THE ROLE OF KNOWLEDGE COMMUNICATION IN THE EFFECTIVE MANAGEMENT OF POST-DISASTER RECONSTRUCTION PROJECTS IN INDONESIA

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Declaration

The researcher declares that the work presented in this thesis, to the best of his knowledge is original and his own work. Also neither the thesis in its entirety nor any portion of it has been submitted for application for another academic degree or qualification in another university or institution of learning. Other sources of information used in the study have been well acknowledged and referenced.

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- Hidayat, B. & Egbu, C. (2013), "Knowledge communication in post-disaster reconstruction projects in Indonesia: the barriers", ANDROID Residential Workshop, 23-24 October 2013, Limassol, Cyprus

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List of Abbreviation

Bappenas	*Badan Perencanaan Pembangunan Nasiona (* National Development Planning Board)
BRR	*Badan Rehabilitasi dan Rekonstruksi* (Rehabilitation and Reconstruction Board)
CSFs	Critical Success Factors
CIDB	Construction Industry Development Board
DRM	Disaster Risk Management
HRM	Human Resource Management
ICT	Information and Communication Technology
IT	Information Technology
LPJK	*Lembaga Pengembangan Jasa Konstruksi* (Indonesian Construction Industry Development Board)
KM	Knowledge Management
NGOs	Non-Governmental Organisations
OHCA	Office for the Coordination of Humanitarian Affairs
PDR	Post-disaster Reconstruction
PU	*Pekerjaan Umum* (Department of Public Work)
RAND	Recovery Aceh and Nias Database
UN	United Nations

Abstract

Disasters have become prevalent events, particularly in Indonesia which is considered to be a country that is particularly vulnerable to disasters. The fairly recent earthquakes in Indonesia (the 2004 Aceh earthquake, the 2006 Yogyakarta earthquake and the 2009 West Sumatra earthquake), have caused loss to human life and also damage to houses, buildings and infrastructures. With regard to the disaster management cycle, reconstruction plays an important role as the key phase in mitigating future disasters. The importance and challenges associated with knowledge management in post-disaster reconstruction projects have received very little attention. The significance of the challenges is not matched by parallel research in the area. This research aims to develop a conceptual model and a set of guidance for improved awareness and understanding of the role of knowledge communication in effective project management of post-disaster reconstruction (PDR) projects. In addressing this aim, the research identifies challenges in PDR projects; investigates critical success factors related to PDR projects; and investigates knowledge communication implementation in PDR projects. The research also developed a model and a set of guidance. This research adopted a mixed methodological (quantitative and qualitative) approach. It also used questionnaire survey and semi structured interview to elicit the research data. A total 143 respondents comprising contractors, local governments, NGOs, and consultants, completed the questionnaire. The data elicited from the questionnaire was the basis for quantitative analysis using SPSS version 16 software package. Thirty-three (33) interview data obtained were analysed qualitatively using the NVivo version 9 software package. The study concludes, inter alia, that construction quality is the central issue in PDR projects. Achieving planned quality is perceived as the most challenging aspect in the PDR projects. Similarly, meeting the required quality is also considered as the most important criterion for project success. Contractors, consultants and local governments consider the 'golden triangle' (time, cost, and quality) as the main success criteria, whereas NGOs consider end users' (disaster victims) satisfaction as the main success criterion. In the main, 'conducting meetings', 'face-to-face interactions' and 'reports' are considered as the main methods for communicating knowledge among project stakeholders. Limited time, limited ability, and different backgrounds of stakeholders are the main barriers in communicating knowledge. With regard to the role of knowledge communication, the research showed that knowledge communication offers significant contribution to improving the quality of work, to the spread of best practices, and a reduction of re-work. Although respondents acknowledged the importance of knowledge communication, the implementation, however, is still primarily limited to face-to-face project meetings. An analogical model, called the KERAN model, and guidance document have been developed in this research. The model represents the process of post-disaster reconstruction projects and the role of knowledge communication in projects. The model is accompanied by a guidance document that explains the implementation of knowledge communication in post-disaster reconstruction projects. The model and guidance document have been validated using a questionnaire that has been completed by project managers. The study recommends that project managers in Indonesia should develop their skills in project control, take full advantage of the benefits of project meetings, and improve their communication and social skills in order to improve knowledge communication on projects. Future work is needed on how to transfer disaster related knowledge to construction workers.

CHAPTER 1. INTRODUCTION

This chapter presents a statement of the research problem and discusses the research aim and research objectives, research questions, and benefits of the research. It also presents the thesis structure and the main contents of each section.

1.1. The statement of the problem

Natural disasters have become more common, with an increasing number of extreme weather events and threat of earthquakes caused by climate change (World Bank, 2008). Disaster is defined as '*a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community and society to cope using its own resources*' (UN/ISDR, 2010). The cause of a disaster may be due to natural causes, a failure of technology and an act of human violence (such as terrorism or war) (Eshghi and Larson, 2008). Disasters can be classified into two main types: natural disasters and man-made disasters. This disaster classification can be developed further into the following classifications, based on the hazards: biological, geological, meteorological, human conflict and technological disasters (CDD, 2010).

Eshghi and Larson (2008) report the frequency of disasters and that their effects seem to be increasing. Disaster records were analysed in the Emergency Event Database (EM-DAT, available at www.em-dat.net), and this shows that from the 100 most costly natural disasters of the 20th century, 65 occurred in the 1990s, 25 in the 1980s and 10 in the 1970s. Modern technology, communication and media services have detected and recorded more disaster than ever before, so it seems that there has been an increase in disasters occurrences. Another reason is the growth of population where more people live in vulnerable areas. The global population has grown sharply from 1.6 billion at the beginning of the 20th century to more than 6 billion in 1999 (Population Institute, 2011).

Indonesia is considered to be a very vulnerable country and prone to disasters, since it has more than 18,000 islands and is situated along the pacific 'ring of fire' of active volcanoes and tectonic faults. The national population is approximately 224 million inhabitants, comprising of a mix of ethnicities, religions, customs and traditions. 383 out of 471 districts/cities are disaster prone areas with a large population and uneven population distribution (Hadi, 2009a).

EM-DAT, the international database, records the top ten natural disasters in Indonesia between 1900 and 2010. This is depicted in Table 1-1:

Table 1-1 Top 10 natural disasters in Indonesia for the period 1900 to 2010

Disaster	Date	No Killed
Earthquake & Tsunami	26/12/2004	165,708
Earthquake (seismic activity)	21/01/1917	15,000
Drought	January 1966	8,000
Earthquake (seismic activity)	27/05/2006	5,778
Volcano	1909	5,500
Volcano	May-1919	5,000
Earthquake (seismic activity)	12/12/1992	2,500
Storm	June 1973	1,650
Volcano	03/01/1963	1,584
Volcano	1930	1,369

Source: "EM-DAT: The OFDA/CRED International Disaster Database, www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium

It can be clearly seen from Table 1-1 that earthquakes are a prominent disaster in Indonesia. Irsyam et al. (2010) calculated more than 14,000 earthquake occurrences with a magnitude of M>5.0 in Indonesia between 1897-2009. The largest earthquakes in the last six years were the 2004 Aceh earthquake and tsunami (M_w = 9.2), the 2005 Nias Earthquake (M_w = 8.7), the 2006 Yogjakarta earthquake (M_w = 6,3), the 2009 Tasikmalaya earthquake (M_w = 7.4) and the 2009 Padang earthquake (M_w = 7,6) (Irsyam et al, 2010). Losses from earthquakes are not only measured in terms of human lives but also damage to housing and infrastructure. In the 2004 Aceh earthquake, 120,000 houses were damaged, followed by 306,234 and 13,577 houses damaged in the 2006

Yogyakarta and 2007 Bengkulu earthquake, respectively (Hadi, 2009b). More recently, the 2010 Padang earthquake caused 114,797 houses to be damaged.

In the disaster management cycle, response and recovery phases occur after the disaster strikes (see Figure 2-1, page 15). Response is the emergency action taken during the disaster and for a short term after the disaster. The main purpose of the response phase is to save human lives in the form of rescue and supplying victims' needs. The recovery phases take a longer time, and occurs after the emergency action in the response phase, aiming to repair damage, restore services, and to reconstruct facilities after disaster has struck (Alexander, 2002).

The reconstruction phase plays an important role in disaster management. Livelihoods of affected communities are restored by building new housing units and infrastructures. It is an opportunity to re-plan the community and begin afresh. Previous living conditions can be restored and may result in better living conditions through reconstruction. Regarding the disaster cycle, reconstruction is the key for mitigation and preparedness for the next disaster by applying structural measures and non-structural measures. The quality of constructed houses and infrastructures during the reconstruction phase will influence vulnerability for the next disaster.

Emergency relief activity directly after disaster strikes is often considered to be an effective operation. This activity is built around an international infrastructure of national, international and inter-governmental organisations and backed by media interest to generate public awareness and response (Lloyd-Jones, 2006). In contrast, recovery activity is usually slow, expensive and complex in terms of coordination and management (Koria, 2009). Von Meding et al. (2008) argue the reconstruction stage is the most poorly executed area in disaster management.

The reconstruction effort is often largely ad-hoc, without a strategic framework and sufficient coordination (Shaw et al., 2003). Furthermore, Shaw et al. also notes that inadequate planning, lack of preparedness and mitigation infrastructure, poor dissemination and inappropriate measures for accountability contribute to problems during reconstruction. This situation seems to be caused by the fact that reconstruction and long term recovery is a local government led activity; but the local government often has limited resources or is incapacitated, as a result of the disaster, in order to plan and implement a recovery strategy (Lloyd-Jones, 2006).

Portraits for the reconstruction process are often not good in the public's perception. Many articles in newspapers revealed many problems in conducting reconstruction in Indonesia. These problems are, for examples, the slow progress of the reconstruction (Tobing and Muhammad, 2008), scarcity of construction materials which led to delay (Serambi, 2008c), raising of the cost (Analisa, 2008a), failure in project tendering (Serambi, 2006a), and lack of coordination and supervision in the reconstruction (Harian Global, 2008). It is not uncommon to find cases of poor construction practices like illegal sub-contracting (Serambi, 2006c) and collusion and corruption of government officials (Analisa, 2008b, Waspada, 2008) and NGO's staffs (Serambi, 2006b). Also may be found many cases on projects become failure where contractors abandoned the reconstruction projects (Serambi, 2008b, Serambi, 2008a), or questionable construction quality of reconstruction which repeat the pre-disaster vulnerability (Media Indonesia, 2008).

Information and knowledge play an important role in effective disaster risk reduction and response. Coordination and integration of stakeholders' actions in disaster mitigation and response could be enhanced by good communication and exchange of critical disaster management information and knowledge (Pathirage et al., 2008). However, knowledge sharing seems to be one of the major causes of problems in disaster management. Mohanty et al. (2006) note that there is a gap in information coordination and sharing; despite thousands of organisations supporting disaster management for decades, the knowledge and experience of disaster practitioners remains an individual or institutional domain. There is also failure to implement existing knowledge (Alexander, 2008). Lessons from previous disasters are not becoming 'lessons learned' but only 'lessons identified', and because institutional memory is short, these lessons become 'lesson-unlearned' (Alexander, 2008).

One of the major reasons behind the unsatisfactory performance levels of current disaster management practices in Sri Lanka is a lack of effective information and knowledge dissemination (Haigh et al., 2006) which was due to, for example, the structure of the project and management office of post-tsunami reconstruction. Its fragmented structure created overlap, duplication, and made communication difficult between parties. It also disabled effective transfer of tacit knowledge between parties, as various offices were located in different parts of the capital city of Colombo (Koria, 2009).

Systematic review in disaster management from Lettieri et al. (2009) concluded that knowledge management in disaster management is a main area for further research. According to Lettieri et al., most publications focus on various phases of the disaster management process and the majority of contributors in publications in disaster management are from the USA and Canada.

Despite Indonesia being very prone to disasters, there are few published journals which discuss disasters in Indonesia. By using Business Source Premier (EBSCO), Emerald Management e-Journals, Management & Organization Studies (CSA) and Science Direct (Elsevier) electronic databases as source databases, with keywords for searching in abstracts such as 'disaster', 'Indonesia', 'reconstruction', and 'knowledge'; a number of publications were identified and are presented in Table 1-2.

Table 1-2 Number of publications about disasters in Indonesia

Source	**Number of publications*)**			
	Keywords			
	Disaster, Indonesia	**Disaster, Indonesia, reconstruction**	**Disaster, Indonesia, Reconstruction, Knowledge**	**Disaster, Knowledge management, reconstruction**
A	32	5	0	1
B	6	4	0	8
C	51	6	0	3
D	19	1	0	2

Note: A = Business Source Premier (EBSCO); B = Emerald Management eJournals; C = Management & Organization Studies (CSA), D = Science Direct (Elsevier) electronic databases.

*) results as at 20th August 2010.

Table 1-2 shows that research into knowledge management in post-disaster reconstruction is needed. The reconstruction process is often associated with delays (Steinberg, 2007, Bakar et al., 2009, Koria, 2009), rising costs (Sharma, 2001, Khatam, 2006, Koria, 2009), corruption (Schultz and Søreide, 2008, Aspinall, 2009, Hees, 2011, Van Klinken and Aspinall, 2011), and poor quality (Arfiadi et al., 2008, Boen, 2008, Pribadi et al., 2008, Rand et al., 2011). On the other hand information and knowledge have important roles to play in managing effective disaster responses (Kaklauskas et al., 2009, Thanurjan and Seneviratne, 2009, Pathirage et al., 2012). However, it seems there are difficulties in conveying knowledge (Mohanty et al., 2006, Alexander, 2008) from one party to another that prevents the achievement of effective management. Organisations may obtain benefits from knowledge management if knowledge is conveyed easily from one person to another (Lurati and Eppler, 2006, Otter and Emmitt, 2007, Tai et al., 2009). The activity of conveying knowledge in this research is termed 'knowledge communication' (Eppler, 2007), which is also known by phrases such as knowledge sharing, knowledge dissemination, and knowledge transfer. The role of knowledge communication in the effective management of post-disaster reconstruction projects is worthy of exploration. In the case of Indonesian's disaster management and reconstruction efforts, appropriate research projects are seldom undertaken; hence this study will be of great interest to those researching in this field.

From the problems statement above that have been previously discussed in this section 1.1, four research questions have arisen as stated in the following section 1.2. To answer the questions the research objectives have been set and presented in section 1.3. The structure of this report is based on the research objectives where one chapter presents and discusses one particular objective. The structure of this report is presented in section 1.6 (page 10).

1.2. Research questions

The research questions posed in this research are:

1. What are the main challenges and critical success factors in post-disaster reconstruction projects?

2. What are the main characteristics of post-disaster reconstruction projects and how do they affect the management of projects?
3. How is effective knowledge communication implemented in post-disaster reconstruction projects?
4. What methods are currently employed for the implementation of knowledge communication, and what barriers/challenges exist in this regard?

1.3. The research aim and research objectives

The aim of the research is to develop a conceptual model and a set of guidelines for improved awareness and understanding of the role of knowledge communication in the effective project management of post disaster reconstruction projects.

In order to achieve the above aim, the following objectives have been formulated:

1. To investigate and document the key roles and challenges faced by different stakeholders in post disaster reconstruction projects, from a project management of the construction facility perspective.
2. To explore the extent to which the nature of post disaster reconstruction projects impact on the effective management of projects.
3. To investigate and document the critical success factors of effective project management of post disaster reconstruction projects.
4. To explore the nature of knowledge communication practices and techniques currently employed in the effective management of post disaster reconstruction projects, and present their level of efficacy and success.
5. To investigate and document the role that knowledge communication plays in the effective project management of post disaster reconstruction projects, together with how well knowledge communication approaches are emphasised and exploited.

6. To develop and validate a conceptual model that best encapsulates the role that knowledge communication plays in effective project management of post disaster reconstruction projects.
7. To develop and validate a set of guidelines for the purpose of improving awareness and understanding of the role of knowledge communication in post-disaster reconstruction projects for the benefit of project managers.

The linkage between research questions, research objectives, and the chapters in which they are discussed is presented in the following table:

Table 1-3 Link between research questions, objectives, and chapters in the report

Research questions	Objectives	Chapters
1. What are the main challenges and critical success factors in post-disaster reconstruction projects?	Objective 1: To investigate and document the key roles and challenges faced by different stakeholders in post disaster reconstruction projects, from a project management of the construction facility perspective	Chapter 4
	Objective 3: To investigate and document the critical success factors of effective project management of post disaster reconstruction projects.	Chapter 6
2. What are the main characteristics of post-disaster reconstruction projects and how do they affect the management of projects?	Objective 2: To explore the extent to which the nature of post disaster reconstruction projects impact on the effective management of projects.	Chapter 5
3. How is effective knowledge communication implemented in post-disaster reconstruction projects	Objective 4: To explore the nature of knowledge communication practices and techniques currently employed in the effective management of post disaster reconstruction projects, and present their level of efficacy and success.	Chapter 7
	Objective 6: To develop and validate a conceptual model that best encapsulates the role that knowledge communication plays in effective project management of post disaster reconstruction projects	Chapter 8
4. What methods are currently employed for the implementation of knowledge communication, and what barriers/challenges exist in this regard?	Objective 5: To investigate and document the role that knowledge communication plays in the effective project management of post disaster reconstruction projects, together with how well knowledge communication approaches are emphasised and exploited	Chapter 7
	Objective 7: To develop and validate a set of guidelines for the purpose of improving awareness and understanding of the role of knowledge communication in post-disaster reconstruction projects for the benefit of project manager	Chapter 9

1.4. Contribution to the body of knowledge

This research has contributed to the body of knowledge by providing practical contributions to disaster management practitioners and the construction industry, as well as theoretical contributions to other industries that wish to improve knowledge communication in their organisations.

The topics of critical success factors (CSFs) and success criteria have been well documented in the construction industry. However, research into CSFs from a disaster context or during post-disaster reconstruction is still under researched. This research contributes to the body of knowledge by identifying challenges, CSFs, and success criteria of post-disaster reconstruction (PDR) projects.

Research into knowledge management has been growing during the last two decades including research that focuses on the construction industry. However, as shown in this research background, there is still little research into knowledge management in Indonesia and knowledge management from a post-disaster reconstruction context. This research contributes to the body of knowledge by exploring knowledge management and serving as a starting point for implementing knowledge communication into PDR projects. This research provides effective methods, barriers, and roles of knowledge communication.

This research also has developed a model (named the KERAN model) and guidance document that will help stakeholders in PDR projects to understand the process of PDR projects and the role knowledge communication plays in the process.

Some parts of this research have already been presented at conferences and presentations. Please refer to page ii for the list of publications.

1.5. Benefits of the study

Identification of critical success factors (CSFs) can be helpful in analysing the potential reasons of post-disaster reconstruction project success or failure. By understanding the CSFs, it will enhance the probability of project success. The CSFs and guidance document from this research will provide direction and help managers in the management of post disaster reconstruction projects. The concept of CSFs offers a smarter way to identify factors which present or not present in a project are likely to make project successful (Alzahrani and Emsley, 2013).

It will also provide benefit to the National Disaster Management Agency, because in planning and implementing a reconstruction plan for the next disaster, they will be able to easily identify and prioritise critical issues associated with implementing the plan. NGOs have become more involved in post-disaster reconstruction in recent years, with the CSFs and guidance notes they will have a better understanding of reconstruction.

The topic of CSFs has been a significant one in project management. Toor and Ogunlana (2009) have comprehensively listed CSFs in general construction projects, design build projects, public-private-partnerships or BOT projects, international and multi-firm projects, large construction projects and various other project management topics. However, to date, there is no specific study of CSFs in post-disaster reconstruction projects.

Knowledge communication in post-disaster reconstruction projects was also investigated. Identification of the effective knowledge communication methods and the barriers to communicating knowledge will help to improve knowledge communication on projects which in turn may enhance project performance.

The research outputs, the model and the guidance document will also benefit stakeholders of post-disaster reconstruction project. The outputs will help them to understand the process of PDR projects and the role of knowledge communication in the project.

1.6. Structure of the thesis

The thesis has been organised in a logical manner to help the reader to understand the researcher's efforts to achieve the objectives of the research. The thesis consists of ten chapters.

Chapter 1 is an outline of the background for the research, and discusses the aim, objectives, research questions and benefits of the study.

Chapter 2 presents the literature review on disaster management, knowledge management and project management. It highlights the reconstruction process as the intersection area of these three topics.

The research methodology is presented in chapter 3, including the selection and justification of the research approach and sample frame adopted. Difficulties encountered during various research stages are also presented with various instruments to mitigate such difficulties. The methods for qualitative and quantitative data analysis are also discussed.

In chapter 4, the key stakeholders of post-disaster reconstruction are identified. Their role and involvement are also discussed in this chapter.

Chapter 5 discusses challenges associated with post-disaster reconstruction (PDR) projects. This chapter also highlights the different challenges among the post-disaster key stakeholders.

In chapter 6, critical success factors (CSFs) for the PDR projects are devised by analysing results and findings from the questionnaire surveys and interviews. Also the criteria for project success, based on views from different stakeholders in PDR projects will be discussed.

In chapter 7, the implementation of knowledge communication in PDR projects is discussed, with the focus on the methods and the barriers in communicating knowledge. The roles of knowledge communication in PDR projects are also highlighted.

Chapter 8 discusses the development of a model for improved awareness of the role of knowledge communication in PDR projects. The model takes consideration from research findings which have been presented in previous chapters.

Chapter 9 presents the development of a guidance document for improved awareness of the roles of knowledge communication in PDR projects.

Finally, in chapter 10, the conclusions and summaries of the main findings of this research and its contribution to research in post-disaster reconstruction are presented. This chapter also provides recommendations for future research in this area.

CHAPTER 2. REVIEW OF LITERATURE

2.1. Introduction

The reconstruction in disaster management requires resources to build physical infrastructure and to restore the living conditions of disaster-affected communities. Effective project management which refers to managing people, managing the cost, managing quality, and managing risk is important in post-disaster reconstruction. Effective project management can help in managing resources. In trying to manage resources through effective project management the knowledge of the project manager is important.

The research background set out in section 1.1 shows that little research is carried out on knowledge management in the post-disaster reconstruction context, specifically in the Indonesia context. This research focuses on knowledge communication relating to the management of post-disaster reconstruction projects. Therefore, there are three bodies of knowledge in this research: disaster management, project management and knowledge management.

This chapter focuses on a literature review of those three bodies of knowledge. Section 2.2 discusses disaster and disaster management, followed in section 2.3 by a literature review of project management. The next section, 2.4, discusses knowledge and knowledge management; and section 2.5 concludes the chapter with a summary of the literature review. Further discussions regarding these three topics are subsequently presented in chapter 4 (page 99), chapter 5 (page 131), chapter 6 (page 185), and chapters 7 (page 217).

2.2. Disaster Management

2.2.1. Definition of a Disaster

On average, around 82,000 people are killed annually by disasters where most of the fatalities are concentrated in low and middle-income countries (World Bank, 2011, p2). So, what is a disaster?

Ruthenford and Boer (1983) give the definition for a disaster as "*a destructive event which, relative to the resources available, causes many casualties, usually occurring within a short period of time*". They stress that a disaster occurs when there is a difference between available resources and the number of casualties. Moe et al. (2007) also highlight the resource discrepancy when they defined the disaster as a situation which overwhelms local capacity and needs external assistance (Moe et al., 2007). John Hopkins & IFRC (2008) consider the unpredictable characteristic of a disaster when they define the disaster as "*a sudden overwhelming and unforeseen event*".

