based post disaster housing reconstruction is aim to ensure the project objectives can be met.
- Risks in pre-construction stage of community based post disaster housing reconstruction is more important to be managed compare to the construction stage.

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