Some authors (Quarantelli, 2001, Shaluf, 2007a) argue that there is little consensus about definition of the disaster, since it is based on discipline. As previously suggested by Quarantelli (1985) that disaster has many dimensions: physical agents, physical impact, assessment of physical impact, social disruption, a crisis situation, imbalance in demand-capability ratio. Perry (2007) identified more than three dozen definitions of disaster, and he concluded that the definitions have similarities in describing a disaster as a social phenomenon and disruption of people's lives.

Shaluf (2007a) analysed classifications of the disaster classification from the disaster agencies and concluded that a disaster can be classified into three categories: natural, man-made and hybrid disasters. Natural disasters are calamitous events resulting from natural causes. Man-made disasters include social, technical and warfare disasters. A combination of natural forces and human errors are categorised by him as a hybrid disaster.

Perhaps the disaster definitions above are relatively intangible criteria, so the well adopted definition to record an event as a disaster is a classification by

Emergency Disaster Database (www.em-dat.net). They categorise an event as disaster if one of following criteria are fulfilled:

- Ten or more people are reported killed;
- 100 or more people are affected by the event;
- A declaration of state of emergency; or
- A call for international assistance.

In this research the definition of disaster formulated by the United Nations (UN) is adopted. The definition covers the aspects of loss, damages, and the ability of the affected community to cope with a disaster, and the UN defines disaster as '*a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community and society to cope using its own resources'* (UN/ISDR, 2010).

The definitions of a disaster have been discussed in this section, in the next section, disaster management will be addressed.

2.2.2. Disaster management cycle

Disaster management can be defined as "*the body of policy and administrative decisions, the operational activities, the actors and technologies that pertain to the various stages of a disaster at all level*" (Lettieri et al., 2009). Shaluf (2007b) broadly defined it as 'a collective term encompassing all aspects of planning for and responding to the disasters, including both pre-disaster and post-disaster activities".

Considering disasters as repetitive events, disaster management forms a cycle and most authors divide disaster management into four phases: mitigation, preparedness, response and recovery (Alexander, 2002, The Johns Hopkins and Red Cross and Red Crescent Society, 2008, Perera et al., 2010), as presented on Figure 2-1.

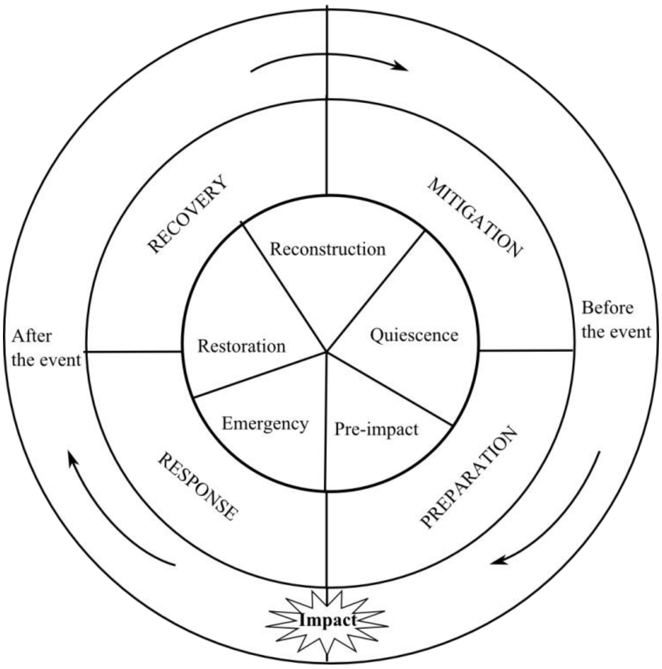

Figure 2-1 Disaster cycle (Alexander, 2002)

Mitigation and preparation phases may take place before or after disaster strikes. Mitigation is all activities planned to reduce the impact of future disasters; these activities are usually divided into two categories: structural mitigation and non-structural mitigation. Structural (physical) mitigations are engineering solutions and non-structural (non-physical) mitigations that include land-use planning, insurance, legislation, training, and public awareness (Loh, 2005). 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 the disaster and the short term after the disaster, the main purpose of the response phase is to save human lives in the form of rescue and supply of victims' needs. The recovery phase takes a longer time and occurs after emergency action in the response phase, the aims of the 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 residents then followed by trained and skilled staff from the search and rescue department of government.

International relief teams arrive later, usually after one day, depending on accessibility to the disaster area and the political situation in the disaster affected country. The relief phases follow immediately after the rescue phase and may take from one to three months, depending on the magnitude of the disaster and the government's resources. The recovery phase starts immediately after the end of the relief phase, short-term recovery activities being clearing debris, building houses, restoring lifelines and infrastructure and long-term recovery activities attempt to build a safer and sustainable livelihood (Shaw, 2006).

The reconstruction phase plays an important role in disaster management. Livelihoods of affected communities are restored by building new housing units and infrastructures. It is an opportunity to re-plan the community, beginning a new life with a new start. Previous living conditions can be restored and may result in better living conditions after reconstruction.

Reconstruction is the essential element for mitigation and preparedness for the next disaster by applying structural measures and non-structural measures. The quality of constructed houses and infrastructure during the reconstruction phase will influence the vulnerability for the next disaster.

2.2.3. Post-disaster reconstruction

The term reconstruction may involve building the confidence, self-respect, self-esteem, self-dependency, mutual support and mutual trust and rebuilding the communities (Jayaraj, 2007). Aysan & Davies (1993) define reconstruction as "*the full restoration of all services, and local infrastructure, replacement of damaged physical structures, the revitalization of the economy and the restoration of social and cultural life*". From the above definitions, the term 'reconstruction' may refer to the physical, social and economic aspect of restoration after a disaster. This study only focuses on the physical aspect of reconstruction.

The reconstruction process may be divided into two main programs; the first is building housing units and the second is restoring or building infrastructure: roads, ports, electricity, lifelines, railways, water supply and sanitation.

Housing projects seem to be the first priority in most post-disaster reconstructions in many countries, because they are needed by the disaster victims, and often become the first priority for the government. In developing countries where disaster victims have no home insurance or financial ability to rebuild their home, the governments provide permanent houses to homeless disaster victim citizens. Freeman (2004) investigates the allocation of post-disaster financing for housing and reveals that housing is the favoured expenditure with 30-50% financial allocation.

For reconstruction, Quarantelli (1995) differentiates between sheltering and housing and distinguishes between them using four different terms: emergency sheltering, temporary sheltering, temporary housing, and permanent housing. Housing occurs when disaster victims have responsibilities and their daily routines have been established.

There are two common procurement methods of housing projects. First, because housing projects relatively need less construction skills, equipment, and simple construction methods compared to infrastructure projects, disaster victims or communities can build the houses by themselves. The second approach is the government appointed private contractors to build the houses. Lizarralde & Davidson (2006) recognise these approaches as informal and formal solutions. Despite their paper suggesting that the informal approach is better and has some advantages (e.g. flexible house form, use recycled materials, variety of function), the quality of what they called 'spontaneous housing' is questionable.

It is necessary to distinguish between a 'common' or 'normal' project and a post disaster reconstruction project. Masurier et al (2006) in their study in New Zealand concluded that there is a greater degree of coordination with policy and legislation required for a large scale disaster while routine construction processes have proved adequate for small-scale disasters. Most existing legislation was not drafted to cope with emergency situations and was not developed to operate under the conditions that will certainly succeed in the aftermath of a severe disaster (Masurier et al., 2006).

Post-disaster housing projects, according to Davidson et al. (2007), have similar challenges with low-cost housing in developing countries, but a disaster context adds additional challenges for post-disaster housing projects. The additional challenges are as follows: conditions after the disaster are in an uncertain position, and resources for the project are scarce. Many local and international organisations are simultaneously running the same housing project, often they compete for scarce resources. Also, donors who finance the project appear to get the results of a project quickly. The reconstruction projects are expected to have sustainability, to be implemented in order to raise the level of development and to reduce vulnerability for future disasters.

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

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

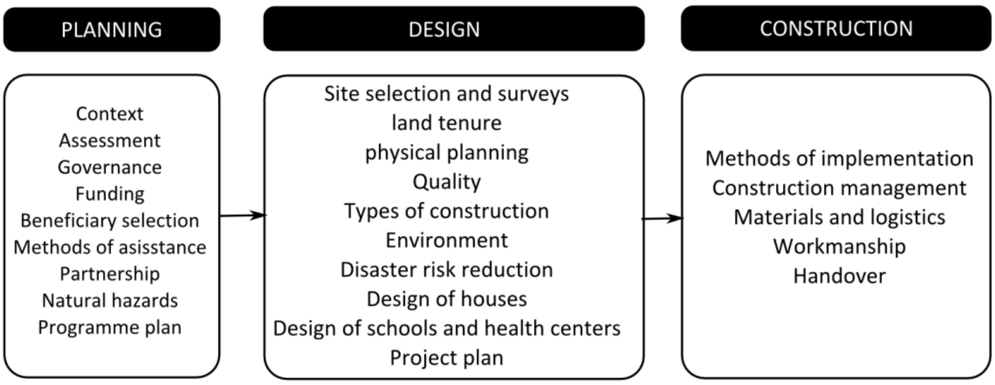

Figure 2-2 Key considerations in post-disaster reconstructions (Da Silva, 2010)

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

- Understanding the context and impact of a disaster;
- Understanding the local governance structures, regulatory framework and establishing methods of coordination;

- Understanding funding streams and timescales;
- Identifying beneficiaries;
- Determining which method of assistance is most appropriate;
- Establishing partnerships with other stakeholders in order to provide assistance;
- Recognising natural hazards which pose a future risk;
- Capturing the objectives, timescales, resources and risk in the programme plan (Silva, 2010).

The design stage is about the design of reconstruction projects, the key considerations in this section 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;
- Minimising the environmental impact of reconstruction;
- Incorporating disaster risk reduction strategies;
- Design of houses, schools and health centres;
- Capturing the scope of works, programmes, human resources, cost plans and risk management plans into detailed project plans to inform the construction (Silva, 2010).

The construction section is the 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).

Jha et el. (2010) suggest various approaches in post-disaster reconstruction (Table 2-1), they are the cash approach (CA), owner-driven reconstruction

(ODR), community-driven reconstruction (CDR), agency-driven reconstruction in-situ (ADRIS), and agency-driven reconstruction in the relocated site (ADDRRS) approach.

In a CA approach, disaster victims, regardless of their house ownership status, are given financial support to repair and reconstruct damaged houses. In ODR, disaster victims also receive technical assistance as well as cash or vouchers. Disaster victims form communities which are the basis for a CDR approach where a community may have various involvements in the project cycle.

In ADRIS (Agency-Driven Reconstruction In-Situ), one or more contractors are hired by a government or agency to design and build the house. Materials and labour may come from outside the community and the community may or may not be involved in the design by suggestion or modifying the design. In an ADRRS approach, the government and agency purchase land and relocate disaster victims there. Construction is implemented by contractors with little or no involvement of the community.

Benefits and disadvantages of those various reconstruction approaches are presented in the following Table 2-1.

Table 2-1 Advantages and disadvantages of reconstruction approaches (Jha et al., 2010)

Advantages	Disadvantages and risks	Recommendations
Cash Approach (CA)		
Cost-effective approach with fast delivery of aid to beneficiaries. Simple delivery mechanisms. Cash aid can be adjusted to the beneficiaries' income, family size, livelihoods, and socio-cultural requirement. Allow repair of houses or use of salvaged and local building materials. Cash approach is best when local building capacity and financial support are sufficient. Family who receive cash aid may use it based on their priority.	Pre-disaster vulnerabilities may be replicated. Building skills may not be improved. Little opportunity to use new building technologies. Repair and reconstruction may be difficult for vulnerable people if without assistance from others. Aid cash may be used for other matters and leave houses unrepaired. Possibility of negative publicity if beneficiaries use cash aid for questionable purposes. Cash approach may increase risk of corruption.	Cash approach is suitable when damage is not severe and is not caused by poor construction or poor building code implementation. Ensure that labour and materials markets in the reconstruction area are functioning properly.

Advantages	Disadvantages and risks	Recommendations
Owner-Driven Reconstruction (ODR)		
Put beneficiaries in an active role which accelerate recovery from psychological trauma after the disaster. Support for beneficiaries can be suited to their needs of their income, family size, livelihoods, and socio-cultural needs. Allows incremental housing construction practices. Promotes the use of salvaged and local building materials for house repairing. Usually involves local construction industry, therefore helping in restoring local economy and livelihood. Maintains local cultural identity, local construction traditions, and architectural style. Enable beneficiaries to add their own saving to the aid, so they can meet their particular needs. It is less affected by unstable political situation (for example eastern province of Sri Lanka). distributed and remote settlement (for example, Gujarat in Pakistan)	Requires good construction standards and supervision, in order to avoid poor construction quality and pre-disaster vulnerabilities. Rigid construction standards and use of imported construction technology may lead to difficulties for people in complying with the requirements, even with supervision. It may difficult to be conducted in relocated communities and poor communities with lack of construction experience (e.g. urban squatters). Although this approach is suitable for reconstruction of multifamily and high-rise buildings, skilled technical supervision is essential. Without help in managing reconstruction, the elderly and other vulnerable groups may face problems and difficulty in meeting reconstruction milestones.	Establish a support system for home owners that are adoptable to local requirements. Make certain that the assistance is fair and sufficient to satisfy minimum construction standards. Set up a delivery mechanism for financial assistance that is easy to understand and access. Provide sufficient training for construction workers and supervisors. Recognise housing rights and include the needs of tenants, squatters, and the homeless. Modify the approach to cover remote areas and socioeconomically disadvantaged people. Give focus and support to vulnerable groups (e.g. orphans, widows, the elderly, and the very poor). Implement ways to avert inflation and provide access to quality construction materials. Consider involving NGOs as part of the enabling system.
Community-Driven Reconstruction (CDR)		
This approach is useful where: Introduction of new building technologies, materials, or house design in the reconstruction; or Agencies are responsible to bring in materials; or Housing reconstruction is connected to community development activities. Can promote social cohesion when people from different backgrounds work together. Provides high levels of flexibility and accountability and also give control to owners over reconstruction. More certain in access to construction materials. Size of project may have high impact in reactivation of local economy.	Cost may be high due to involvement of agency. Agency may enforce standards designs and materials, thus less accommodating of individual preferences. Local contractors dictate community construction committees who manage large amounts of resources. Participation from community may be limited if: Consultation is only with the leaders whose views may not reflect community's view; Reconstruction processes are dominated by local elites; Participation is viewed as unnecessary time-consuming process; or Women's views are not included in the process.	Set at the start the community's agreement on level and type of agency involvement. Provided qualified staff to guide participatory process. Include community participation in whole process of project cycle, site selection, planning of settlement, and housing design. Avoid overruling community preferences and recognize the different needs and capacities of community members. Provide control mechanisms to avoid project resources from being diverted by local elites.

Advantages	Disadvantages and risks	Recommendations
Agency-Driven Reconstruction In-Situ (ADRIS)		
Communities are not relocated to new location. People can be effectively involved in construction and monitoring. New building technologies can be implemented. No need to purchase land.	Construction methods, designs, and settlements layouts are often not fit with existing layout. Existing structures and environments (houses, trees) may be considered as obstacles that need to be demolished, causing social and environmental impact. Building technologies from outside may have negative impacts on environment and do not meet local needs. It is not easy to adopt community participation and may be limited only to the leaders, resulting in uneven benefits for elites. Construction quality is often poor due to inexperience of agency with oversight of housing construction, among other reasons. Contractors persuade community to ask additional benefits from the government. Risk of corruption and exploitation by contractors	Avoid ADRIS if local building capacity is available. If ADRIS is unavoidable, ensure community participation in choosing of housing design, site layout, building materials, and construction. Ensure fair distribution of project benefits with transparent allocation criteria based on social evaluation, and monitor their application. Protect the heritage value of pre-disaster environment, both built and natural, including buildings and trees that survived the disaster. Enforce contractors to use local designs and building materials. Hire a professional project manager or "clerk of the works" from the construction industry to supervise construction. Setup social audit systems to ensure local accountability. Assure quality control through an independent third-party assessment.
Agency-Driven Reconstruction in Relocated Site (ADRRS)		
This approach is suitable when pre-disaster settlements are located in hazardous locations. May be more cost-effective and faster compared with other approaches. Offer opportunity to solve pre-disaster housing problems (e.g. shortages, vulnerability, and poor housing conditions). Suitable for crowded urban settlement, rental housing, and complex building technologies (multi-storey construction). Has benefit in heritage conservation by relocation from sensitive sites. Can simultaneously solve different population groups' needs, depending on the design of the settlement.	Difficulties and delays to find suitable land and Negative socioeconomic impacts and disruption of livelihoods from relocation may cause occupancy rates to remain low. Poor site selection may cause negative environmental impacts or re–create vulnerability of the original location. Construction quality is often poor. Loss of local building culture and capacity. Disruption of access to common property and to natural and cultural heritage sites. Settlement layout, housing designs, and building technologies can be not proper to local communities and culturally inappropriate, particularly in rural areas. Repairs and extensions to houses built with foreign building technologies may be unaffordable.	Only adopt ADRRS if ODR is not possible on safety grounds. Avoid this approach in rural areas, anywhere people can manage house construction on their own, and where livelihoods are very site-specific. Carefully evaluate relocation effects on livelihoods and provide mitigation measures. Identify beneficiaries and allocate houses during the planning stage. Ensure community participation throughout the project cycle, site selection, settlement planning, and housing design. Establish social audit system to ensure local accountability Ensure quality control through an independent third-party audit. Take into consideration socioeconomic and gender-specific requirements.

Advantages	Disadvantages and risks	Recommendations
	Contractors may persuade communities to demand additional benefits from the government. Lack of community participation or oversights may result in poor targeting, unequal distribution of houses, and elite capture.	

Considering the approaches above, and in relation to quality of construction, it suggests that the community-driven reconstruction (CDR) approach is a better solution for achieving good quality construction, as Jha et al. did not mention quality in the disadvantages and risks of the approach. However, as the participation of the community may vary in the CDR approach, the construction may be implemented by local builders which render the project vulnerable to poor construction quality. In other words, all the approaches are exposed to quality risks, except where good standards, building codes and proper supervision are in place.

The next section will discuss disasters in Indonesia and post-disaster reconstruction in Indonesia.

2.2.4. Disasters and disaster management in Indonesia

The profile of Indonesia shows that the country is very vulnerable to disasters. Indonesia is located on the 'ring of fire' of active volcanoes and tectonic plates. The population of Indonesia was more than 237.5 million in 2010 and had grown more than 32% compared to the census of 20 years ago, in 1990 (BPS, 2011a). More than 80% of areas, 383 out of 471 districts and cities, are considered to be disaster prone (Hadi, 2009a). Indonesia was also ranked first in human disaster exposure to disaster for tsunami and landslide (Preventionweb, 2010).

According to the international database 'Centre for Research on the Epidemiology of Disasters (CRED)', in the last 20 years, disasters in Indonesia were dominated by the occurrence of flood, earthquake and landslide (Table 2-2). Earthquake, wildfire, and drought were the three events that most affected inhabitants in Indonesia (Table 2-3). However, six out of ten of the most deadly disasters in the period were earthquakes (Table 2-4).

Table 2-2 Disaster occurrences in Indonesia for the period 1992 to 2011

Disasters	No of events
Drought	2
Earthquake (seismic activity)	54
Tsunami	4
Epidemic	18
Flood	89
Landslide	33
Storm	2
Volcano	19
Wildfire	8

Source: "EM-DAT: The OFDA/CRED International Disaster Database, www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium"

Table 2-3 Top 10 natural disasters in Indonesia for the period 1992 to 2011 sorted by numbers of total affected people

Disaster	Date	No Total Affected
Earthquake (seismic activity)	27/05/2006	3,177,923
Wildfire	Oct-94	3,000,000
Earthquake (seismic activity)	30/09/2009	2,501,798
Drought	Sep-97	1,065,000
Flood	23/12/2006	618,486
Flood	09/02/1996	556,000
Earthquake (seismic activity)	26/12/2004	532,898
Flood	27/01/2002	500,750
Earthquake (seismic activity)	12/09/2007	459,567
Flood	28/11/2000	386,021

Source: "EM-DAT: The OFDA/CRED International Disaster Database, www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium"

Table 2-4 Top 10 natural disasters in Indonesia for the period 1992 to 2011, sorted by numbers killed

Disaster	Date	No Killed
Earthquake & Tsunami	26/12/2004	165,708
Earthquake (seismic activity)	27/05/2006	5,778
Earthquake (seismic activity)	12/12/1992	2,500
Earthquake (seismic activity)	30/09/2009	1,195
Earthquake (seismic activity)	28/03/2005	915
Earthquake (seismic activity)	17/07/2006	802
Epidemic	13/05/1998	777
Drought	Sep-97	672
Epidemic	Jan-98	672
Epidemic	01/01/2004	658

Source: "EM-DAT: The OFDA/CRED International Disaster Database, www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium"

Earthquakes are quite different from other natural disasters; they strike without warning and thus may result in many casualties. Buildings without earthquake-resistant construction will be heavily damaged, even if the cause is by a minor earthquake (Mitchell, 1976, Revi and Jain, 1992). Structural inadequacy that leads to building failure can be found in almost every earthquake (Lewis, 2003).

Badan Nasional Penanggulangan Bencana (BNPB, National Disaster Mitigation Agency) is an Indonesian governmental agency that is responsible for disaster management in Indonesia. The agency has produced '*Index Rawan Bencana*' (Disaster Risk Index/DRI), the DRI shows that 396 of 494 districts and cities are have DRI categorised as 'high' level of risk (BNPB, 2011).

The DRI map of Indonesia is shown in Figure 2-3. It shows that most of provinces in Indonesia have a high vulnerability to disasters.

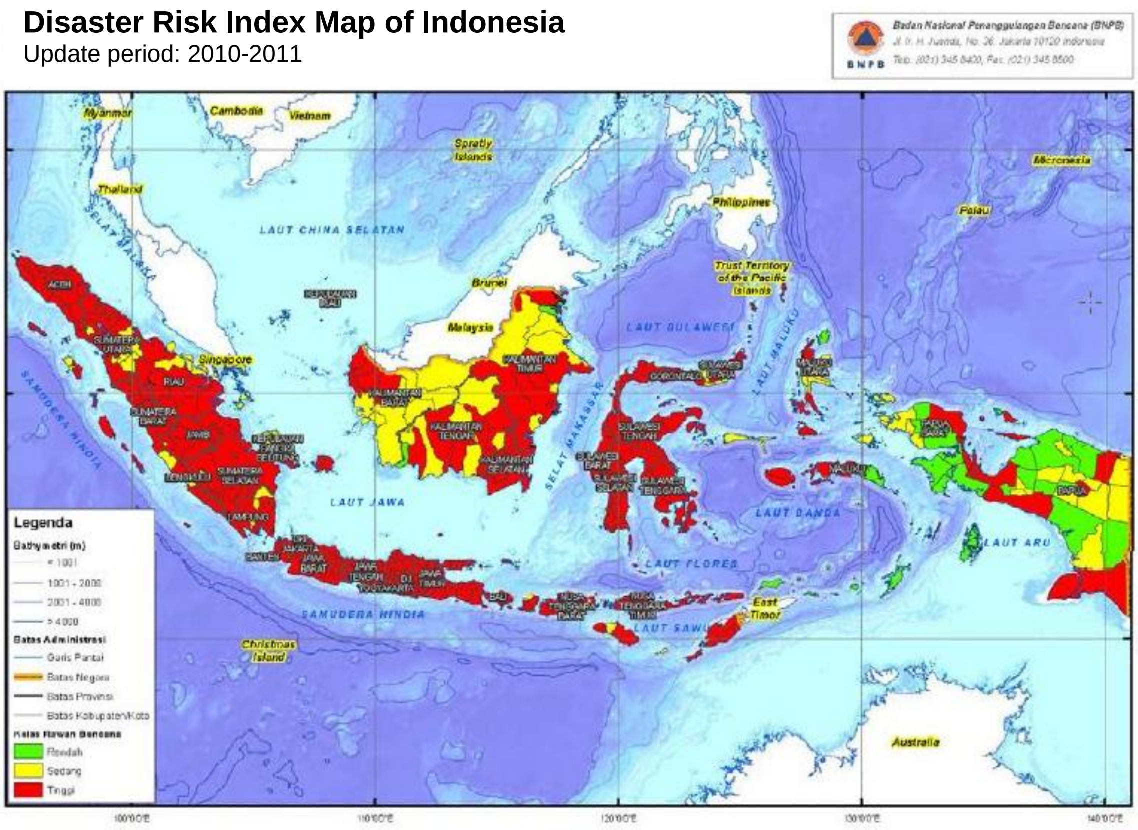

Figure 2-3 Indonesian Disaster Risk Index map (BNPB, 2011)

2.2.4.1. Disaster management in Indonesia

As described in the previous section, within a given range and frequency of hazards, Indonesia may be considered as a 'supermarket of disasters' (James, 2008). Effects of the earthquake and tsunami of Boxing Day 2004 in Aceh was an important trigger for the change and reorganisation of disaster management in Indonesia (Chang Seng, 2013).

Previously, disaster management in Indonesia was under the authority of BakornasPB (Disaster management coordination agency). At the provincial and district level there are Satkorlak (Implementation coordination unit) and Satlak (implementation unit) respectively. Satkorlak is usually chaired by governor and Satlak by mayor or *bupati* (head of a district). BakornasPB had a coordinating role, but lacked operational response and this awkward situation in the Indonesian governmental system made BakornasPB less effective in disaster management (UNDP, 2009).

After the 2004 tsunami, focus on disaster management started to shift from disaster response to disaster reduction when the disaster management law 24/2007 (Government of Indonesia, 2007) was enacted. The president of Indonesia issued a presidential regulation 8/2008 establishing the National Disaster Management Agency (BNPB) which replaced BakornasPB as the primary disaster management agency in Indonesia.

2.2.4.2. Post-disaster reconstruction in Indonesia

In the previous section 2.2.4, it was shown that earthquakes are a frequent, deadly disaster in Indonesia. The ground shaking in earthquakes may cause houses, buildings, bridges and infrastructure to collapse, bringing devastation to everything in an affected area.

In the last ten years, there have been three major post-disaster reconstructions in Indonesia. Figure 2-4 shows the location of the reconstruction, in Aceh, West Sumatra, and in Yogyakarta province. Comparing these locations with the disaster risk index in Figure 2-3, all three locations are in a very vulnerable location to disasters. In the following sub-sections, the reconstruction in those locations are briefly described.

Aceh earthquake and tsunami reconstruction

On 26 December 2004, a powerful earthquake, with a magnitude of 9.1, struck 250 km off the coast of Banda Aceh, Indonesia (USGS, 2004). The earthquake resulted in a tsunami that hit 12 nations, with Indonesia considered to be the worst hit. 130,000 people were victims; 37,000 were missing, and 500,000 were displaced. 800 km of coastline was devastated, and entire villages were totally damaged (BRR, 2005b, BRR, 2006a). Another earthquake struck on 28 March 2005, at Nias, Simelue and the southern part of Aceh, and this added additional damage and loss.

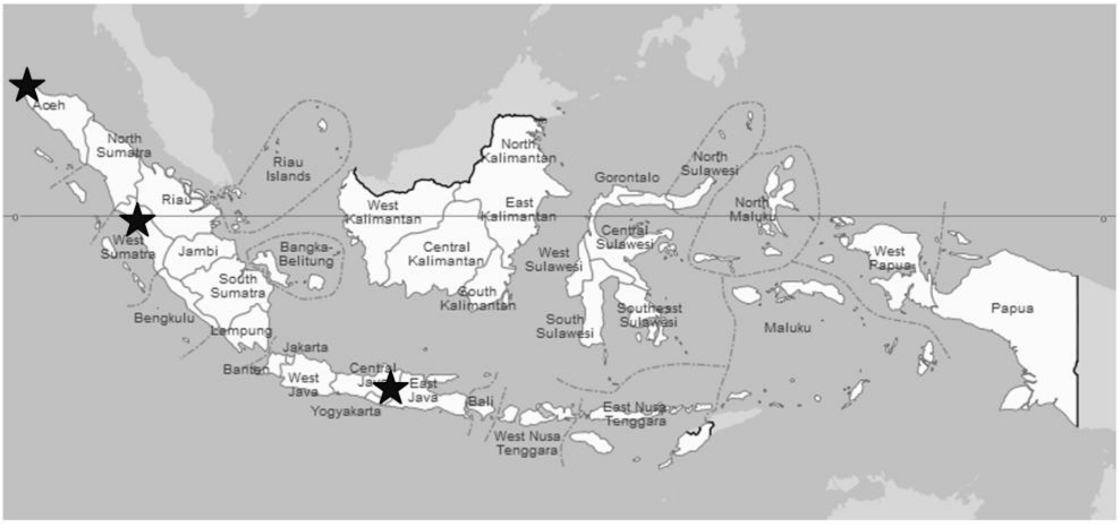

Figure 2-4 Map of post-disaster reconstruction in Indonesia

The government of Indonesia appointed the National Coordinating board for Disaster Management (Bakkornas PBP) to implement an emergency response. After the emergency response, the government established the Agency of Rehabilitation and Reconstruction for Aceh and Nias (BRR) on 28 April 2005. BRR's responsibility was to redevelop Aceh and Nias with the assignment to manage projects funded by the Indonesian Government's National Annual Budget (*APBN*) and to coordinate projects funded by donors and foreign NGOs (BRR, 2006b).

After four years of the reconstruction process in Aceh, BRR as implementing agency achieving the following results as described in Table 2-5.

Yogyakarta reconstruction

On 27 May 2006, an earthquake that measured 5.9 on the Richter scale struck, with the epicentre 33 kilometres south of Bantul city in the Yogyakarta province. It was estimated that 5,700 people became victims and more than 37,000 were injured in Yogyakarta and the Central Java province. Housing damage and loss were around 50% of the total loss, an estimated 154,000 houses were completely destroyed, and 260,000 houses suffered some damage (BAPPENAS, 2006a). The high number of casualties were due to high population density in the area and inadequate seismic design provision, for example, poor structural connection between roof systems and wall systems (Elnashai et al., 2007).

Table 2-5 Achievements after 4 years of Aceh reconstruction (BRR, 2010)

Effect of the earthquake and Tsunami	Achievement
635,384 people displaced	
127,720 people killed and 93,285 missing	
104,500 small-medium enterprises (SME) destroyed	155,182 labourers trained 195,726 SMEs receive assistance
139,195 houses destroyed	140,304 permanent houses built
73,869 hectares of agricultural land destroyed	69,979 hectares of agricultural land reclaimed
1,927 teachers killed	39,663 teachers trained
13,828 fishing boats destroyed	7,109 fishing boats built or provided
1,089 religious facilities destroyed	3,781 religious facilities built or repaired
2,618 kilometres of road destroyed	3,696 kilometres of road constructed
3,415 schools destroyed	1,759 schools built
517 health facilities destroyed	1,115 health facilities constructed
669 government buildings destroyed	996 government buildings constructed
119 bridges destroyed	363 bridges constructed
22 ports destroyed	23 ports constructed
8 airports or airstrips destroyed	13 airports or airstrips constructed

The recovery process was planned by the National Development Planning Agency (Bappenas) and coordinated with provincial governments of Yogyakarta and Central Java. The rehabilitation and reconstruction process focused on three programmes: housing recovery, public infrastructure recovery, and economic recovery; the process was estimated to take 2 years and was finished in 2008 (BAPPENAS, 2008).

In the reconstruction, the local government offered Rp.15 Million (approximately £1100) to each house for repair. The government also offered technical and management assistance by utilising facilitators from the Community Working Group (*Pokmas*); facilitators are recruited people with skills in building construction and social assistance (Setiawan, 2007).

Setiawan (2007) also notes the problems faced during the reconstruction were as follows:

- Late payment to the community working group (*Pokmas*);

- Availability of workers and materials;
- Difficulty in getting design drawings and building permits;
- Less utilisation of facilitators;
- Coordination in community working group (*Pokmas*).

West Sumatra reconstruction

A 7.6 Richter scale earthquake struck off the western coast of Sumatra island Indonesia; the epicentre was 45 kilometres from Padang, the capital city of West Sumatra province, in Indonesia. Two strong earthquakes succeeded a few minutes later. 739 lives were claimed as victims and 739 persons were missing. The damage also included 121,679 homes which were severely damaged, 52,206 which were moderately damaged, and 57,510 homes which were slightly damaged (United Nation, 2009). Furthermore, 447 office buildings, 4,784 educational facilities, 153 health facilities, 285 religious buildings, 58 markets, and 68 bridges were damaged (Pranoto et al., 2011). Although with this enormous amount of damage, the West Sumatra earthquake was declared a provincial disaster, it was not a national level disaster as previously declared by the government in the Aceh and Yogyakarta reconstruction.

The recovery process was led by the Government of Indonesia (GoI), and the recovery process is divided into several clusters: agriculture, early recovery, education, food and nutrition, health, logistics and telecommunications, protection, shelter, and water & sanitation.

After the humanitarian response to the West Sumatra earthquake, the number of non government organisations decreased from hundreds in 2009 to a few in 2010 (Ratnanto, 2010). On the other hand, the role of local government increased.

2.3. Project Management

2.3.1. Definition

Project Management Institute (PMI, 2008, p.5) defines a project as "*a temporary endeavour undertaken to create a unique product, service and result*". Temporary means that every project has a definite beginning and a definite end. A project has a definite duration which can be short (in months) or a long duration, as in years. The end of the project is when the project's objectives have been met, or it may be when it becomes clear that the project objectives will not, or cannot, be met and the project is terminated. Projects are also unique activities because an individual project has a different location, different design, and different contractors, and so on.

Project management is defined by PMI (2008, p.6) as "*the application of knowledge, skills, tools and techniques to project activities to meet project requirements*". The stages processed in project management are: initiating, planning, executing, monitoring and controlling, and closing.

Project managers in accomplishing the project objectives are conducting the following tasks: planning, organising, directing and controlling (Fryer et al., 2004). In the planning stage, project managers set objectives, anticipate what will happen and navigate a way to achieve the targets. Good planning characteristics are realistic, flexible, based on accurate information and readily understood (Fryer et al., 2004). In organising, project managers put plans into action by allocating tasks to people, requesting resources and coordinating the entire task. Because they are people who implement the plan, project managers also direct people by leading, communicating and motivating, co-operating and disciplining people. In implementing the plans, project managers control, compare realisation with the plan and take corrective action if there are variances in implementation.

2.3.2. Project success and critical success factors

Project success means different things to different stakeholders. A project that may seem successful to the client may be a completely unsuccessful venture for contractors or end users (Toor and Ogunlana, 2009). Stakeholders have distinct vested interest in a particular project and therefore the view of success may also vary across various stakeholders (Bryde and Brown, 2004).

Project success can be framed in terms of other concepts such as efficiency and effectiveness (Ika, 2009). Many authors and practitioners consider efficiency and effectiveness as synonymous, and this confusion is often present in the project management literature (Belout, 1998). As described by the famous American author, Peter Drucker, efficiency is to “do things right,” or to maximise output for a given quantity of inputs or resources, and effectiveness is to “do the right things,” or to attain the project’s goals and objectives. Drucker considers effectiveness to be more important than efficiency. Project success, therefore, corresponds to a project’s efficiency and effectiveness (Belout, 1998).

The success of a project can be viewed from two perspectives: macro level success and micro level success (Lim and Mohamed, 1999). End user and project beneficiaries usually see project success at a macro level where success is determined by final functions or benefits from the project. On the other hand, contractors and consultants view project success from the micro perspective, which is based on traditional measurements, i.e. the project is on time, within budget and according to specification. The other difference between the macro and micro view is that the macro view is more concerned with the long term benefit; the micro view is more focused on the short-term benefit.

Cookie-Davies (2002) also offers a distinction between project success and management success. Project success is measured against the overall objectives of the project and project management success is measured against common and traditional measures of performance against cost, time, and quality.

At the beginning of the research on success criteria, it was assumed that the success criteria were the ‘golden triangle’ of time, budget, and quality. However, the success criteria then have developed more than those three criteria. Many additional criteria may be identified and become significant criteria (Atkinson, 1999). The success criteria may be different to different stakeholders (Westerveld, 2003, Andersen et al., 2006, Toor and Ogunlana, 2008, Alzahrani and Emsley, 2013). For example World Bank, in its development project, views project success from impact and sustainability of the project (Ika et al., 2012). Perceiving project success simply as compliance with time, cost and quality constraints can be labelled as a ‘narrow’ view in this respect (Westerveld, 2003).

Success criteria are often related to key performance indicators (KPI), which is defined by Cox et al. (2003) as “compilations of data measures used to assess the performance of a construction operation". In his research Cox suggests six very significant indicators: quality control, on-time completion, cost, safety, $/unit, and unit/MHR.

Cookie-Davies (2002) highlights the difference between the success criteria and success factors. Success factors are those which contribute to achieving success on a project. Success criteria are the measures by which the success or failure of a project will be judged.

Success factors are defined in a business context as any knowledge, skill, trait, motive, attitude, value or other personal characteristic that is essential to perform the job or role, and that differentiates solid from superior performance (PEPDS, 2010). Rockart (1979) defined critical success factors (CSFs) as those few key areas of activity in which favourable results are absolutely necessary for a particular manager to reach his or her goals. Boynton and Zmud (1984) defined CSFs as those few things that must go well to ensure success for a manager and an organisation, and for that reason they represent those managerial or enterprise areas that must be given special and continual attention to bring high performance.

Within the project and project management contexts, the success and failure factors were first introduced by Rubin and Seeling (1967 cited in Belassi and Tukel (1996)) while the term "critical success factors" were first used by Rockart (Rockart, 1979).

The distinction between "success criteria" and "success factors" is also important (Cooke-Davies, 2002). Success criteria are the measures by which success or failure of a project or business will be judged, whereas success factors are those inputs to the management system that lead directly or indirectly to the success of the project or business. In construction projects, Ashley (1986) identified seven success factors and six success criteria. These success factors are planning effort (construction), planning effort (design), project manager goal commitment, project team motivation, project manager technical capabilities, scope and work definition and control systems. The six success criteria are budget performance, schedule performance, client satisfaction, functionality, contractor satisfaction and project manager/team satisfaction.

The application of the CSF method has significant benefits. CSFs can be used to direct organisational efforts in developing strategic plans (Munro and Wheeler, 1980), to formulate a set of strategies, and to identify critical issues associated with implementing a plan (Boynton and Zmud, 1984). CSFs also help project owners and managers to monitor and control project performance affectively (Yu and Kwon, 2011).

From previous studies, success factors have been identified and presented in Table 2-6. However, there is a paucity of research on success factors in a post-disaster reconstruction context. The extent to which the context of re-constructing after a disaster has on success factors remains largely un-researched. The findings in Table 2-6 provide a basis for formulating questions about CSFs for the questionnaire survey in this study (refer to Appendix C. The questionnaire shown on page 345).

Table 2-6 Identified success factors from publications

No.	Factor	Literature	Count of citations
1	Effective project control and monitoring	(Ashley, 1986, Pinto and Slevin, 1987, Slevin and Pinto, 1987, Belassi and Tukel, 1996, Munns and Bjeirmi, 1996, Cicmil, 1997, Cooke-Davies, 2002, Westerveld, 2003, Chan et al., 2004, Nguyen et al., 2004, Fortune and White, 2006, Iyer and Jha, 2006, Toor and Ogunlana, 2010)	13
2	Effective project planning	(Ashley, 1986, Morris and Hough, 1987, Pinto and Slevin, 1987, Belassi and Tukel, 1996, Munns and Bjeirmi, 1996, Cicmil, 1997, Westerveld, 2003, Chan et al., 2004, Nguyen et al., 2004, Fortune and White, 2006, Jefferies, 2006, Toor and Ogunlana, 2010)	12
3	Competent project manager	(Ashley, 1986, Kerzner, 1987, Belassi and Tukel, 1996, Westerveld, 2003, Chan et al., 2004, Nguyen et al., 2004, Fortune and White, 2006, Iyer and Jha, 2006, Toor and Ogunlana, 2010)	9
4	Appropriate project organisation	Bellasi and tukel (1996), Cicmil (1997), Cooke-Davies (2002), Chan et al. (2004), Fortune & white (2006), Jefferis (2006), Toor & Ogunlana (2009)	7
5	Competent project team	Bellasi and tukel (1996), Westerfeld (2002), Nguyen et al. (2004), Fortune & white (2006), lyer & Jha (2006), Jefferies (2006), Toor & Ogunlana (2009)	7

No.	Factor	Literature	Count of citations
6	Involvement of stakeholder/ community	Westerveld (2002), Chan et al. (2004), Nguyen et al. (2004), Fortune & white (2006), lyer & Jha (2006), Jefferies (2006), Toor & Ogunlana (2009)	7
7	Personnel	Ashley (1986), Pinto & Slevin (1987), Morris and Hough (1987), Munn & Bjeirmi (1996), Fortune & white (2006), lyer & Jha (2006), Toor & Ogunlana (2009)	7
8	Sufficient resources	Bellasi and tukel (1996), Westerfeld (2002), Nguyen (2004), Fortune & white (2006), lyer & Jha (2006), Jefferies (2006), Toor & Ogunlana (2009)	7
9	Top management / parent company support	Kezner (1987), Pinto & Slevin (1987), Chan et al. (2004), Nguyen et al. (2004), Fortune & white (2006), lyer & Jha (2006), Toor & Ogunlana (2009)	7
10	Feedback capabilities in the system	Pinto & Slevin (1987), Cooke-Davies (2002), Chan et al. (2004), Fortune & white (2006), lyer & Jha (2006), Toor & Ogunlana (2009)	6
11	Good written contract	Morris and Hough (1987), Sanvindo et al. (1992), Munn & Bjeirmi (1996), Bellasi and tukel (1996), Nguyen et al. (2004), Toor & Ogunlana (2009)	6
12	Information and communication	Pinto & Slevin (1987), Sanvindo et al (1992), Chan et al. (2004), Nguyen et al. (2004), Fortune & white (2006), Toor & Ogunlana (2009)	6
13	Political environment	Morris and Hough (1987), Munn & Bjeirmi (1996), Bellasi and tukel (1996), Chan et al. (2004), Fortune & white (2006), Jefferies (2006)	6
14	Fast-trouble shooting capabilities in the system	Kezner (1987), Pinto & Slevin (1987), Cooke-Davies (2002), Fortune & white (2006), Toor & Ogunlana (2009)	5
15	Learning from previous experience	(Sanvido et al., 1992, Chan et al., 2004, Nguyen et al., 2004, Fortune and White, 2006, Toor and Ogunlana, 2010)	5
16	Use of technology and IT	Bellasi and tukel (1996), Chan et al (2004), Nguyen et al. (2004), Fortune & white (2006), Toor & Ogunlana (2009)	5
17	Adequate funding	Morris and Hough (1987), Nguyen et al. (2004), Fortune & white (2006), Jefferis (2006)	4
18	Consultation/coordination/meeting	Pinto & Slevin (1987), Nguyen et al. (2004), lyer & Jha (2006), Toor & Ogunlana (2009)	4
19	Physical environment	Bellasi and tukel (1996), Chan et al. (2004), Fortune & white (2006), Jefferies (2006)	4
20	Economic environment	Bellasi and tukel (1996), Westerveld (2002), Chan et al. (2004)	3
21	Size of project	Ashley (1986), Chan et al. (2004), Fortune & White (2006)	3
22	Social environment	Morris and Hough (1987), Bellasi and tukel (1996), Chan et al. (2004)	3
23	Team composition	Sanvindo et al (1992), Jefferis (2006), Toor & Ogunlana (2009)	3
24	Absence of bureaucracy	Nguyen et al. (2004), Toor & Ogunlana (2009)	2
25	Awarding bid to right contractor	Nguyen et al. (2004), Toor & Ogunlana (2009)	2
26	Complexity of the project	Chan et al. (2004), Jefferies (2006)	2

No.	Factor	Literature	Count of citations
27	Industrial relation environment	Bellasi and Tukel (1996), Chan et al. (2004)	2
28	Procurement and tendering method	Chan et al. (2004), Jefferies (2006)	2
29	Project duration	Cooke-Davies (2002), Morris and Hough (1987)	2
30	Urgency	Morris and Hough (1987), Chan et al (2004)	2
31	Privately or publicly funded	Chan et al. (2004)	1

It is notable in identifying CSFs from previous studies that there is a range in number of success factors from each publication. For example, Kerzner (1987) proposes six critical success factors for successful projects. These factors are corporate understanding of project management, executive commitment to project management, organisational adaptability, project manager selection criteria, and project manager leadership style and commitment to planning and control. In comparison, a study by Toor and Ogunlana (2008) has identified 39 critical success factors, although they have grouped these factors into four categories. Nguyen et al. (2004) found that research on project success factors needs further effort; too general or too specific success factors pose certain difficulties when implemented in practice, particularly in developing countries where knowledge infrastructure, including state-of-the-art managerial skill, is not available (Nguyen et al., 2004).

Chan et al. (2004) carefully reviewed the literature on CSFs and suggested that CSFs can be grouped under five main categories: human-related factors, project-related factors, project procedures, project management action, and external environment. Their findings are supported by a study by Toor and Ogunlana (2009) who grouped success factors into four categories: human-related factors, project-related factors, project management-related factors, and external environment related factors.

2.4. Knowledge management

2.4.1. Definition of knowledge

Bender and Fish (2000) define knowledge as the mental state of ideas, facts, concepts, data and techniques which build on received information that is enriched by personal experience, belief, and values. Davenport and Prusak (1998) defined knowledge as a "*fluid mix of framed experiences, values, contextual information and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organisations, it often becomes embedded not only in documents or repositories but also in organisational routines, processes, practices and norms*".

Knowledge is context specific, produced knowledge will be different from one individual to another if the context is different (Aomolaiye and Egbu, 2005). Bender and Fish (2000) also note that even if different people receive the same information, formed knowledge will differ among the individuals.

Egbu, Hari and Kumar (2003a) defined knowledge management as "*a process by which knowledge is identified, created (acquired/captured), codified, stored, disseminated (shared/transferred), implemented (adapted, transformed, synthesised) and measured for the benefit of an organisation*". According to Moodley et al. (2001) knowledge management is about how to get the right knowledge to the right people at the right time, and it includes organisational processes which look for data and information capacity and is combined with creativity of people. Previously, Chase (1997) simply defined knowledge management as being about encouraging people to share knowledge to create value-added products and services.

2.4.2. Data, information and knowledge

Alavi & Leidner (2001) noted that in defining knowledge, some authors make a hierarchical view of data, information and knowledge. A common perspective of the hierarchy is to view data as raw numbers and facts, information is processed data and knowledge is authenticated information.

Information relates to facts, procedures, concepts, interpretations, ideas, observations and judgments, and will be processed in the minds of individuals and form knowledge (Alavi and Leidner, 2001). Knowledge is converted into information when expressed in the form of text, graphics, and words.

Bender and Fish (2000) also suggest a hierarchical view of data, information and knowledge, as presented in Figure 2-5. According to them, data are discrete and objective about facts or events which are also the raw material to form information. Data becomes information when meaning and understanding are added into the data. Furthermore, they suggest information transformed into knowledge of individuals includes personal experience, beliefs and values.

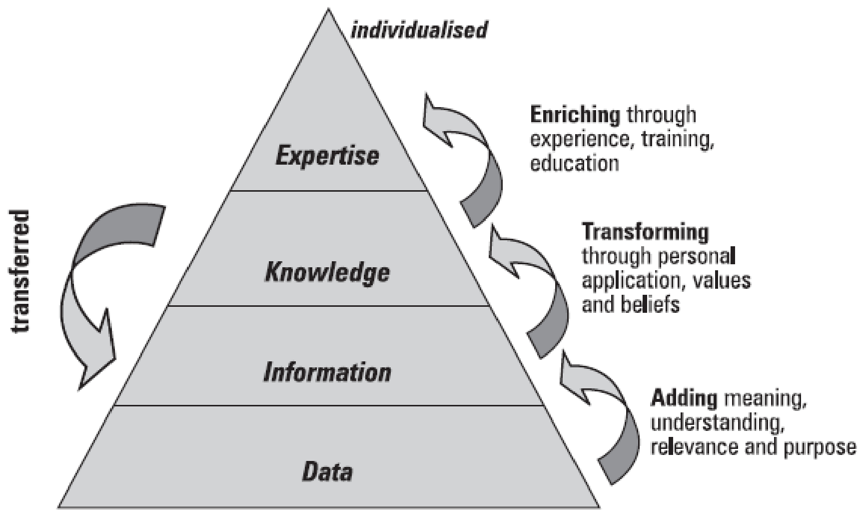

Figure 2-5 Knowledge hierarchy (Bender & Fish, 2000)

McDermott (1998) distinguishes knowledge from information with these following characteristics:

- Knowledge is a human act;
- Knowledge is the residue of thinking;
- Knowledge is created in the present moment;
- Knowledge belongs to communities;
- Knowledge circulates through communities in many ways;
- New knowledge is created at the boundaries of old.

Knowledge may be viewed from different perspectives; Alavi and Leidner (2001) suggest five perspectives: a state of mind, an object, a process, a condition of having access to information, or a capability.

Table 2-7 Knowledge perspective and their implication (Alavi and Leidner, 2001)

Perspective		Implication for knowledge management (KM)	Implication for Knowledge Management System (KMS)
Knowledge vis-à-vis data and information	Data is facts, raw numbers. Information is processed/interpreted data. Knowledge is personalised information.	KM focuses on exposing individuals to potentially useful information and facilitating assimilation of information	KMS will not appear radically different from existing IS, but will be extended toward helping in user assimilation of information.
State of mind	Knowledge is the state of knowing and understanding	KM involves enhancing individual's learning and understanding through provision of information	Role of IT is to provide access to sources of knowledge rather than knowledge itself
Object	Knowledge is an object to be stored and manipulated	Key KM issue is building and managing knowledge stocks	Role of IT involves gathering, storing and transferring knowledge
Process	Knowledge is a process of applying expertise	KM focus is on knowledge flows and the process of creation, sharing and distributing knowledge	Role of IT is to provide link among sources of knowledge to create wider breadth and depth of knowledge flows
Access to information	Knowledge is a condition of access to information	KM focus is organised access to and retrieval of content	Role of IT is to provide effective search and retrieval mechanism for locating relevant information
Capability	Knowledge is the potential to influence action	KM is about building core competencies and understanding strategic know-how	Role of IT is to enhance intellectual capital by supporting development of individual and organisational competencies

2.4.3. Type of knowledge

Many authors have identified types of knowledge, but the most widely accepted knowledge types are Polanyi's tacit and explicit knowledge (Al-Ghassani, 2003). Tacit knowledge is stored in the human brain in the form of mental models, skills and experience which is difficult to communicate, while explicit knowledge is encoded in organisational formal models, rules, documents, products, and can be easily communicated.

Knowledge is widely classified into tacit knowledge and explicit knowledge. Tacit knowledge is rooted in action, experience and involvement in a specific context and consists of cognitive and technical elements. The cognitive dimension refers to a mental model consisting of mental maps, beliefs, paradigms and viewpoints. The technical component consists of know-how, crafts, and skills in a specific context (Alavi and Leidner, 2001).

From \ To	Tacit	Explicit
Tacit	Socialisation	Externalisation
Explicit	Internalisation	Combination

Figure 2-6 Modes of knowledge conversion (source: Nonaka and Takeuchi, 1995)

Knowledge can be converted from one type to another by four modes of knowledge conversion, the SECI model (Figure 2-6), proposed by Nonaka dan Takeuchi (1995). Tacit knowledge can be converted into another person's tacit knowledge by a socialisation process, or can be converted into explicit knowledge by an externalisation process. The socialisation process may be in the form of face to face interaction, and the externalisation process is in codifying knowledge into written documents.

Conversely, explicit knowledge can also be converted into another type of explicit knowledge by a combination process and can be converted into tacit knowledge by an internalisation process.

2.4.4. Definition of Knowledge management

According to Obaide (2004) the field of KM is influenced and informed by many different disciplines that result in KM being multidisciplinary and there are many definitions of KM. These disciplines are: cognitive science (understanding of knowledge workers); social science (understanding motivation, people, interactions, culture and environment); management science (building knowledge-related capabilities); knowledge engineering (eliciting and codifying knowledge); artificial intelligence (automating routine and knowledge-intensive work) and economics (determining priorities).

Shankar et al. (2003) suggest some definitions of KM, arising from differently focussed studies, as presented in Table 2-8.

Table 2-8 Classification of KM definitions (Shankar et al., 2003)

No	Reference	Definition of KM
Focus: Need of KM		
1	CPA Journal (2008)	Knowledge management is concerned with organizing and analyzing information in a company's computer databases so this knowledge can be readily shared throughout a company, instead of languishing in the department where it was created, inaccessible to other employees.
2	Bair (1997)	Knowledge management aims to capture the knowledge that employees really need in central repository and filter out the surplus. Use of technology to capture the knowledge residing in the minds of the employees so it can be easily shared across the enterprise.
3	O'leary (1998)	Enterprise knowledge management entails formally managing knowledge resource in order to facilitate access and reuse of knowledge, typically by using advanced information technology. KM is formal in that knowledge is classified and categorized according to a pre-specified – but evolving – ontology into structured and semi-structured data and knowledge bases.
Focus: what KM demands		
4	Thomas et al. (2001)	Knowledge management is seen primarily as a domain of capturing, organizing, and retrieving information, evoking notions of databases, documents, query languages, and data mining.
5	Hannabuss, (1987)	Finding out how and why information users think, what they know about the things they know, the knowledge and attitudes they possess, and the decisions they make when interacting with others.
6	Hibbard (1997)	Combining indexing, searching and push technology to help companies organize data, stored in multiple sources and deliver only relevant information to users.
7	Anthes (1991)	Policies, procedures and technologies employed for operating a continuously updated linked pair of networked databases.
8	Gopal and Gagnon (1995)	Identification of categories of knowledge needed to support the overall business strategy, assessment of the current state of the firm's knowledge and transformation of the current knowledge-base into a new and more robust knowledge base by filling knowledge gaps.
9	Chorafas (1987)	Ensuring a complete development and implementation environment designed for use in a specific function requiring expert system support.
Focus: KM practices		
10	Mack et al. (2001)	Capturing knowledge and expertise created by knowledge workers as they go about their work and making it available to a larger community of colleagues. Technology can support these goals, and knowledge portals serves as a key tool for supporting knowledge work.
11	Birkett (1995)	Bringing tacit knowledge to the surface, consolidating it is usable forms by which it is more widely accessible, and promoting its continuing creation
Focus: KM and IT		

No	Reference	Definition of KM
12	Strapko (1990)	Understanding the relationships of data; identifying and documenting rules for managing data, and assuring that data accurate and integrity is maintained.
13	Zeleny (1987)	Facilitation of autonomous coordination of decentralized subsystems that can state and adapt their own objectives.
14	Maglitta (1995)	Mapping knowledge and information resources both on-line and off-line; training, guiding and equipping users with knowledge access tools; monitoring outside news and information.
Focus: KM processes		
15	Davenport (1994)	Process of capturing, distributing, and effectively using knowledge
16	Garvin (1994)	Creation, acquisition and transfer of knowledge and modification of organisational behaviour to reflect new knowledge and insight
17	Albert (1998)	The process of collecting, organizing, classifying and disseminating information throughout an organisation, so as to make it purposeful to those who need it.
Focus: holistic nature of KM		
18	Alavi and Leidner (1999)	Knowledge management refers to a systematic and organisationally specified process for acquiring, organising and communicating both tacit and explicit knowledge of employees so that other employees may make use of it to be more effective and productive in their work.
19	Maglitta (1996)	Knowledge management in general tries to organise an make available important know-how, wherever and whenever it is needed. This includes processes, procedures, patents, reference works, formulas, "best practice", forecast and fixes. Technologically, intranets, groupware, data warehouse, networks, bulletin boards, and video conferencing are key tools for storing and distributing this intelligence.
20	Zuckerman and Buell (1998)	Knowledge management is the strategic application of collective company knowledge and know-how to build profits and market share. Knowledge assets, both ideas and concepts and know-how, are created through the computerized collection, storage, sharing an linking of corporate knowledge pools. Advanced technologies make it possible to mine the corporate mind.

In relation to knowledge management, there are three main schools of thought or knowledge management models where management practices, techniques, and technologies adopted vary. These schools of thought are technocratic, economic, and behavioural (Earl, 2001, Egbu et al., 2003b). The technocratic model focuses on information management and information technologies which help employees improve their business performance. In the economic model, knowledge is regarded as capital or an asset to be exploited, and in the behavioural model endeavours to create the business culture which encourages knowledge production, sharing and use (Earl, 2001, Egbu et al., 2003b).

2.4.5. Benefits of KM

Organisations may adopt two strategies of knowledge management implementation, i.e. IT focus strategy and human resource management (HRM) focus strategy (Carrillo and Chinowsky, 2006). In an IT focussed strategy, knowledge management is implemented by providing IT tools to facilitate the capture, access, and reuse of knowledge and information. In an HRM strategy, the focus is on how to motivate and facilitate knowledge workers to develop, enhance, and use their knowledge to achieve organisational goals (Carrillo and Chinowsky, 2006).

Carrillo and Chinowsky (2006) argue that the two strategies above are based on differentiation between explicit and tacit knowledge by Nonaka and Takeuchi. Explicit knowledge is that which could be documented and stored in paper or electronic form. This explicit knowledge is suitable for an IT-focussed KM implementation strategy. Tacit knowledge is stored in people's heads and is acquired by experience. Tacit knowledge is better shared through face-to-face communication, community of practise, lessons learned; so tacit knowledge is more suitable for the HRM focus in KM implementation (Carrillo and Chinowsky, 2006).

Knowledge management is considered a key source of competitive advantage and may lead to organisational success, proven by various empirical and theoretical evidence. However, Choy et al. (2006) argues that there are unsuccessful KM efforts: " *…while many organisations are claiming to have implemented KM, not many of them are considered to be successful in their KM effort*". Their research focused on KM performance outcomes and from the previous ten related works they identified 37 performance outcomes (Table 2-9). They group the outcomes into five dimensions: 1. Systematic knowledge activities; 2. Employee development; 3. Customer satisfaction; 4. Good external relationship; and 5. Organisational success.

Table 2-9. KM performance outcomes (source: modified from (Choy et al., 2006))

No	Outcomes	Frequency of citation
1	Identifying and sharing best practices	5
2	Enhanced business development and creation of new business opportunities	5
3	New or better ways of working	4
4	Better decision making	3
5	Better customer handling through better client interaction and sharing knowledge with clients	3
6	Faster response to key business issues	3
7	Improved productivity in delivering products and services to clients and by solving emerging organisational problems	3
8	Reduced costs	3
9	Improved new product development	3
10	Better staff attraction/retention	3
11	Increased innovation and creativity	3
12	Development and constant improvement of competitive long-range service and technology strategies	2
13	Development of entrepreneurial culture for organisational growth and success	2
14	Improved employee skills and quality through capacity building and upskilling	2
15	Increased profits	2
16	Stimulation and motivation of employees	2
17	Enhanced product or service quality	2
18	Creation of more value to customers	2
19	Improved learning/adaptation capability	2
20	Formalised knowledge transfer system established – enhance transfer of knowledge between one employee to another	2
21	Enhanced and streamlined internal administrative processes	2
22	Better on-the-job training of employees	2
23	Immediate results in solving organisational-wide problems	1
24	Increased market share	1
25	Increased share price	1
26	Enhanced intellectual capital	1
27	Improved communication	1
28	Improved efficiency	1
29	Return on investment in KM efforts	1
30	Increased market size	1
31	Entry into different market type	1
32	Increased empowerment of employees	1
33	Improved capture and use of knowledge from sources outside the firm	1
34	Improved integration of knowledge within the firm	1
35	Enabled identification of knowledge gaps	1
36	Identified knowledge assets	1
37	Identified knowledge flow	1

Some benefits and barriers related to KM in the construction industry have been identified by Graham and Thomas (2005) which are related to people and culture, organisational performance and organisational structure. The benefits and barriers are depicted in Table 2-10 below.

Table 2-10 Benefits and barriers of KM (Graham and Thomas, 2005)

Benefits	Barriers
Cost/time reduction	Lack of time & money
Process and product improvement	Employee resistance
Innovation, success & market leadership	Poor organisational culture & structure
Client orientation & satisfaction	Piecemeal, ad hoc adoption
Improved decision support & problem solving	Problems of measurability and validation
Less repeated mistakes and duplication of work	Lack of incentives to encourage knowledge sharing
Improved staff quality, satisfaction, motivation & retention	Lack of understanding of the benefits of KM
Increased awareness, accessibility and availability of knowledge	Conflicting orientations to change and lack of sensitivities to context
More effective team work	

As in the previous table, implementation of knowledge management in an organisation has benefits when improving the organisation's performance. Furthermore, Tseng et al. (2012) have quantified the five-year outcome of knowledge implementation in SMEs in Hong Kong, as presented in the following table:

Table 2-11 Outcome of KM implementing SMEs

Dimension	Outcome
Internal process	Improvement in working process: 30% Speed up 10% of the time of search for technical documents Speed up 10% of the time of evaluation for alternative vendors Increase 10% of yield rate Increase 20% of accuracy rate on goods delivery
Finance	Reduce 11.6% of cost Increase 14.2% of revenue
Customer	Increase 10% of the efficiency of reply to customers Increase 10% of the customer satisfaction
Employee	Reduce more than 25% of the learning time Increase 20% of the ability of problem solving
Innovation	Speed up the R&D Increase more than 15% of number of idea Speed up the entry of market and organization change

Source: (Tseng et al., 2012)

2.4.6. Knowledge management in the construction context

Management of knowledge has become important in business in the last few decades since business' emphasis has moved from a resource based to a knowledge based business environment, the knowledge economy, which is based on knowledge workers (Drucker, 2001, Egbu and Botterill, 2001). Although the economic value of knowledge has been discussed for centuries, only in the mid 1990s was there a 'boom' of activity in knowledge management in the form of publications, conferences, or consultancies (Quintas, 2005). According to Quintas (2005) there are a few drivers that accelerated growth of knowledge management, for instance wealth generated from knowledge, realisation of people as the core in organisational knowledge, change of market, recognition of innovation as essential to competitiveness, and the limitation of technology. Knowledge management is a vital requirement for innovative organisations, which with knowledge management it enables knowledge in an organisation to be exploited and to have competitive advantages (Egbu et al., 2001).

One of the construction industry's characteristics is low profit margins. As the Egan report (1998) shows, it is one of the reasons for under-performance in the construction industry. Productivity is the key to overcoming the low level of margin in the industry. As Pathirage (2007) argued, knowledge management has become vital in the construction industry, since the industry is exploring ways to increase the efficiency, "*finding new ways of doing things*" (Pathirage, 2007). Also in order to fulfil clients' demand, construction organisations should improve on past solutions, innovate, and manage change, by producing new knowledge (Egbu et al., 2003b).

Fong (2008) argues that a project may be seen from two perspective. First, as a management view where the project is seen as the management of deployment of resources, including plant, people, and materials. The second view is that the project may be viewed from the knowledge perspective where the projects create and acquire knowledge from one project to the next.

A similar view is held by Egbu and Robinson (2005), who point out that the construction industry is a knowledge-based industry, although the industry is commonly known for its products: buildings, roads, bridges, dams and monuments. They argue that the construction industry provides services to its clients and customers, and the industry may be rightly labelled as a knowledge-intensive industry which depends on professional knowledge or expertise. Egbu and Robinson (2005) gave an example of the construction of a new modern office complex, in which 70% of production costs can be associated to knowledge-based elements.

The construction industry is considered as an important sector in a country's economy, as the industry employs millions of people and contributes significantly to GDP. The industry is dominated by small and medium enterprises and with small numbers of large companies. In the UK, small and medium enterprises (SMEs) account for over 90% of all organisations (Egbu and Robinson, 2005), in Indonesia, the proportion of SMEs is greater and large enterprises only account for 1% of all organisations (Suraji and Krisnandar, 2008).

For construction projects, Robinson et al. (2005) argue there is a need to classify knowledge of an organisation based on the business context: product, process and people. They show the distinction by considering the end product of construction projects, e.g. standard construction, traditional construction and innovative construction. These three end products need a mix of tacit and explicit knowledge, where innovative construction requires more tacit than explicit knowledge.

Based on Nonaka and Takeuchi's (1995) theory of knowledge creation, the SECI model, knowledge production in a construction project can be considered in four modes (Socialisation, Externalisation, Combination, and Internalisation) through interaction of individuals and organisations from the beginning of the project to the handing over of the completed project. The socialisation process transforms tacit knowledge into explicit knowledge. Trainee workers learn skills from their mentors through observation, imitation and practise (Egbu and Robinson, 2005). Reading manuals, textbooks or standards, then interpreting those documents to develop an internal mental model and is an example of the internalisation process which converts explicit knowledge into tacit knowledge. The opposite process, externalisation, is the process to convert tacit into explicit knowledge. An example of externalisation in construction is the drawing from the designer, which explains the designer's concept. Explicit to explicit knowledge interaction takes place through a process called combination. Individuals and project teams create knowledge through integrating and processing of various project documents.

However, the nature of the construction industry does not provide effective knowledge well (Graham and Thomas, 2005). According to the authors, the nature of the complex and disparate industry, with poor relationships, and employee migration of the industry contribute to ineffective KM. There are some characteristics that also contribute to it: one-off project teams, non-repetitive nature of works, pressure to complete and lack of incentives to appraise performance, all contribute to ineffective KM.

By assessing empirical works on knowledge management in the construction industry, Pathirage et al. (2007) highlight the people factor and their tacit knowledge is more important than the explicit knowledge. Tacit knowledge in the form of skills, experience and talent are considered to be valuable towards organisational performance due to the intrinsic characteristics of the construction industry (Pathirage et al., 2007) which are of a short-term, temporary, and project based nature (Green et al., 2004).

2.5. Summary

This chapter presents the literature review of knowledge management, project management, and disaster management. In the early part of this chapter, disaster and disaster management were discussed, primarily within the context of disasters in Indonesia. The discussion then reviewed project management, specifically in relation to project success factors and success criteria. The final part of this chapter discussed knowledge, knowledge management and its implementation in construction projects.

From the discussion throughout the chapter, the following conclusions can be made:

- Indonesia is very prone to disasters.
- The reconstruction phase plays a significant role in disaster management. The outputs of the reconstruction will affect the capacity of disaster-affected community in the next disaster.
- Various factors are identified in the literature review as being critical success factor (CSFs). However, there is little research into CSFs in a post-disaster reconstruction context.
- Knowledge management has benefits which can improve an organisation's performance. The construction industry may also be considered to be a knowledge-based industry; therefore knowledge management is also important to improve project performance.

Having discussed the central issues in these three topics, the next chapter presents a more in-depth discussion on the research methodology adopted in this present research.

CHAPTER 3. RESEARCH METHODOLOGY

3.1. Introduction

The aim of this chapter is to outline the research methodology and research methods adopted for this study. The first section of this chapter outlines the models of research methodology. The next sections discuss research philosophy, research approaches and research strategies. Then identification of the respondents, data collection method, and data analysis will be discussed. The final section of this chapter presents the profiles of the respondents.

This work is a PhD research study upon which the researcher enrolled on October 1st 2009. The main activities of the research are presented in Appendix H. Research timeline (page 378).

3.2. Definition and Model of research

There are many definitions of research. Research, in common terms, refers to search for knowledge or discovering something that is unknown (Phillips and Pugh, 2005). Fellows and Liu (2003) define research from several viewpoints; as careful investigation, contribution to knowledge and research as a learning process. Kothari (2004) defines research as the search for knowledge through objective and systematic methods of finding a solution to a problem.

Those definitions of research imply that there should be a systematic way of conducting research, which in publications is referred to as research methods or research methodology. These two terms are often used interchangeably, but there is a clear difference between those terms. Research methodology defines the overall approach to be used in the research process, from the theoretical underpinning to the collection and analysis of data (Collis and Hussey, 2003). Research methods refers to the techniques and procedures used to obtain and analyse data (Saunders et al., 2009). Therefore, research methods are a part of research methodology.

A number of models have been developed to illustrate the key elements of research methodology, for example the nested model (Kagioglou et al., 2000) and the research onion (Saunders et al., 2007).

Saunders et al (2007) argue that there are important layers to consider before choosing data collection techniques and analysis procedures. They proposed the 'research onion' (Figure 3-1), a research methodology that consists of layers starting from research philosophy at the outer layer, through research approaches and research strategies to data collection methods at the inner layer.

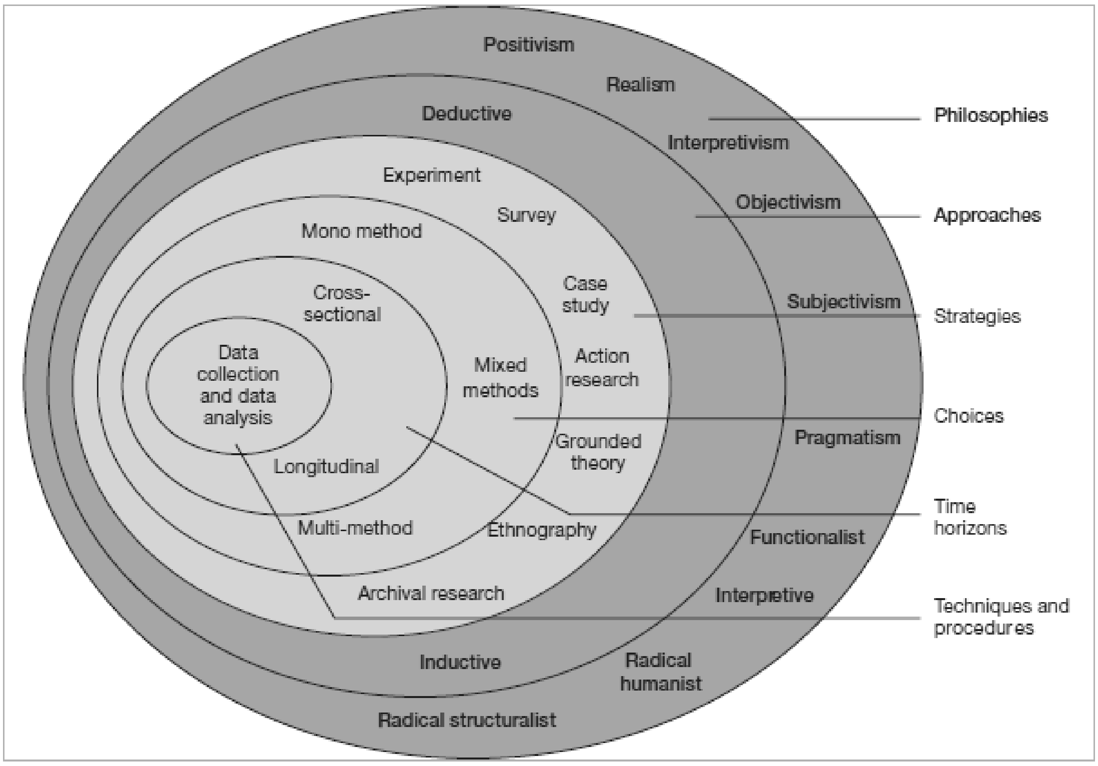

Figure 3-1 Research Onion (Saunders et al., 2007)

The nested model consists of three key elements: research philosophy, research approach and research techniques. Within this model the research techniques are guided by the research approaches and the research approaches are guided by the research philosophy. Research approaches consist of dominant theory generation and testing methods and the research techniques comprise data collection tools (Kagioglou et al., 2000).

Both of the research models show that research philosophy plays an important role in the research. The following section discusses the research philosophy.

3.3. Research philosophy

Research philosophy is a term that relates to development of knowledge and the nature of knowledge which contains assumptions of how we see the world (Saunders et al., 2007). According to Saunders et al. (2007), there are three ways of thinking about research philosophy: epistemology, ontology and axiology, all of which will influence the research process.

3.3.1. Ontology

Ontology is concerned with the nature of reality (Saunders et al., 2007). The ontology spectrum is objectivism and subjectivism. Objectivism assumes that social entities exist in reality external to social actors. Subjectivism believes that social phenomena are created from the perceptions and consequent actions of social actors, this is a continual process in that through the process of social interaction those social phenomena are in a constant state of revision (Saunders et al., 2007).

This research focuses on knowledge communication which basically requires an interaction of people. Therefore, the ontology assumption for this research leans toward to subjectivism.

3.3.2. Epistemology

Epistemology is concerned with the study of knowledge and what accepted as being valid knowledge, that involves an examination of the relationship between the researcher and that which is being researched (Collis and Hussey, 2003).

Saunders et al. (2007), define the important distinctions of epistemology as positivism at one end and interpretivism at the other end. In the positivism philosophy, the researcher will work with an observable social reality and the end product of the research can be law-like generalisations similar to those produced by the physical and natural scientist (Remenyi et al., cited in

Saunders et al., (2007)). Interpretivism is an epistemology that advocates that it is necessary for the researcher to understand the differences between the human role as a social actor, it emphasises the difference between conducting research among people rather than objects in the positivism stance (Saunders et al., 2007). Furthermore, Saunders et al. argue that interpretivsm is highly appropriate in the case of business and management research because situations of business and management are complex and unique and which will lose its rich insight if such complexity is reduced entirely to a series of law-like generalisations as in positivism.

Weber (2004) gives an explanation about the differences of positivisms and interpretivism which is shown in following table.

Table 3-1 Differences between positivism and interpretivism

Assumptions	Positivism	Interpretivism
Ontology	Person (researcher) and reality are separate.	Person (researcher) and reality are inseparable (life-world).
Epistemology	Objective reality exists beyond the human mind.	Knowledge of the world is intentionally constituted through a person's life experience.
Research object	Research object has inherent qualities that exist independently of the researcher.	Research object is interpreted in light of meaning, structure of person's (researcher's) life experience.
Method	Statistics, content analysis.	Hermeneutics, phenomenology.
Theory of truth	Corresponding theory of truth: one-to-one mapping between research statement and reality.	Trust as intentional fulfilment: interpretations of research object match lived experience of object.
Validity	Certainty: data truly measures reality.	Defensible knowledge claims.
Reliability	Replicability: research results can be produced.	Interpretive awareness: researchers recognise and address implications of their subjectivity.

Source: (Weber, 2004)

This research aims to develop a conceptual model of the role of knowledge communication in effective management of post-disaster reconstruction projects. Data gathering will involve the perception of experts and practitioners on post-disaster reconstruction projects. The focus is on what people are thinking, feeling or aware of regarding a certain topic, therefore the researcher needs to be part of what is being observed in order to understand and explain the phenomena. Hence, the epistemology for this research leans more towards interpretivism.

3.3.3. Axiology

The last research philosophical assumption is Axiology. It is a branch of philosophy that studies judgements about value (Saunders et al., 2007). In this continuum, an assumption has to be made about whether it is value free and unbiased or value laden and biased (Collis and Hussey, 2003). This study leans more towards the value-laden as the research choices are determined by human interest and belief.

3.4. Research Approach

Saunders et al (2007) define the research approach as how theory is developed, which can be classified as either the deductive approach or the inductive approach. In the deductive approach, researchers develop a theory and hypothesis (or hypotheses) and design a research strategy to test the hypothesis. While in the inductive approach, the researcher collects data and develops a theory as a result of data analysis (Saunders et al., 2007). Although it is potentially misleading, Saunders et al., state that the deduction approach is close to positivism and induction to the interpretivism philosophy.

3.5. Research strategy

There are three types of research purpose: exploratory, descriptive and explanatory (Saunders et al., 2007, Yin, 2009). Exploratory research is a valuable means of finding out 'what is happening, to seek new insights, to ask questions and to assess phenomena in a new light' (Saunders et al., 2007). Descriptive research is to portray an accurate profile of persons, events or situations, while an explanatory study is to establish causal relationships between variables (Saunders et al., 2007). Research questions can be both descriptive and explanatory, so the research may have more than one purpose.

Research strategy is the way the researcher chooses to answer the research questions; it will be influenced by the research philosophy and approach (Saunders et al., 2007). Saunders et al., propose the following research strategies; experiment, survey, case study, action research, grounded theory, ethnography and archival research. They also argue that no research strategy is inherently superior or inferior to any other and the research strategies are also not mutually exclusive. For example, it is quite possible to use the survey strategy as part of a case study (Saunders et al., 2007).

3.6. Research choices: mixed method

According to the research onion formulated by Saunders et al. (2007), the research choices consist of mono method, mixed method, and multi-method (Figure 3-1, page 51). The term ‘mixed method’ is often used interchangeably with ‘multi-method’. However, these are two different approaches. In a multi method, two quantitative inquiries (for example survey and experiment) are conducted in one research; or two qualitative inquiries (for example interview and observation) in a single research (Saunders et al., 2007, Pluye et al., 2009, Harrison, 2012). In mixed method investigations, qualitative and quantitative inquiries are conducted in a single research. Considering the research questions (which are exploratory and descriptive, see page 6), and the fact that this research is an initial study into knowledge management in Indonesia, it is important to adopt a mixed-method study that has some advantages (for example: triangulation, complimentary, expansion) which will be explained in section 3.6.

This study adopted the mixed method research approach, which integrates thematic and statistical data, combines qualitative and quantitative paradigms and allows investigation from both inductive and deductive perspectives (Johnson et al., 2007, Jogulu and Pansiri, 2011, Östlund et al., 2011). Therefore, this method enables researchers to combine theory generation and hypothesis testing within a single study (Jogulu and Pansiri, 2011). Furthermore, Jogulu and Pansiri (2011) add that adopting the mixed method approach may reduce over-dependence on statistical data from a social phenomenon or experience, which, mostly, is subjective in nature.

The mixed method approach is often referred to as the third path, the third research paradigm, or third methodological movement (Fidel, 2008, Modell, 2009, Jogulu and Pansiri, 2011). The approach is another option in research beside well the established quantitative and qualitative paradigm. The use of mixed-methods is growing, especially in the discipline of social and behavioural science, nursing, health and medicine, whilst in the business and management field the mixed-method has been accepted (Cameron and Molina-Azorin, 2011).

Mixed method research may be defined as "*the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration (Johnson et al., 2007).*"

There are five reasons to adopt a mixed method approach in research (Greene et al., 1989, Hesse-Biber, 2010):

- Triangulation: Triangulation seems to be the most commonly cited reason that mixed methods are incorporated into research. The researcher is looking for a convergence of the data collected by all the methods used in a study to enhance the credibility of the research findings.
- Complimentary: Allows the researcher to gain a fuller understanding of the research problem and/or to clarify a given research result. This is accomplished by utilising both quantitative and qualitative data and not just the numerical or narrative explanation alone to understand the social story in its entirety.
- Development: Mixed methods often aid in the development of the research project by creating a synergic effect, where by the "*results from one method…help develop or inform the other method*".

- Initiation: A study's findings may raise questions or contradictions that will require clarification, thus initiating a new study.
- Expansion: Producing detailed findings enables future research endeavours and allows researchers to continuously employ different and mixed methods in their pursuit of new or modified research questions.

Stewart et al. (2008) provides a long list of benefits experienced in mixed-methods research. For instance, it provides a holistic picture and analysis of one method that guides the other.

Since the mixed method combines both a quantitative and qualitative approach, thus the types of mixed method are based on the design and how it is weighted and the timing of the approach, or according to Creswell et al. (Creswell et al., 2004) on the priority and implementation of the mixed-method. One approach can be dominant over the other, or in contrast, both approaches are in equal weighted in the research. In timing of implementation, both approaches (qualitative and quantitative) can be conducted at the same time (concurrent) or implemented sequentially. In the sequential approach the research can be conducted using quantitative data collection first then followed by a separate qualitative data collection, or vice versa. The possible configurations of mixed method approach are presented in following table (Creswell et al., 2003, Johnson et al., 2007, Kroll and Morris, 2009, Rudd and Johnson, 2010, Jogulu and Pansiri, 2011, Harrison, 2012).

Table 3-2 Types of mixed method approach

	Concurrent	**Sequential**
Equal Status	QUAL + QUAN	QUAL → QUAN QUAN → QUAL
Dominant Status	QUAL + quan QUAN + qual	QUAL → quan Quan → QUAL QUAN → qual Qual → QUAN

Harrison (2012) conducted research on mixed-method research publications in a 10 year period in a journal of business research. From the twenty five publications, Harrison concluded that the priority skews more to quantitative strands where 40% prioritise quantitative data, 12% prioritise qualitative data and 48% prioritise both equally. In terms of the timing, Harrison found that more publications have a sequential design (68%) than a concurrent design (24%).

This research adopted an equal and concurrent (QUAL + QUAN) mixed-method design because the purpose of mixing the methods is to achieve triangulation. This design was used to ensure comprehensiveness and triangulation of the results. This design is also unique to triangulation in the Greene and Caracelli's mixed method designs, they state the following; "*Strong between-methods triangulation is also enhanced when the status of the different methods-that is, their relative weight and influence is equal and when the quantitative and qualitative study components are implemented independently and simultaneously*" (Greene et al., 1989).

Mixed-method research are concretely implemented at the techniques level of research, at the level of sampling, data collection and data analysis (Sandelowski, 2000). One of important aspects in the mixed-method approach is how to integrate the qualitative and quantitative data. Caracelli and Greene (1993) suggest four strategies for the integration: data transformation, typology development, extreme case analysis and data consolidation. In data transformation, one type of data is converted into another. For instance, quantitative data are transformed into narrative and included in qualitative data for thematic analysis. For data integration in typology development, Caracelli and Greene suggest the analysis of one data type produces a typology which is later applied as framework in other type of data. In extreme case analysis, extreme case findings from one type of data are then explored further in the other type of data, with additional data collection. The last strategy, data consolidation, reviews both types of data to create new or consolidated variables or data sets.

Mixed-method research may have challenges in the measurement of key variables, the analysis of data and the interpretation of the results (Lawrenz and Huffman, 2002). Triangulation in mixed-method research may have three possible outcomes, convergence, inconsistency and contradiction (Russek and

Weinberg, 1993). Divergence and contradictory findings may be considered to be an advantages because it challenges the researcher to search for the explanation (Waysman and Savaya, 1997).

Bryman (2007) revealed some barriers to integrating the qualitative and the quantitative research in mixed method research:

- Different audiences. Mixed-method researchers may write the research report with regard to the expectations of the audience by emphasizing one set of findings or excluding another set of findings.
- Methodological preferences. The researchers may have greater familiarity and confidence in one particular method, thus it will inhibit integration with another method.
- Structure of research projects. If either the quantitative or the qualitative component provides the main point of orientation of research it will be difficult to bring the research together as the research was not conceptualised in a sufficiently integrated way.
- Role of timelines. One method may produce results faster then another, so prevent the integration of the data.
- Skills specialism. The presence of skills specialism in mixed-methods research may lead to a division of roles and responsibilities that hinder the integration of the data.
- Nature of the data.
- Bridging ontological divides. The difference between objectivism and constructivism may make them difficult to combine.
- Publication issue. Some journals may want either quantitative or qualitative evidence to be highlighted. The other problem is length restriction in some journals that prevents the presentation of findings from qualitative and quantitative aspects of a mixed-method research.
- Problem of exemplars. The relative absence of well-known exemplars of mixed-methods research may cause difficulty for the researcher to combine the data because there is lack of ‘best practice’ to draw upon.

Implementing the mixed-method research may have an additional resource burden. As noted by some authors (Waysman and Savaya, 1997, Evans et al., 2002, Stewart et al., 2008, Kroll and Morris, 2009, Silva, 2011) that additional interview techniques for data collection required substantial additional time and financial resources for interviewing, transcribing and analysing the data. Furthermore, Waysman and Savaya (1997) argue that mixed-method research requires expertise in designing and implementing different methods, as well as in analysing, interpreting and integrating the findings from the different methods. As the results, Bryman (2008) demonstrates that mixed-method research is not always mixed to the extent that is sought.

3.7. Research ethical consideration

The basic ethical principal in data collection is that no harm should come to the respondents as a result of their participation in the research (Oppenheim, 2003, p.83). There are several considerations in ethical issues during a research (Saunders et al., 2007):

- Privacy of potential research participants and actual research participants.
- Participation in the research is voluntary in and participants have the right to withdraw partially or completely from the research.
- Consent and possible deception of participants.
- Confidentiality and anonymity of data from research participants.
- Unpleasant situations (embarrassment, stress, discomfort, pain and harm) for research participants during the data collection process.

Those considerations are acknowledged in this research. Before the data collection process a research proposal was submitted to the Research Ethic Panel of University of Salford for research ethical approval. This study received the approval on 29 September 2011.

3.8. Identification of the respondents

One important challenge in this research is identification of respondents. The post-disaster reconstruction process is viewed from a construction project management perspective, thus respondents for this research are construction project stakeholders that in Indonesia usually consist of contractors, consultants, and local governments (as project owner or client). A review of the literature on post-disaster reconstruction (see section 2.2.3, page 16) shows the involvement of NGOs and disaster-victims (or end-users of the project) in PDR projects. However, as noted by Shaw (Shaw, 2003) the NGOs also play a role as representative of the victims, so in this research the disaster victims (end-users) are excluded as respondents. As a result, there are four groups of respondents in this research: contractors, consultants, local governments, and NGOs. It is important to make sure that the respondents have experience of one post-disaster reconstructions project in Indonesia (Aceh, Yogyakarta, or West Sumatra reconstruction). In the following sub-sections the process of identification of those respondents will be discussed.

3.8.1. Identification of respondents from contractors and consultants

The first attempt to obtain a list of contractors and consultants involved in post-disaster reconstruction was by contacting '*Lembaga Pengembangan Jasa Konstruksi* (LPJK) (Indonesian construction service development board). LPJK, by law no 18/1999, is the only agency assigned to develop the construction industry in Indonesia. The secretary of LPJK was contacted, and surprisingly, LPJK do not have a list of contractors involved in post-disaster reconstruction. However, they have a database of contractors and consultants from all provinces in Indonesia on their website at www.lpjk.org. LPJK also suggested contacting government-owned contractors, because most of them are involved in reconstruction projects.

The database on the LPJK website (www.lpjk.org) offers basic information about a company, e.g. address, company qualification and classification and experience (Figure 3-2). It is difficult to identify a company that has experience in reconstruction because the search feature on the website only allows a search by company name. Users of the database have to open details of a company, one by one.

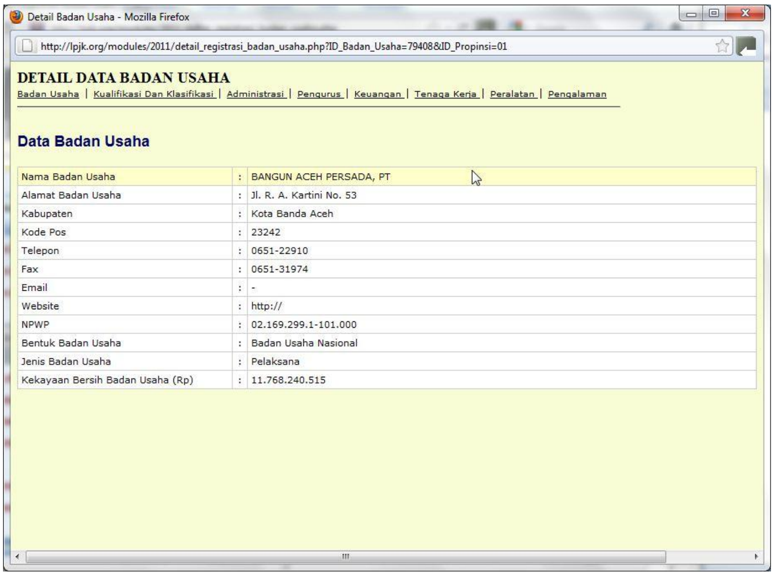

Figure 3-2 Database in LPJK website

The next attempt to obtain a list of contractors and consultants was by a web search. BRR is a government body in Aceh and Nias reconstruction and had produced a series of books which catalogue projects in reconstruction. The books can be accessed on the 'national development planning board' (Bappenas) website http://monevacehnias.bappenas.go.id. However, the books only contain information about the project name, location, contract value and the name of contractors.

From the six books downloaded from the Bappenas website (BRR, 2008a, BRR, 2008b, BRR, 2008c, BRR, 2008d, BRR, 2008e, BRR, 2008f), it can be identified that 2133 projects contained the names of contractors. The books are considered to be a good source from which this research could obtain contractors that have experience in post-disaster reconstruction. As the books only contained the name of the contractor, other information about contractor (e.g. address) was obtained from the LPJK website.

To ensure the contracting companies are still in business, the names from BRR's books were input into the company registration year 2010 database on the LPJK website. Although these books were published in 2008, almost half of them are not registered in the 2010 LPJK database.

By checking the name of the contractors, one by one, on the LPJK database 500 contractor details were initially available and were classified into a list of contractors which had experience in post-disaster reconstruction. In the middle of 2010, there was an internal dispute in the LPJK board of directors that resulted in a new board of directors for LPJK. As a result, the LPJK website also changed from www.lpjk.org to www.lpjk.net. The database of construction industry companies on the old website (lpjk.org) is not available on the new website (lpjk.net). It became difficult to obtain more contractors which have experience in post-disaster reconstruction for use in this research because the new website provides very few records on its database.

3.8.2. Identification of respondents from NGOs

The first attempt to obtain a list of NGOs involved in post-disaster reconstruction was from the website of the National Agency for Disaster Management (*Badan National Penaggulangan Bencana*, BNPB). Despite the BNPB website (http://www.bakornaspb.go.id) having a section entitled ‘NGO’s, there are only 4 links to NGO websites. The idea to use this website was abandoned.

For the second attempt, the list was obtained from Preventionweb (http://www.preventionweb.net) which is supported by UN-ISDR (United Nation International Strategy for Disaster Reduction). This website was chosen because most NGOs involved in the Aceh reconstruction were international NGOs. A publication entitled ‘Profile and directory: disaster risk reduction organisations in Indonesia 2008’ (BNPB, 2008) was obtained from the website. Surprisingly, this publication was produced by BNPB but was not found on their website. There are 62 organisations under the ‘international organisation’ section. However it was not possible to see which organisations were involved in reconstruction. The idea to use this publication was also dropped.

Since in this research there are three cases of reconstruction the next effort to find a suitable list for NGOs was from the websites of each reconstruction. In the Aceh reconstruction, there was RAND (Recovery Aceh and Nias Database, http://rand.brr.go.id/RAND/); the Yogyakarta and Padang reconstruction was provided by United Nations Office for the Coordination of Humanitarian Affairs (OCHA). These three databases have a comprehensive list of NGOs involved in the reconstructions, so it was used as a list for the population sample in this research.

It is necessary to make sure all NGOs in the databases are involved in physical reconstruction and they are still in business. RAND and OCHA databases provided contacts (name, email address, phone number) for each organisation involved in post-disaster reconstruction. Considering that Aceh and Yogyakarta reconstruction has finished and the reconstruction, as a project based activity has ceased, personnel will have moved to another area and in all probability most contact phone numbers will no longer be active, it was considered that email addresses were more suitable to contact the NGOs.

From the databases, contacts details for potential respondents were obtained and acted as a sampling frame in this research. The potential respondents may have been involved in two or all three reconstruction projects, so contacts acquired from databases were re-checked to avoid duplication. The final contacts, as shown in Table 3-3, a total of 644 individuals and their emails are identified using this approach.

Table 3-3 Number of email contacts identified for respondents from NGO

Reconstruction	Source database	Number of contacts
Aceh	RAND	298
Yogyakarta	OCHA	132
West Sumatra	OCHA	214

After the RAND and OCHA databases were chosen as a source list for the population sample it was also necessary to make sure email addresses of contacts were still active and reachable. Most email software provides notification when a sent email has arrived at the designated address. The notification is usually a simple report of 'delivered' or 'failed'. In this research an email was sent from Microsoft Outlook software to each contact, with re-delivery receipt requested.

Furthermore, some authors (Wright, 2005, Naoum, 2007) suggest that introduction or notification to respondents about the research will probably increase response rate form questionnaires. Introduction and invitation emails were sent individually to each potential respondent between 11th and 27th July 2011. With the introduction email a research information sheet was attached. The sheet provides information about the research, the funding and research ethics so the respondent can decide to participate or not in this research. Examples of the introduction and invitation emails and the research information sheet can be sees in Appendix B, page 342.

Results from the notification of emails and response emails from contacts were as follows:

Table 3-4 Delivery notifications and email response

Email status and response	**Aceh reconstruction contacts**		**Yogyakarta reconstruction contacts**		**West Sumatra reconstruction contacts**		**Total**	
Failed	152	51%	62	47%	44	21%	258	40%
Delivered	97	33%	46	35%	125	58%	268	42%
Reply and Reject	6	2%	6	5%	8	4%	19	3%
Participate	**28**	9%	**14**	11%	**29**	14%	**71**	11%
Not Known	15	5%	5	4%	8	4%	28	4%

The status of the ‘failed’ email when the email was sent did not reach the destination address because no such address existed in the designated mail server. ‘Delivered’ in the table above means a sent email was safely delivered to a contact’s mailbox, but they did not reply to the introduction-invitation email. ‘Participate’ means the contact agrees to be a respondent in this research and ‘reply and reject’ means they decided not to participate in their reply email. Some emails that were sent to contacts were categorised as ‘not known’, because there was no delivery notification so it was not possible to decide if the email was delivered or failed.

From Table 3-3 it can be seen that the number of failed emails is quite high, around 40 percent. Perhaps the main reason is the emails domains no longer exist, thus the email addresses also do not exist. The number of delivered emails where no reply was received is also high; most of these emails are from free email services, e.g. Yahoo and Gmail. However 90 potential respondents have replied to the email and responded to the invitation, the result was 19 persons declined to participate and 71 persons agreed to participate in this research. The 71 potential respondents will be sent the questionnaires.

3.8.3. Identification of respondents from local governments

Respondents from government in this research are from local governments. Local governments are defined as a government at the level of a district (*kabupaten*) or city (*kota*). Indonesia has 399 district governments and 99 city governments, totalling 497 local governments. From the reconstruction reports published by Bappenas (Bappenas, 2006b, BAPPENAS, 2006a, BAPPENAS, 2008, Bappenas, 2009), 45 local governments have been identified as being involved in post-disaster reconstruction.

After determining 45 local governments, the next step is to choose to whom the questionnaire will be sent because local governments consist of many agencies (*dinas*). Because reconstruction works are physical construction projects they are closely related to the public works agency (*dinas pekerjaan umum* or commonly abbreviated to PU).

The next challenge was to find contacts and addresses for public work agencies for each local government. The Department of Public Works, as the agency at the national level is known, did not have any kind of list of all local public work agencies on its website. The alternative way was by using Google Search to find contacts and addresses for public work agencies. Most of the contacts and addresses were acquired through local government official websites. Although this method takes a longer time, it was successful for locating respondents from within governments.

The process and source for identification of respondents for the questionnaire survey is described in Figure 3-3.

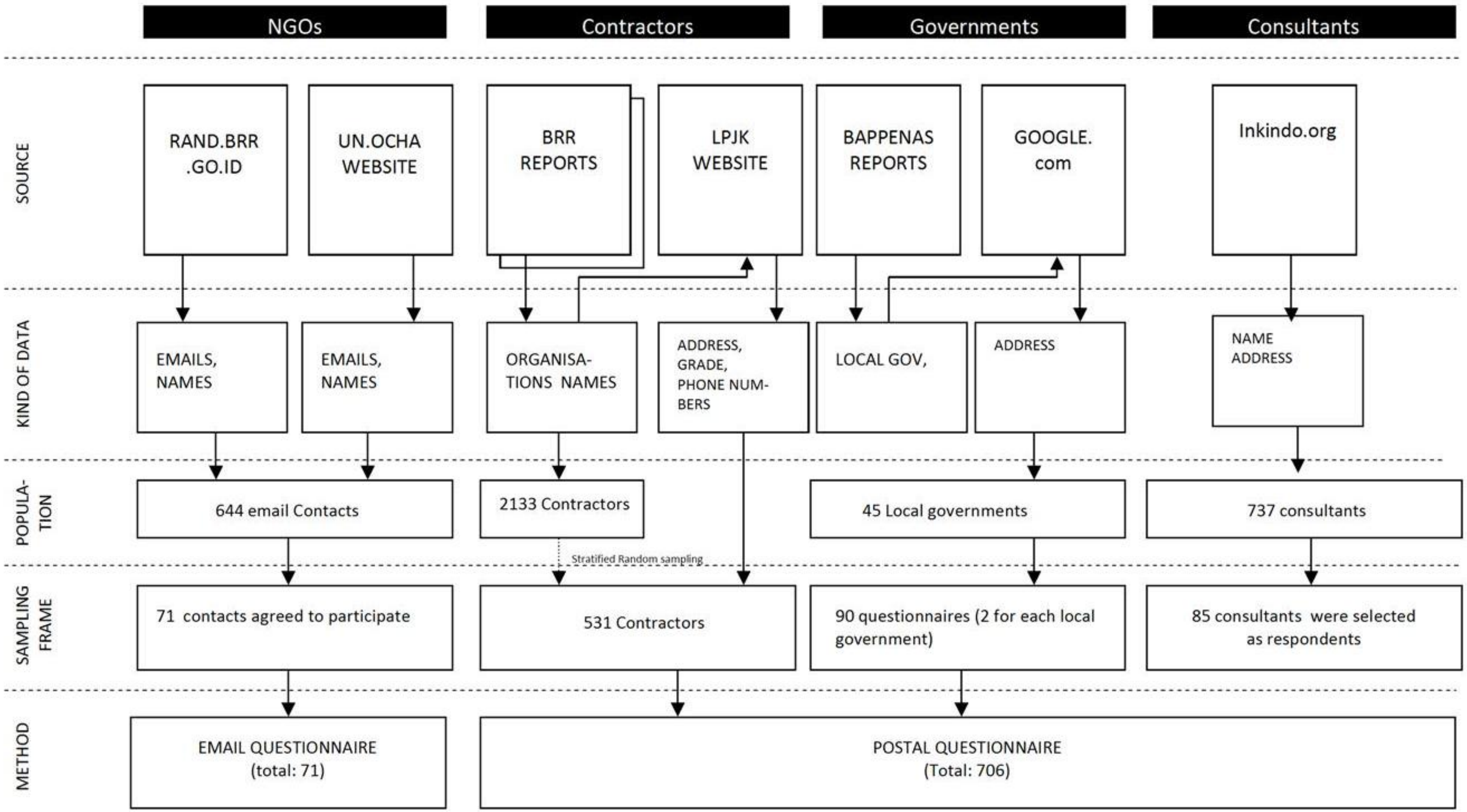

Figure 3-3 Identification respondents for the questionnaire survey

3.9. Data collection methods

There are two main research techniques available to draw data and information from respondents, these are postal questionnaires and interviews (Naoum, 2007). Since this research is implementing mixed methods, both techniques will be implemented.

3.9.1. Questionnaire survey

Postal questionnaires are suitable for surveys that are ‘simple enough’ to be explained in a few printed paragraphs. Naoum, (2007) suggests postal questionnaires have been widely used for descriptive and analytical surveys in order to find out facts, opinions and views on what is happening, to whom, where, how many or how much. The benefits and limitations of postal surveys are explained in the following paragraphs.

Benefits of using questionnaires (Egbu, 1994, Naoum, 2007):

- Questionnaires can cover a wide geographical range, it is perceived to have high validity in the results. The questionnaire also has economical benefit because it is suited to collecting a mass of information at minimum expense.
- It is a quick method of conducting surveys, if administrated properly the bulk returns will be received within two weeks. A reminder needs to be sent to those who have not returned the questionnaire after two weeks.

On the other hand, the limitations of questionnaires are as follows (Naoum, 2007):

- The postal questionnaire is only suitable for simple and straightforward questions which can be answered with the aid of easy instruction. So the questions need to be very carefully worded and free from ambiguity, vagueness, technical expressions and difficult questions.
- The questionnaire is not flexible where the answers have to be accepted as final and there is no opportunity to clarify the answer.

- The respondent may answer generally when asked about a specific. Also the respondent may answer what they think the researcher wants to hear.
- There is no control over respondents. Although in the questionnaire it is stated that a particular person should complete the questionnaire, there is no guarantee this statement will ensure the right person will complete the questionnaire.
- Companies receive many questionnaires and business pressure may make student questionnaires a lower priority.

Questionnaires can also be distributed online or by internet questionnaire. Because the cost of computer hardware and software is decreasing more people are using the internet for communication and information. Wright (2005) suggests the internet is a rich domain for conducting survey research. There are many web survey businesses that offer services and products to conduct online surveys. Gorard, (2003) also suggests email questionnaire have a better response rate than postal questionnaire and also have a very short response time.

Furthermore, Wright explains the benefits and disadvantages associated with online surveys. The advantages are the ability of online surveys to access individuals in distant locations, the ability to reach difficult to contact participants and automated data collection in online surveys reduces researcher effort and time. Online surveys also have economical benefits where it is cheaper compared to paper questionnaires. On the other hand, the disadvantages are concerned with the validity of data and sampling issues and concern about the design, implementation and evaluation of an online survey (Wright, 2005).

3.9.1.1. Design and contents of the questionnaire

After deciding to adopt the questionnaire survey as a data collection method, it is important to spend time designing the questionnaire. As discussed earlier, one of the disadvantages of the questionnaire is having no control over respondents, i.e. the response depends on the respondents' willingness to complete the questionnaire. Success of a questionnaire survey may be rated by the response rate. Thus, it is important to incorporate some aspects of increasing the response rate into the questionnaire design.

Tung (2000) implies that the design of the questionnaire may affect the response rate, which include the sequencing of the questions, the way the questions are framed, the content of the questions and the wording of the questions. Dillman (2007) in his book ‘Email and Internet Surveys’ considers response rates to be a social exchange which ‘*action of individuals are motivated by the return these actions are expected to bring, and in fact usually do bring, from others’*. Dillman suggests 3 vital elements for predicting a particular activity: rewards, cost and trust. The theory of social exchange implies the following questions are important for designing a questionnaire and implementation process: how to increase rewards for responding, how to reduce the cost and how to establish trust (Dillman, 2007).

Research by Edwards et al. (2002) compared several variables which affect the response rate and advice on how to increase the response rate is given. The variables are incentive, length of questionnaire, appearance, method of delivery, contact, content, origin of questionnaire and communication with respondents.

In the context of health research, Edwards et al. (2004) in their publication analysed 38 questionnaire survey trials and they suggest that the response rate can be increased by using a shorter questionnaires. Jepson et al. (2005) found 1000 words to be the threshold point in survey response rates; where the questionnaire which contains less than 1000 words has a better response rate than a questionnaire containing more than 1000 words. Similar studies (Kalantar and Talley, 1999, Edwards et al., 2002, Ronckers, 2004, Edwards et al., 2009, Rolstad et al., 2011) also reveal that shorter questionnaires may increase the response rate. However, Mond et al. (2004) reported a contrast result, where there is little to be gained by reducing the length of questionnaire. According to them, delivering the questionnaire by hand is more effective than a postal delivery (Mond et al., 2004). Gorard, (2003) suggested a maximum of eight pages self-administrated questionnaire, and to keep the number of questions below 100.

In the questionnaire the respondents were asked to rate answers by using a five-point scale (1 to 5), based on their experience in PDR projects. This five-point scale is commonly used in project management research. Furthermore, a study by Weijters et al. (2010) show in their framework that a 5-point, fully labelled, scale is the most appropriate method for opinion measurement for the general population. Point 1 is the minimum level and at the opposite end point 5 is the maximum. For example in rating challenges in PDR projects, point 1 represents 'not challenging at all' and point 5 represents 'very challenging'. The scale is similar to the Likert scale attracts critics and debates on whether it can be treated, or not, as interval data that allows the use of mean scores for data analysis (Jamieson, 2004, Norman, 2010). However in project management literature it is not uncommon to treat the Likert scale as interval data and use mean score for analysis. For instance, the International Journal of Project Management has many publications (examples: Andersen et al., 2002, Ogunlana et al., 2002, Dvir et al., 2003, Lyons and Skitmore, 2004, Nordqvist et al., 2004, Parker and Skitmore, 2005, Lebcir et al., 2008, Ling et al., 2009, Qureshi et al., 2009, Din et al., 2011, Jun et al., 2011, Liu et al., 2011, Caniëls and Bakens, 2012, Hwang and Low, 2012, Seiler et al., 2012) that use the Likert scale and mean scores in their analysis.

The questionnaire for this present research was carefully laid out in Ms-Word software and designed to appeal to respondents. The questions and the answers on a five-point scale were formatted into tables, provided with check-boxes to answer the questions to give it gives professional look. The questionnaire survey can be found in Appendix C.

Since this survey has two questionnaire delivery methods, postal and email, the instructions for completing the questionnaire were different. In the postal questionnaire the instruction is 'to tick (☑)' the provided boxes. The design for email questionnaire was from different than the postal questionnaire, where the boxes were converted into 'check-boxes'. This enables the email-respondents to answer directly in the questionnaire file by clicking appropriate boxes.

The contents of the questionnaire are grouped into 5 sections in a ten page questionnaire. Brief descriptions of the sections are as follow.

- Section A is about general information of the respondents,
- Section B covers questions on challenges in post-disaster reconstruction projects;
- Section C asks about project success criteria and critical success factors;
- Section D contains questions about knowledge communication in post-disaster reconstruction projects, covers knowledge communication methods, knowledge communication barriers and the role of knowledge communication;
- The last section, section E, is the closing section.

3.9.1.2. Questionnaire administration

The distribution of questionnaires started in the first week of March 2012, with two methods of distribution: postal questionnaire and email attachment. Postal questionnaires were all mailed directly to the following respondents: contractors, consultants and government employees and email questionnaires were sent to respondents from NGOs. The address of contractors and consultants were obtained from company registration 2010 on the Indonesian construction industry development board (LPJK) website at www.lpjk.org (see section 3.8).

A set of sent questionnaire consists of four parts; they are the ten-page questionnaire, a covering letter, a sending envelope and a return envelope (Figure 3-4). The cover letter describes the aim of the research, and highlights the importance of the respondent's contribution, a statement about the confidentiality of the research, and information on returning the questionnaire. Lewin (2005) indicates that a cover letter with these contents improves the response rate of self-administrated questionnaire. The cover letter is individually written to respondents and includes the respondent's address.

In the questionnaire set is also provided a stamped-addressed envelope, the return envelope is A5 in size, smaller than the sending envelope (size A4). The return envelope is stamped to remove any cost burden by respondent. The return envelope is already labelled with the return address in order to avoid addressing errors in returning the questionnaire.

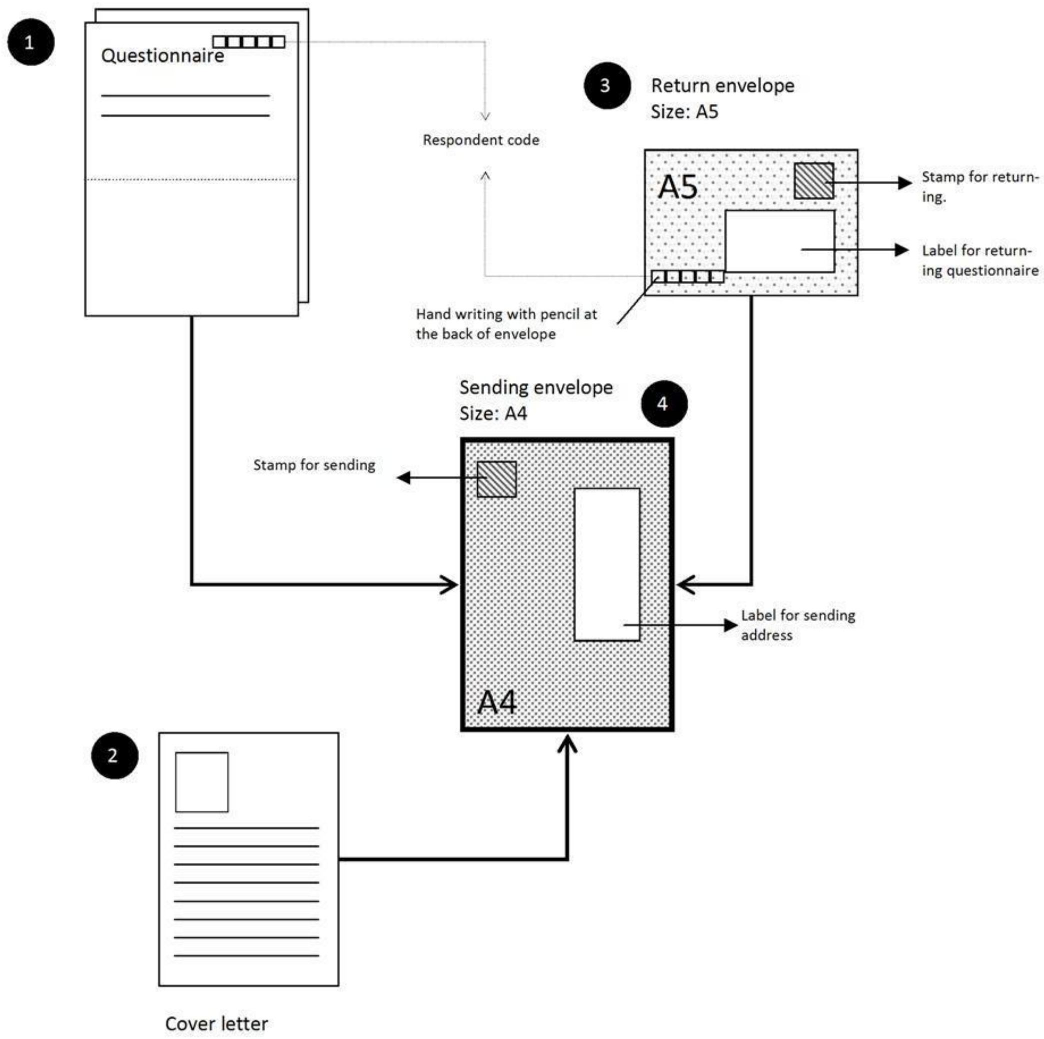

Figure 3-4 Contents of sent questionnaire

It was expected there will be non-response where the respondents do not return the questionnaire. To track respondents who have returned the questionnaire a 'respondent code' is assigned to each of the questionnaires. The code is hand written, in a small size, so as not to be obvious on the front of the questionnaire and on the back of return envelope.

With this attention to detail, it is hoped that the respondents will only have to make the smallest possible effort to complete and return the questionnaire. However, there is another challenge after the respondent has completed the questionnaire, to post it. Mail boxes are now uncommon in Indonesia, so to post the questionnaire the respondents must go directly to the post office. This may reduce the response rate of the questionnaire.

The questionnaire for email distribution was created using Microsoft Word software version 2007, and provided a 'check box' for the respondents to click the answers on the questionnaire. The questionnaire document is locked with a 'protect document' feature therefore, the respondents cannot edit the document.

The questionnaire document was sent as an email attachment, and for tracking purposes, in every email the 'delivery report' was activated. In a similar way as the postal questionnaire, the email questionnaire was sent individually with personal covering letter.

The detail of sent questionnaire is presented in the following Table 3-5.

Table 3-5 Distribution of sent questionnaire

Respondent group	**Number of sent questionnaire**	**Method of distribution**
Contractors	531	Postal
Consultants	85	Postal
NGOs	71	Email
Governments	90	Postal
Total	777	

3.9.1.3. Improving response rate

At the end of the second week of questionnaire distribution 13 postal questionnaires have been returned. It was considered relatively low. Payne & Payne (2004, p.222) argue that high response rates depend on good record keeping and prompt intervention. Several authors (Egbu, 1994, Olomolaiye, 2007, Edwards et al., 2009, Din et al., 2011) also suggest employing follow-up techniques to increase survey response rates after the questionnaires have been sent out. A telephone call and email reminders are the most commonly used techniques and the authors also suggest sending replacement questionnaires to non-respondents to increase the chance of them answering the questionnaire, "*...the respondents have another opportunity to return something without having to wade through a pile of files on their desk or in their office*" (Olomolaiye, 2007).

Non respondents can be identified from the 'respondent code' which is given as a reference number in each questionnaire. The first follow up was made to the non respondents three weeks after the initial questionnaire distribution, in the form of a written reminder.

The second follow up was conducted in the sixth week after the initial distribution, also in the form of a written reminder. However, in the second reminder the questionnaire and cover letter were re-sent with the reminder letter.

3.9.1.4. Response rate at the eight week stage

In the eighth week after sending out the questionnaires, 151 responses were received as shown in Table 3-6 below.

Table 3-6 Questionnaire response

Week	Postal		Email		Total	
	Returned	undelivered	Returned	undelivered	Returned	undelivered
1	0	0	16	1	16	1
2	13	46	12	0	25	46
3	23	35	6	0	29	35
4	14	5	8	0	22	5
5	16	2	2	0	18	2
6	16	13	0	0	16	13
7	11	6	0	0	11	6
8	14	11	0	0	14	11
Total	107	118	44	1	151	119

All the questionnaires were fully examined and it was decided to discard eight questionnaires because they were uncompleted or incomplete.

The final number of respondents from the questionnaire survey is 143 respondents with distributed as shown in following table.

Table 3-7 Final number of usable returned questionnaire

Group	Number of usable questionnaires
Contractor	47
Consultant	26
Government	34
NGO	36
Total	143

Although this research used a relatively recent database, i.e. company registration in year 2010, 119 questionnaires were returned by the post office to the researcher, undelivered. Most of the undelivered questionnaires were addressed to contractors from Aceh province. The reasons the questionnaires were returned by the post office were because the organisation name was not known at the address or the addresses were found but the organisations had moved.

To understand this situation, an explanation from secretary of a contractor's association, given below, may illustrate why many questionnaires returned undelivered:

> *"We have 3000 to 4000 members across Aceh, with only 10 companies with large qualifications. From the 4000 in the company there are only 10 large companies. Of the 10 companies that qualified, I guess there are only 4 or 5 good companies. Good in the sense that the company has offices, has a staff of experts, each day there are activities and they have the proper equipment. 5 companies were good again, but their work is 'Monday-Thursday' [difficult]. Then the staffs of experts are not settled, if there is a project there are experts, if there is no project, no expert staff.*
>
> *The number of medium companies is roughly 15% to 20%, the remaining 80% are small firms. Medium and small companies, many do not have an office, the office is in a car or on a motorcycle."*

Another view from contractor about use of an address for their office:

> *"At one address could reside several companies. Because at the time of project tendering it is easier if the companies under one coordinator. I have one company, but below me I have another company that I can use as a coordinator. So to make it easier, use the coordinator's address. Then, because there is no activity, the address is still listed, but no activity.*

> *We are renting an office at the moment. Contractors may borrow their address from their friend. If the lease is up they move and the old address is not changed."*

The undelivered postal-questionnaire may be excluded from response rate calculation (Yu et al., 2008, Tuuli and Rowlinson, 2009, Breuer et al., 2011, Maute, 2011, Boschman et al., 2012). If the 119 undelivered questionnaires are excluded from the total of 777 questionnaires, the response rate is 22.9%. Of these, eight questionnaires are considered incomplete and unusable. As a result, the number of useable questionnaires is reduced to 143, representing a response rate of 21.7%.

3.9.1.5. Response rate of questionnaire surveys in other similar studies

By the eighth week of the initial questionnaire distribution the response rate is 21.7%. This is considered to be a low response rate. To understand the response rate of questionnaire methods in project management research the researcher analysed papers published in the International Journal of Project Management (IJPM). The journal is accessed online via www.sciencedirect.com and with a search query "'response rate" questionnaire' for all years IJPM publications the result is 169 articles. Fifty articles have been analysed and the average survey response rate from the fifty publications is 40%.

Al-Tmeemy et al. (2011) conducted a questionnaire survey on contractor organisations in Malaysia and this resulted in a 22.8% response rate. They argue that this level of response rate is acceptable because the normal response rate in the construction industry is 20-30%. A 20-30% acceptance response rate for the construction industry is also suggested by several authors (Akintoye, 2000, Wong and Cheung, 2008, Al-Tmeemy et al., 2012). Thus, this research's rate of 21.7% may be considered to be a low response rate; but with 143 usable questionnaires Ling et al., (2009) argue that statistical analysis can still be carried out because the sample number more than thirty.

However, none of the fifty IJPM researches mentioned above is in an Indonesian construction industry context, especially a post-disaster reconstruction context. Thus, some publications in the Indonesian construction industry context were analysed to get an understanding of the response rate of survey questionnaires, as discussed in the following paragraphs.

Pamulu and Bhuta (2004) used a contractor list from the Indonesian CIDB database in their research and sent 130 questionnaires to contractors in the Indonesian capital, Jakarta. 20 questionnaires were returned undelivered and 48 organisations returned the questionnaire; it represented a 44% response rate.

Alwi, (2003) in his research about construction productivity in Indonesia, sent 300 questionnaires to 125 contractor firms and received 99 questionnaires from 46 different firms. The response rate was 33%.

Research by Mochtar (2004) shows a lower response rate. He sent 126 questionnaires to contractor companies and only seven questionnaires were returned. The response rate is about 5%.

Another study by Wibowo and Wuryanti (2008) resulted in an 18% response rate. They provided self addressed, stamped envelopes and 26 questionnaires were returned.

The closest in context with this research is probably a study by Marzuki and Fauzan, (2008) which investigated value improvement in Aceh reconstruction. The sample for their survey was chosen from seven main counties in the Aceh province. They did not provide information on how many questionnaires were distributed, but they received 25 completed questionnaires. These were from 9 owners, 8 engineering consultants and 8 contractors. In email communication with these two authors, they revealed that respondents' interest to the research was very low and that resulted in few responses. They decided to choose the 'friends approach', where most respondents are known to or friends of the authors.

3.9.2. Semi Structured Interviews

This research used telephone interviews instead of face-to-face interviews. There are several advantages of using telephone interviews, as mentioned by Opdenakker (2006):

- Telephone interviews have wide geographical access. People from any place can be interviewed if they have a telephone or computer access.
- Enables the researcher to work hard to reach populations.
- Enables access to people in close site access or dangerous places.
- Enables discussion of sensitive issues which respondents may be reluctant to do in a face-to-face interview.

However, according to Opdenakker, because the interviewer does not see the interviewee, the telephone interview method reduces social cues such as body language. But, there are still social cues in terms of voice and intonation. However, research by Greenfield et al., (2000) showed that when comparing face-to-face interviews with telephone interviews reveals that "*telephone interviews can perform in a generally equivalent fashion to more costly in-person interviews*".

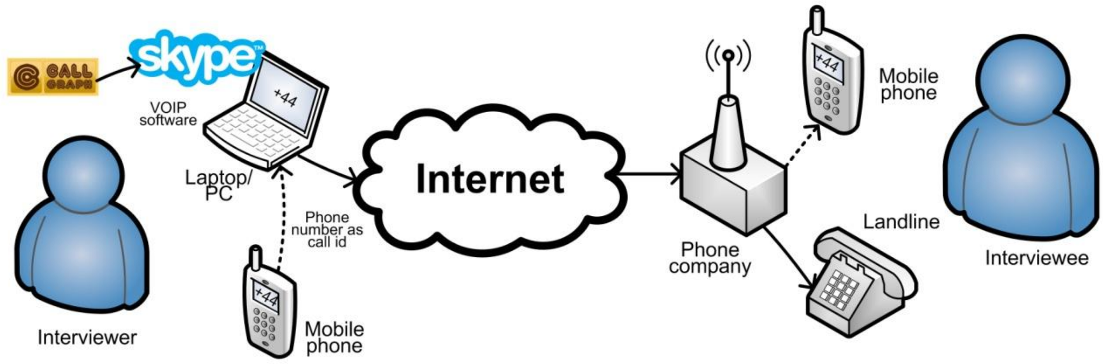

Figure 3-5 Phone interview using Skype software

The interviews were conducted using Skype software, a leading internet call software that allows calls over the internet to the respondents' office or mobile phone (Figure 3-5). This method offers flexibility and convenience to the respondent and at the same time is reliable and cost effective for a long distance conversation. The interviews were recorded with the recording tool software called Call Graph, which is an add-on application for Skype. Call Graph software enables the researcher to record the interview conversation for transcribing purposes.

In addition to the findings from Opdenakker (2006) there are several advantages to doing phone interviews with Skype and Call Graph software configuration (see Figure 3-5):

- Phone interviews offer flexibility to the respondents, because they do not need to meet in specified place, and sometimes, in specific dress. Respondents can receive the phone interview in the afternoon, at home. Most of interviews in this research were conducted in the afternoon.
- Comparing direct calls from a mobile phone with the software on a computer (Skype), the Skype software enables the interviewer to record the conversation clearly. If the interviewer uses a mobile phone, the phone must be in 'speaker mode' and a recorder is placed close to the phone.
- Skype software has a feature that enables the researcher to attach a mobile phone number as the caller ID. The respondents receive the Skype call from researcher's mobile phone, it is convenient because it shows the researcher's phone number and name on the respondent's mobile phone screen.

However, there are also some disadvantages to using phone interviews:

- The interview conversation is recorded using software so there is also a possibility that the software will fail. Testing all the software is recommended before the interview is undertaken.
- When using a mobile phone for interviews, the quality of conversation is influenced by strength and coverage of the mobile phone and the interviewer or respondent may be in a noisy environment.
- Phone interviews offer flexibility to the respondents, but this may become as disadvantage. On several occasions in this research when the respondents were contacted at the agreed time they were driving or elsewhere and had difficulty receiving the call. As a result the interviews were postponed for 30 minutes to an hour or to another day.

In this research 33 interviews were been conducted as shown in Table 3-8 below.

Table 3-8 Number of semi-structured interviews

Group	Number of interviews
Contractor	13
Consultant	7
Government	8
NGO	5
Total	33

The interviews are recorded in mp3 file format and the file renamed with the respondent's code. For example, the code 'R03-CSL-MD' is the respondent's number 3 (R03), the respondent is a consultant (CSL) and initials of the name of the respondent is MD. A separate file which contains the respondent codes and the actual respondent identity was kept in a password protected database during the research for later reference.

3.10. Data analysis

3.10.1. Analysis of the questionnaire data

The data from the questionnaire survey responses were analysed using Statistical Package for Social Science (SPSS version 16) software. This provided ease of handling for the large data sets by organising the data efficiently and dealing with the data easily.

Before the data were entered, identifying the data type was important, in order to plan the correct method for data analyses. The scale of measurement can be divided into four types: nominal, ordinal, interval and ratio.

- Nominal is a value that can be assigned to a code in the form of a number where the numbers are simply labels or category variables comprised of categories that cannot be ranked or ordered, e.g., types of organisation.
- Ordinal refers to a set of categories that are organised in an ordered sequence, i.e., ranking the degree of satisfaction.

- Interval, also called integer, is measured along a scale in which each position is equidistant from another.
- Ratio refers to variables and has all the properties of interval variables, but in the measurement there is always an absolute zero that is meaningful. This means that it can construct a meaningful fraction (or ratio) with a ratio variable.

Statistical tests are based on assumption of distribution of sample data, whereas for parametric techniques it is assumed that populations, from which samples are taken, are normally distributed (Lewin, 2005, Pallant, 2010). In comparison, non-parametric techniques are based on fewer assumptions and they are distribution free, i.e. not having a normal distribution (Barnes and Lewin, 2005, Pallant, 2010).

In order to test for the normal distribution of response data, a Kolmogorov-Smirnov test for all dependent and independent variables was conducted. In this research all of the variables were confirmed as not being normally distributed, therefore, non-parametric techniques were used. Because the variables indicated a significant result (sig. value ≤ 0.05) and ordinal data was used in this study, non-parametric techniques were considered more suitable for the analysis.

Data analysis methods are explained in the following sections.

3.10.1.1. Mean score comparison

The mean is the average value in a data set. Mean score comparisons will be used to identify differences between two or more samples (for example contractors and NGOs) in quantitative data analysis.

3.10.1.2. Cronbach's alpha

Cronbach's alpha is the coefficient for reliability or consistency. Alpha coefficient ranges in value from 0 to 1 where a higher value is desirable.

The commonly accepted rule for describing internal consistency using Cronbach's alpha is as follows:

Table 3-9 Cronbach's alpha

Cronbach's alpha	**Internal consistency**
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

All the data sets from the questionnaire survey for this research shows the Cronbach's alpha value of between 0.81-0.92, which means the data were deemed reliable.

3.10.1.3. Kruskal-Wallis test

This test is a non-parametric test to compare the scores on continuous variables for three or more groups. This test is similar to the Mann-Whitney U test, but it allows comparison of more than two groups (Pallant, 2010). Scores are converted to ranks and the mean rank for each group is compared.

In this test, if output at a significant level is less than the alpha level 0.5, the result suggests that there is a difference in the variable across the groups. However, this test does not notify which of the groups are statistically significantly different from the others. A follow up test, the Mann-Whitney test is implemented to compare each pair of groups and to determine which group has the statistical difference.

3.10.1.4. Mann-Whitney test

The Mann-Whitney test is used to test for differences between two independent groups on a continuous scale. This test is the non-parametric alterative to the t-test for independent samples. This test compares the median of the two groups. In this test, scores on a continuous variable are converted into ranks across the two groups then evaluated as to whether the rankings for the two groups differ significantly.

3.10.2. Analysis qualitative data

3.10.2.1. Stages of qualitative data analysis

Qualitative data generates a mass of text which may be the output of interviews or observations. Lacey and Luff (2007) suggest that analysis of qualitative data is the processes of describing and summarising the text which may include discovery of the relationship between the themes and relates ideas of the respondents' characteristics, draws implication from the data for policy or practice purposes, and helps to interpret findings from previous studies.

Furthermore, Lacey and Luff (2007) explain that analysis of qualitative data should be conducted through the following stages:

- Transcription. The interview data may be in tape recorded format, thus it needs to be transcribed. Non-verbal matter, such as silences and laughter, is an important element of conversations and should be included in the transcription.
- Organise. The data should be organised into easily retrievable sections. Each interview should be given a number or code for identification. Sensitive data, such as names of interviewees should be replaced with pseudonyms or code numbers.
- Familiarisation. The researcher should listen to the interview again, re-read the transcriptions, make memos and summaries before data analysis begins.
- Coding. After familiarisation, codes are assigned to the transcription.
- Identify themes. Themes or concepts emerge from the coding. Re-coding may be needed to develop more, well defined categories.
- Develop and test theory. Relationships between coded data are explored and displayed. When adopting grounded theory, early data is subjected to preliminary analysis then the emerging theory is tested in subsequent data collection. Collection of data will continue until no new themes emerge and theoretical ideas have been tested satisfactorily.

- Write reports which may include citations from the original data.

However, Lacey and Luff (2007) give a warning that analysis of qualitative data is a time consuming process. They estimate it can take a third of the research project's total time for the analysis. They offer tips in the analysis as described in following paragraphs.

Firstly, be organised. Give identification codes to interview transcripts, file notes, photos, videos or documents so they can be retrieved easily. All data should include a date, description of the context and a code for the respondent's anonymity; this will help the researcher to identify the source.

Secondly, use appropriate methods for coding. There are two ways to develop codes, one is by using computer software and the second is by coding manually or using ordinary word processor software. There are two systems in coding, by 'cutting and pasting' text and assigning colour for coding.

Finally, keep a record of thoughts by creating a memo or journal. A memo or journal will help as a basis for narrative analysis in the report and can also help to track the researcher's thought processes in the analysis. Reports of qualitative analysis should include examples of verbatim data to support arguments and give real evidence for the analysis. It is also possible to include flowcharts, tables or diagrams to support the analysis.

3.10.2.2. Computer software for qualitative data analysis

There are several software packages available for qualitative data analysis, such as AtlasTi, NUD*IS and NVivo. It is obvious that computer software have benefits but it also has disadvantage in qualitative data analysis.

There are a number of considerations to reflect on before choosing computer software rather than manually handling qualitative data analysis. The first consideration is about the cost of purchasing the software which is often expensive, and furthermore, it takes time to learn how to use the software. The main consideration may be on the size of the data. If the duration of interviews is more than 6-10 hours, Lacey and Luff (2007) suggest using computer software.

Computer software will help in the analysis of qualitative data in:

- Data storage and management.
- Data searching and retrieval.
- Coding.
- Developing and testing theory.
- Writing reports.

However, the software is only a tool and does not replace the human element. The software does not have the ability to think, reflect and analyse (Lacey and Luff, 2007). There are two sides to an opinion and when using computer software for the analysis the software at the centre of the analysis is unimportant because only the human element recognises both sides of the argument. Welsh (2002) suggests using both methods, the software and manual analysis because the software is only an organising tool and the output of the software (e.g., memo) has to make sense by linking coding and themes.

Ozkan (2004) explores an early version of NVivo software and concludes that even though manual (paper and pencil) can be used for analysis very long data and provide meaningful conclusions, the computer software will greatly reduce the time and energy of the researcher in the analysis process.

3.10.2.3. Nvivo software packages for qualitative data analysis.

NVivo is a qualitative data analysis software that is developed by QSR International. NVivo is a further development from a similar software called Nud*ist (Acronym for Non-Numerical Unstructured Data Indexing and Searching), also developed by QSR International. NVivo was developed when N4 (Nud*ist version 4) was unable to cope with the demands of qualitative data analysis because incompatibility issues with the fundamental architecture of N4 (Richards, 2002). The first version of NVivo in 1999 enabled the researchers to apply character-based coding and to have the facility of rich formatted text available and to freely edit or write text (Bazeley, 2007).

Dean et al. (2006) used Nvivo in their research and recognised a number of benefits but also problems in using NVivo. They suggest some approaches to improve the effectiveness of using NVivo (Dean et al., 2006):

- Understand the research field thoroughly.
- Pay attention to the actual data at all stages.
- Face up to the fact that interviews are rarely complete.
- Start with a structure and continually revise it.
- Continually check the coding.

In NVivo version 9 there are a number of components and terminology that are explained in following table.

Table 3-10 NVivo terminology (QSR International, 2011)

Component	Description
Sources	Collective term for research material, including documents, PDFs, datasets (spreadsheet), audio, video and picture.
Nodes	Containers to gather related material into one place, so the researcher can look for emerging patterns and ideas.
Collections	Collections are views (or groupings) of project items that are stored elsewhere in NVivo project.
Queries	Search criteria to seek and explore patterns in sources or coding.
Models	Visual presentation of the data.
Links	Links to draw connections between items in NVivo project. For example, it can use 'see also' links to point out contradictions, follow evidence or show a sequence of events.
Classifications	Descriptive information about the sources, nodes and relationships.

There are three main sections on the NVivo 9 workspace: navigation view, list view and detail view (Figure 3-6, page 88). NVivo main components can be accessed from navigation view and also from menu and ribbon. The contents of each component can be viewed on list view and detail view shows the actual contents of each item in list view. Basic raw data are stored in the sources component and will be analysed further by coding with assignment of nodes and classifications. Overall, NVivo workspace gives the researcher the ability to easily store, access and analyse the data.

In this report, the analyses from Nvivo are presented in two ways. Firstly, excerpts from the interviews are introduced into the report to illustrate the themes by using NVivo. Secondly, the themes emerging from the interview analysis were formatted into tables. For an example of this action refer to Table 5-1, page 133. Within the table are two headings 'No. of sources' and 'No. of references'; the number of sources refers to the number of interviews which mentioned a particular theme whilst the number of reference refers to the number of codes in a theme.

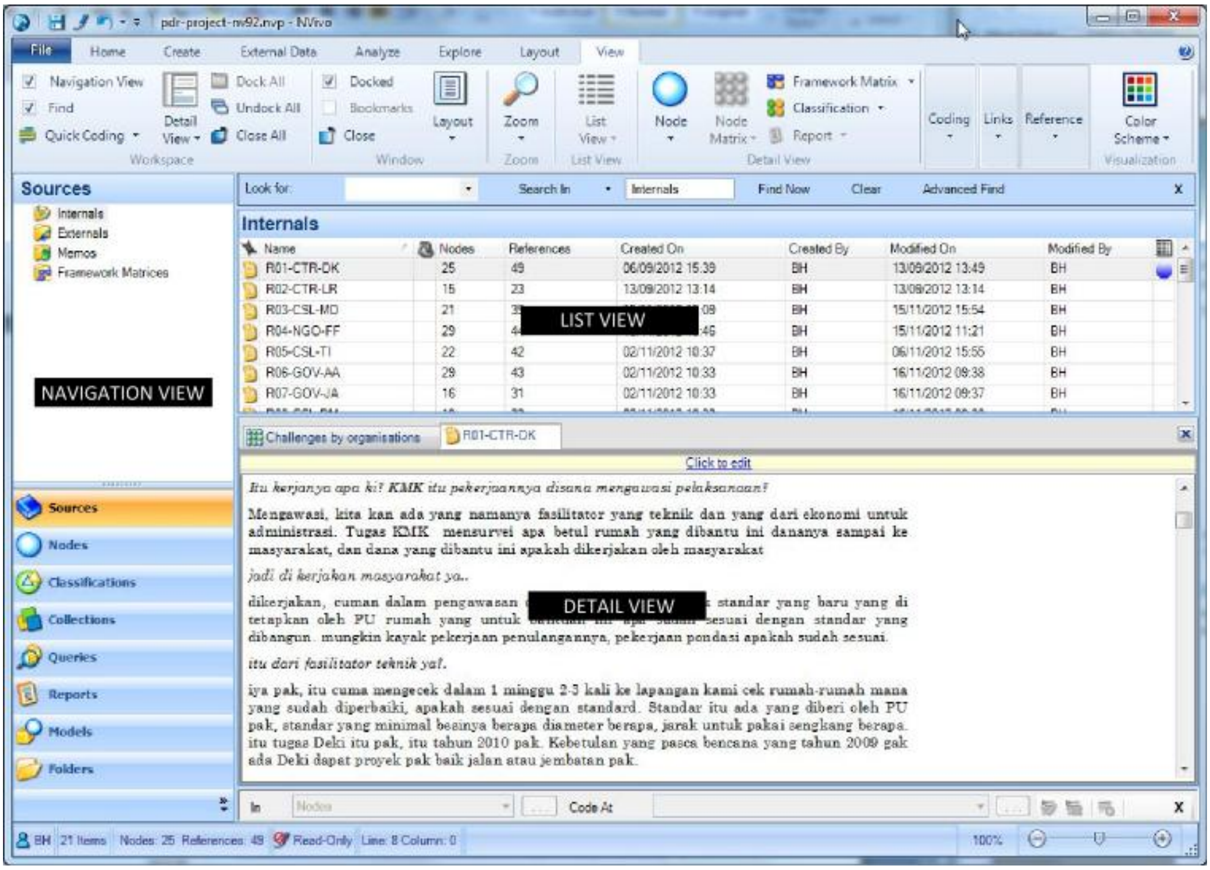

Figure 3-6 NVivo9 workspace

In a research by Auld et al., (2007) they argue that there is little research on the process of deciding to use qualitative analysis software so they developed decision trees to assist the researcher to chose whether to use manual or software to analyse qualitative data. They echoed similar findings that the software has advantages in retrieval and sorting but the software does not do the analysis. Researchers do the analysis by coding, linking nodes and interpreting the results of the query. They propose a number of issues to reflect on before deciding to use NVivo software: training time, creating inter-coder reliability, number and length of documents, coding time, coding structure, use of automated coding, and use of additional supporting software.

3.11. Profiles of the respondents

3.11.1. Questionnaire survey

As described in section 3.9.1.4 in this research 143 questionnaires were considered usable and were used as one of the data sources in this research. In order to have background on the respondents in the questionnaire survey, this section presents the characteristics of the respondents.

Table 3-11 shows the type of organisation involved in this research. From 143 usable questionnaires, 47 of those (33%) were from contractors, 25% were respondents from NGOs/Donors organisations, 24% from Government and 18 % worked in consultant organisations.

Table 3-11 Type of organisation of questionnaire survey respondents

	Frequency	Percent	Cumulative Percent
Contractor	47	33	33
NGO/Donors	36	25	58
Government	34	24	82
Consultant	26	18	100
Total	143	100	

The questionnaire survey also asked about the gender of the respondents. 21 females participated in this research, which represents 15% of usable returned questionnaires (see Table 3-12). Male respondents account for 85% of usable returned questionnaires.

Table 3-12 Gender of the questionnaire survey respondents

	Frequency	**Percent**	**Cumulative Percent**
Male	122	85	85
Female	21	15	100
Total	143	100	

The educational background of the respondents is presented in Table 3-13. Table 3-13 and Figure 3-7 show that 90% of the respondents have a university background both undergraduate and post-graduate.

Table 3-13 Education background of the questionnaire survey respondents

	Frequency	**Percent**	**Cumulative Percent**
High school	6	4	4
Diploma	9	6	10
Undergraduate	76	53	63
Post graduate	52	37	100
Total	143	100	

One explanation for why a number of respondents with university backgrounds were involved in this research is because most of the respondents are familiar with questionnaire surveys having used instruments of data collection for final projects, thesis or dissertation reports.

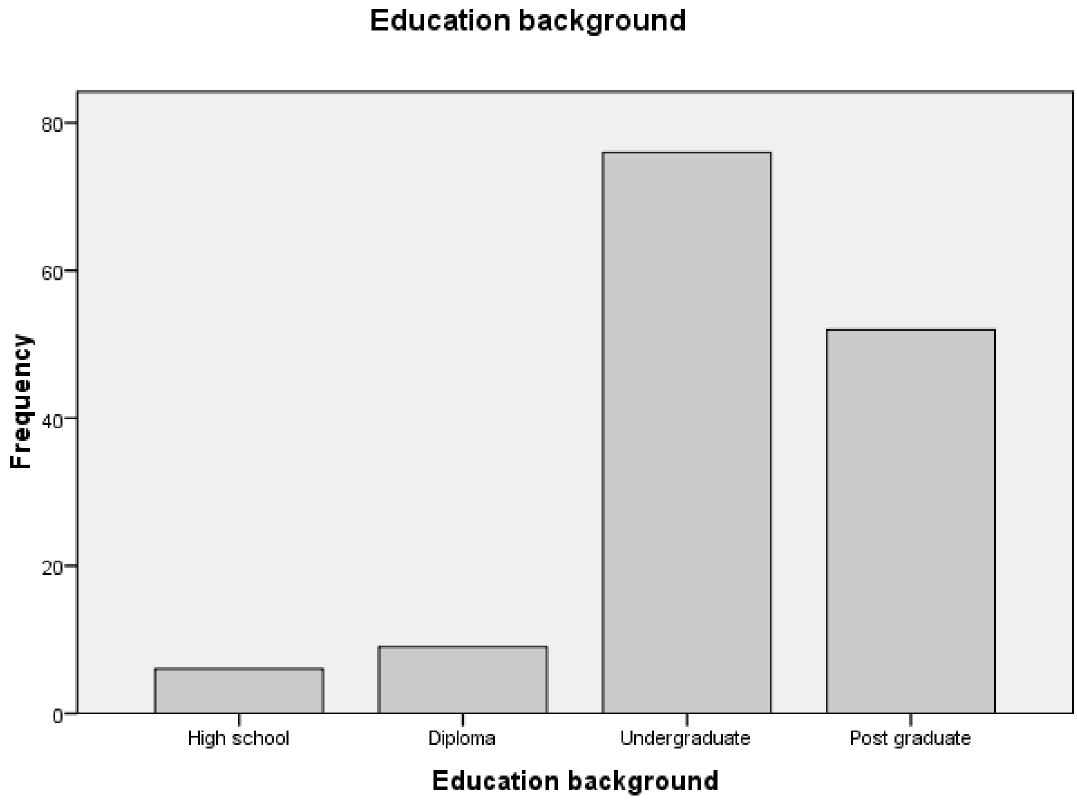

Figure 3-7 Education background of the questionnaires survey respondents

Table 3-14 and Figure 3-8 show a frequency distribution of years of experience the respondents have in construction industry. The table reveals that 63% of the respondents have between one and ten years experience working in the construction industry, whilst 35% have more than ten years experience.

Table 3-14 Years of experience of the questionnaire survey respondents

	Frequency	**Percent**	**Cumulative Percent**
less than 1 year	2	2	2
1-5 years	47	33	35
6-10 years	43	30	65
11-15 years	26	18	83
16-20 years	15	10	93
more than 20 years	10	7	100
Total	143	100	

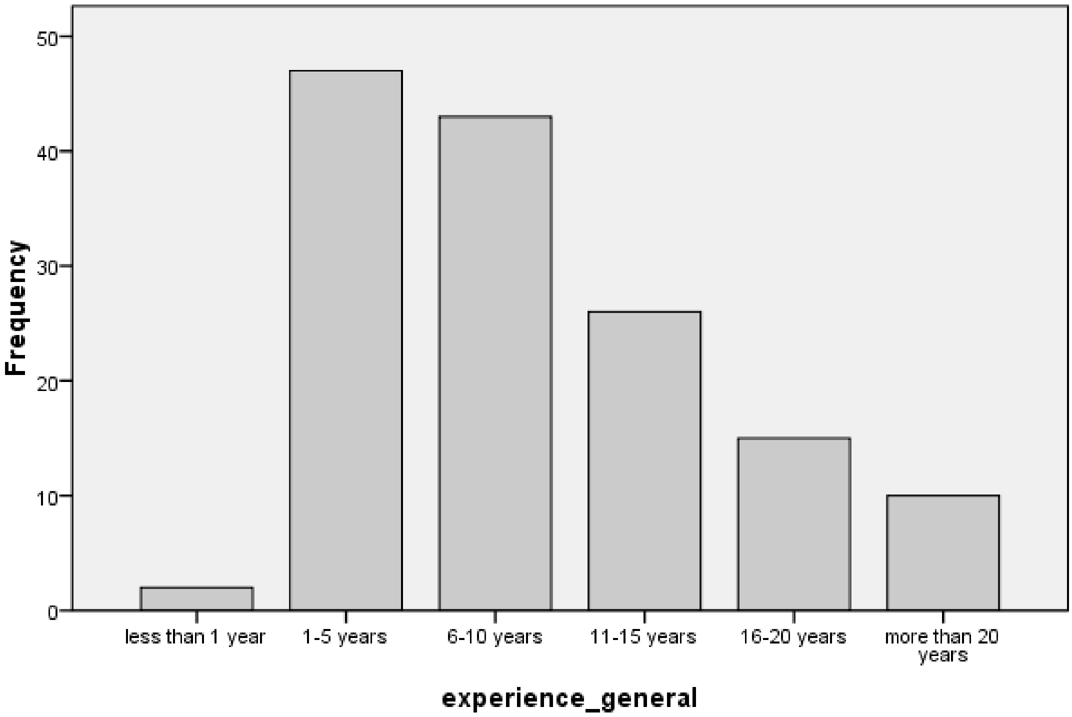

Figure 3-8 Years of experience of the questionnaire survey respondents

Table 3-15 and Figure 3-9 show how many years of experience the respondents have of post-disaster reconstruction projects.

Table 3-15 Years of experience in PDR projects of the questionnaire survey respondents

	Frequency	**Percent**	**Cumulative Percent**
less than 1 year	16	11	11
1-5 years	92	64	75
6-10 years	32	22	97
11-15 years	2	2	99
more than 20 years	1	1	100
Total	143	100	

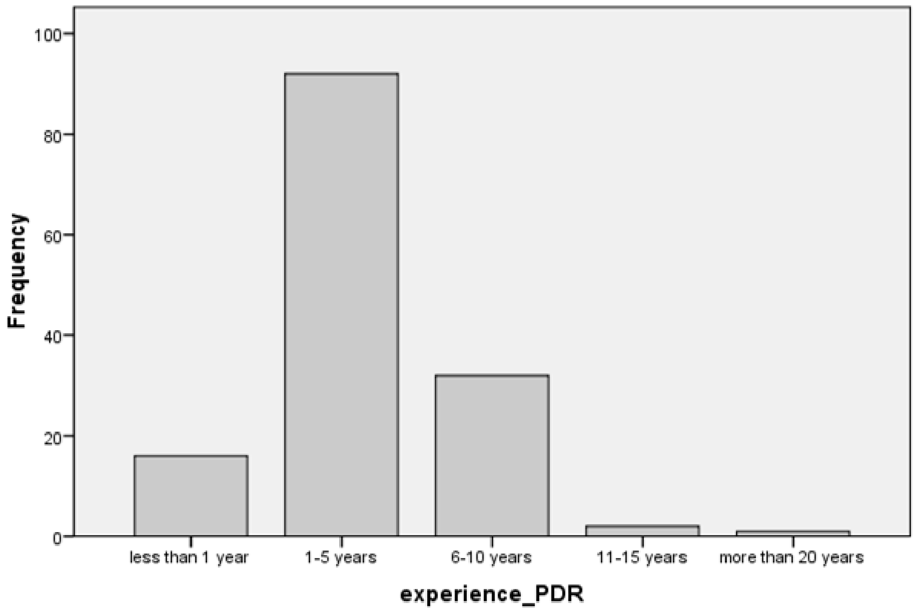

Figure 3-9 Years of Experience in PDR projects of the questionnaire survey respondents

The majority of respondents, 75%, have experience of PDR projects of less than 5 years. This is understood because it is widely known the PDR projects in Indonesia start after the 2004 tsunami and earthquake in Aceh province.

This research also targeted respondents who had experience in PDR projects after the 2004 earthquake and tsunami in Aceh province, the 2006 earthquake in Yogyakarta province and the 2009 earthquake in West-Sumatra province. Years of experience in general as in Table 3-14 shows that 65% of respondent have experience less than 10 years, hence it is understandable that 75% of the survey respondents have 1 to 5 years experience of PDR projects.

The role of the respondents in the reconstruction projects are described in Table 3-16 below. Almost half of respondents (42%) have a role as project manager or construction manager and 12%, 13%, and 15% have a role as consultant, designer and project owner respectively.

Table 3-16 Role of the questionnaire survey respondents

	Frequency	Percent	Cumulative Percent
Project manager	49	34	34
Construction manager	12	8	42
Consultant	17	12	54
Engineer/Designer	19	13	67
Project owner/Client	22	15	82
Other	5	4	86
Director	8	6	92
Project team	11	8	100
Total	143	100	

The location of PDR project was also asked in the questionnaire survey. 47% of the respondents were involved in Aceh and Nias reconstruction projects, 43% of the respondents were involved in the Yogyakarta reconstruction and 10% of them were involved in West Sumatran reconstruction projects.

Table 3-17 Location of PDR projects of the questionnaire survey respondents

	Frequency	Percent	Cumulative Percent
Aceh and Nias reconstruction	67	47	47
Yogyakarta reconstruction	61	43	90
West Sumatra reconstruction	15	10	100
Total	143	100	

The survey also asked the respondents what they perceived to be the most challenging type of reconstruction project. Table 3-18 shows the responses from respondents. Housing projects are considered to be the most challenging as recorded by almost halve of respondents (43%), followed by ‘road and bridge’ projects 30%.

Table 3-18 Type of construction in PDR projects

	Frequency	Percent	Cumulative Percent
Housing	61	43	43
Road & bridge	42	30	73
Office	11	8	81
School	16	11	92
Commercial building	3	2	94
Religious building	2	1	95
Dockyard	2	1	96
Other	6	4	100
Total	143	100	

3.11.2. Semi-structured interviews

As mentioned in section 3.9.2 (Semi Structured Interviews) this research has conducted 33 semi-structured interviews. The backgrounds of the interviewees are presented in the following Table 3-19.

Table 3-19 Background of semi-structured interviews

No.	Respondent code	Duration of interview (minutes)	Brief background
1	R01-CTR-DK	59	DK has ten years experience as a Project Manager and has been involved in several projects in West Sumatra reconstruction.
2	R02-CTR-LR	40	LR owns a contractor company and he has 15 years experience in the construction industry.
3	R03-CSL-MD	52	MD has a post graduate background in civil engineering and has been involved in the construction industry since 1995.
4	R04-NGO-FF	59	FF has a civil engineering education and joined an international NGO in 2005 after the 2004 tsunami. His/her last position in the organisation was Project Manager.
5	R05-CSL-TI	78	TI is an expert in a consultant company in Aceh and has 12 years experience in the construction industry and is an Architect.

No.	Respondent code	Duration of interview (minutes)	Brief background
6	R06-GOV-AA	56	AA joined Department of Public Work (PU) in 1990, was involved in BRR as a *Satker* in the housing division.
7	R07-GOV-JA	47	JA was involved in BRR in the land transportation division working in Department of Transportation from 2003 he/she previously worked at the Department of Public Work (PU) since 1995.
8	R08-CSL-DM	33	DM has 15 years experience and has been involved in Aceh as a construction consultant.
9	R09-CTR-FO	45	FO has been involved in the construction industry in Aceh since 1990 and now also acts as chairman of a contractor's association organisation.
10	R10-GOV-AI	24	AI is a member of a technical support team in West Sumatra reconstruction.
11	R11-GOV-TF	50	TF has 15 years experience working in Department of Public Work (PU) in Aceh province.
12	R12-CSL-IK	59	IK was a team leader from a consultant company which was involved in several design and supervision projects in the Aceh reconstruction.
13	R13-NGO-FY	90	FY has civil engineering educational background and has 25 years experience in the construction industry. He had a Project Manager role in an INGO and was actively involved in Aceh and West Sumatra reconstruction.
14	R14-CTR-LR	42	LR has 20 years in the construction industry and was involved in several projects in Aceh reconstruction as a Project Manager.
15	R15-GOV-WR	46	WR is a key person in the housing division of BRR.
16	R16-NGO-DT	30	DT has architect background and has ten years of experience. He joined an NGO as a Project Manager for Construction.
17	R17-CTR-BS	24	BS is a Project Manager for a BUMN contractor (government owned company) and was involved in a project in West Sumatra reconstruction.
18	R18-NGO-TA	39	TA has architect background and has 20 years experience in construction. He joined

No.	Respondent code	Duration of interview (minutes)	Brief background
			an international NGO in the Aceh reconstruction.
19	R19-NGO-NN	48	NN has civil engineering background and has been involved in Aceh reconstruction and West Sumatra reconstruction as Construction Project Manager.
20	R20-CTR-YZ	31	YZ has more than 30 years experience in the construction industry and was involved in West Sumatra reconstruction.
21	R21-CTR-AD	28	AD has educational background in electrical engineering and he has a contractor company which has been involved in West Sumatra reconstruction.
22	R22-NGO-AS	48	AS has more than 20 years experience in the construction industry with a civil engineering education. He worked at several major construction companies in Indonesia and joined an NGO after 2004 tsunami.
23	R23-CTR-OF	44	OF has 10 years experience in a construction company and was involved in the Aceh reconstruction.
24	R24-CTR-AD	46	AD is General Manager of an Indonesian major construction company which was involved in the Aceh reconstruction.
25	R25-GOV-RR	29	RR has a civil engineering background and was involved in the Yogyakarta reconstruction.
26	R26-CTR-EO	50	EO has ten years experience in construction and was involved in the Yogyakarta reconstruction.
27	R27-CTR-IZ	55	IZ is a Project Manager in a BUMN contractor company and has been involved in a project in the West Sumatra reconstruction.
28	R28-CTR-ES	55	ES have been involved in the Aceh reconstruction and the West Sumatra reconstruction as Project Manager. He has more than 20 years experience in construction.
29	R29-CTR-SS	43	SS currently is a Site Construction Manager in a construction project in the West Sumatra reconstruction. He has a civil engineering background.
30	R30-CSL-IF	43	IF has been involved in consultancy on construction projects for 20 years.

No.	Respondent code	Duration of interview (minutes)	Brief background
31	R31-CSL-AL	64	AL has 20 years experience in consultancy work and also has a position as chairman of a consultants association in Aceh.
32	R32-GOV-RI	51	RI has a post-graduate degree in transportation and was involved in BRR in the transportation division.
33	R33-CTR-YK	54	YK now is member of the local parliament in Aceh province, but is actively involved in the Aceh reconstruction as a Contractor.

3.12. Summary

This chapter presented the research methodology for this research. This research focuses on knowledge communication in post-disaster reconstruction projects with a philosophical position leaning towards subjectivism, interpretivism and value-laden research.

Mixed method is adopted as the research design which allows a combination of quantitative and qualitative research and both a deductive-inductive approach. This research employed questionnaire survey and interviews as the research methods with respondents from contractors, local governments, consultants, NGOs and donors.

The survey distributed to a questionnaire to 777 potential respondents, 119 questionnaires were undelivered and 151 questionnaires were received. However, only 143 questionnaires were usable resulting in a response rate of 21.7%. Parallel to the questionnaire survey, semi structured interviews were conducted with 33 interviewees or respondents. The interviews were conducted by phone using Skype software as an added tool.

This chapter presented the challenges to data collection and also the efforts used to overcome the challenges. Data analysis techniques and profiles of the respondents are also presented in this chapter as background for the findings of this research. In the following next chapters will present the findings from data collection and data analysis.

CHAPTER 4. STAKEHOLDERS AND THEIR ROLES IN POST-DISASTER RECONSTRUCTION PROJECTS

4.1. Introduction

This chapter presents a report to answer objective number 1 in this research 'to investigate and document the key roles of different stakeholders in post-disaster reconstruction projects (PDR) projects'. The first section will explore the definition of a stakeholder followed by identification of key stakeholders and their roles in PDR projects. The next sections will discuss the involvement and effectiveness of stakeholders, based on the questionnaire survey and the interviews.

4.2. Definition of the stakeholders

Stakeholders in project management are increasingly important; Littau et al. (2010) noted that an increasing number of management journal papers in the period from 1994 to 2009 had stakeholders in their topic.

Freeman's definition of a stakeholder (Freeman, 1984) is probably the best known definition in stakeholder theory. Freeman states that *"...a stakeholder in an organisation is any group or individual who can affect or is affected by the achievement of the organisation's objectives..."*.

By this definition, stakeholders in a project can be persons, groups, institutions, or communities. To identify the stakeholders and their salience, Mitchell et al. (1997) proposed the use of any combination of three stakeholders' attributes: power, legitimacy, and urgency. Power is the capacity to induce, persuade or force the actions of others; one party has power but it can be another party who takes action. Legitimacy is "*a generalised perception or assumption that the actions of an entity are desirable, proper, or appropriate within a socially constructed system of norms, values and beliefs*", and the definition of urgency is "*the degree to which stakeholder claim calls for immediate actions*" (Mitchell et al., 1997).

In a similar manner to Freeman's definition, stakeholders, in context of PDR, may be defined as individuals or groups that affect or are affected by reconstruction activity (Asgary et al., 2006, Siriwardena and Haigh, 2011). By this definition stakeholders may obtain benefits from the reconstruction or may have something to lose by it.

Stakeholders in construction are traditionally composed of engineers, quantity surveyors, architects, project managers, clients, and contractors. However, in reconstruction projects following disasters new stakeholders became involved, such as, NGOs, donor agencies, and beneficiaries (Siriwardena et al., 2011).

Takim (2009) recognised that, traditionally, the main participants in a projects the client, architects and contractors. Takim differentiates stakeholders in a project into internal and external stakeholders and her research identified five groups of stakeholder: client, consultant, contractor, end-user, and the community.

4.3. Key stakeholders in post-disaster reconstruction projects

Siriwardena and Haigh (2011) argue that it is very difficult to identify a comprehensive list of stakeholder related to PDR project, since the context and nature will vary among the projects. However, Siriwardena and Haigh have grouped the stakeholders into two sets; the first set comprises stakeholders who are active in normal conditions (before the disaster), and the second group is stakeholders who actively respond to disaster events. They also identify common stakeholders in PDR projects, as described in Table 4-1.

Table 4-1 Stakeholders on PDR projects (Siriwardena and Haigh, 2011)

Stakeholder Group	Example
Individuals	Company owners
Families and households	Long-term local residents
Traditional groups	Clans, religious bodies
Community-based groups	Self-interest organisations comprising resource users, neighbourhood associations, gender or age-based associations.
Local traditional authorities	Village council of elders, a traditional chief
Political authorities recognised by national laws	Elected representatives of a village at district level
Non-governmental bodies that link different communities	A council of village representatives, a district-level association of fishermen
Local government structures	Administration, police, the judicial system
Agencies with legal jurisdiction over natural resources	A state park agency
Local government services in the area	Education, health, forestry and agriculture
Relevant non-governmental organisations	Local, national or international levels
National interest organisations	Workers' union
Cultural and voluntary associations	Unique national landscapes, an association of tourists
Business and commercial enterprises	Local cooperatives to international corporations
Education	Universities and research organisations
Financial	Local banks and credit institutions
Government	National, regional, local
Foreign aid agencies	Staff and consultants of relevant projects and programs
International government bodies	UNICEF, FAO, UNEP

Similar observation have been noted Jha et al. (2010, p.189) that stakeholders involvement is the context specific ability of the stakeholder to participate in the reconstruction project and will be influenced by level of power, interest and resources they have. Jha et al. also classified the stakeholders in PDR projects as in Table 4-2 .

Table 4-2 Stakeholders in the PDR project (Jha et al., 2010)

Type of stakeholder	Example
Those who might be affected (positively or negatively) by the project	Homeowners who prefer to relocate the community versus homeowners who prefer the existing site
The "voiceless" for whom special efforts may have to be made	Squatters who risk being relocated if structural disaster risk reduction investments are built
The representatives of those likely to be affected	Existing community group that has managed the response
Those who have formal responsibility related for the project	Government risk management agency or local planning department
Those who can mobilise for or against the project	Unaffected communities that were already awaiting assistance now delayed by the disaster-related project
Those who can make the project more effective by participating or less effective by not participating	Another NGO working on a related issue in the same community
Those who can contribute financial and technical resources	Microfinance institution or governmental agency
Those whose behaviour has to change for the effort to succeed	Government agency already planning the community's relocation
Those who must collaborate for the project to succeed	Landowner who will need to sell land where structural measures will be built

Another perspective is presented by Bosher et al. (2007) which identifies key stakeholders for integrating disaster risk management (DRM) into design-construction-operation process (DCOP). The stakeholders are classified by their contribution or inputs (Bosher et al., 2007):

- Formal specified input: essential structures input that may need to be driven by legislation;
- Formal unspecified input: essential input that may be driven by "best practice" guidance rather than legislation;
- Informal input: non-essential but nonetheless important information exchange that would be considered as "best practice";
- No input required: stakeholder's input is not required.

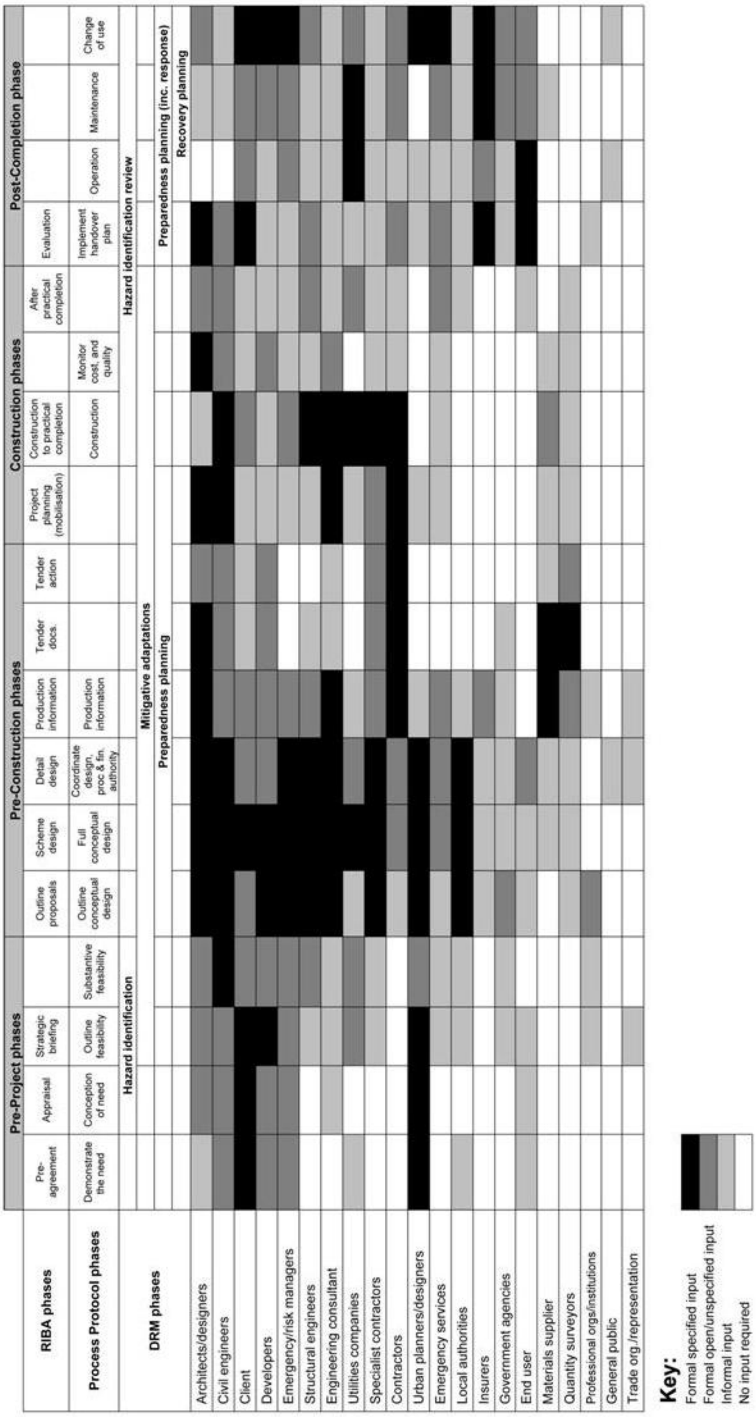

Figure 4-1 Stakeholders' involvement in DRM (Bosher et al, 2007)

Bosher et al.'s findings (see Figure 4-1) show that architects/designers were perceived, by their research respondents, to be the most important stakeholders from construction sectors who provide important input into disaster risk management. On the other hand, trade organisations and the general public were not considered to be key stakeholders. Similar findings can be found in the research by Haigh et al. (2006) which describes the significant role of the construction industry in disaster management.

BRR, as the implementing board of the Aceh reconstruction project, have defined key stakeholders and their role in support of BRR's four-year project (Figure 4-2), as described below (BRR, 2006c):

1. Ministries/Institutions
   - Speed-up the decision making process;
   - Facilitate the flow of fund circulation between budgets in order to avoid disruption to the programme;
   - Strengthen BRR's supervisory board.
2. Local government
   - Financing regional operations;
   - Implementing social and governmental transformation;
   - Responsible for the post Helsinki peace agreement;
   - Contribute to the development budget in line with the rehabilitation and reconstruction programme;
   - Identify regional problems and seek solutions, ensure all the victims are provided with the assistance to which they are entitled;
   - Consult with NGOs and donor agencies;
   - Hold routine coordination meetings with community leaders and all institutions working in the region;
   - Encourage village leaders to settle disputes within their region;
   - Eliminate any form of corruption, collusion and nepotism as well as other criminal behaviour.
3. Donor agencies and NGOs
   - Maintain active involvement in inter-institutional coordination;
   - Deliver routine and objective reports on the progress of programmes;
   - Contribute to the process of reintegration post conflict;
   - Contribute to the revival of livelihoods and the economy;
   - Provide a cost benefit and fund flow analysis;
   - Report to BRR on project progress and problems;
4. Business community

- Apply professionalism and high ethical standards;
- Play an active role in the development of a business and investment climate;
- Uphold the social responsibilities associated with business practices;
- Encourage and improve regional competiveness through a transfer of knowledge and technology;
- Conduct business from an environmental perspective.

5. Civil society
    - Ensure the community understand and know their rights and are aware of the recovery programme designed to support them;
    - Encourage the community to voice its complaints and tackle problems through proper channels and mechanisms;
    - Conduct independent monitoring of recovery projects;
    - Actively engage in mediation between the community and all agencies involved in the recovery process at the community level;
    - Support the community;
    - Support and manage the community's expectations.

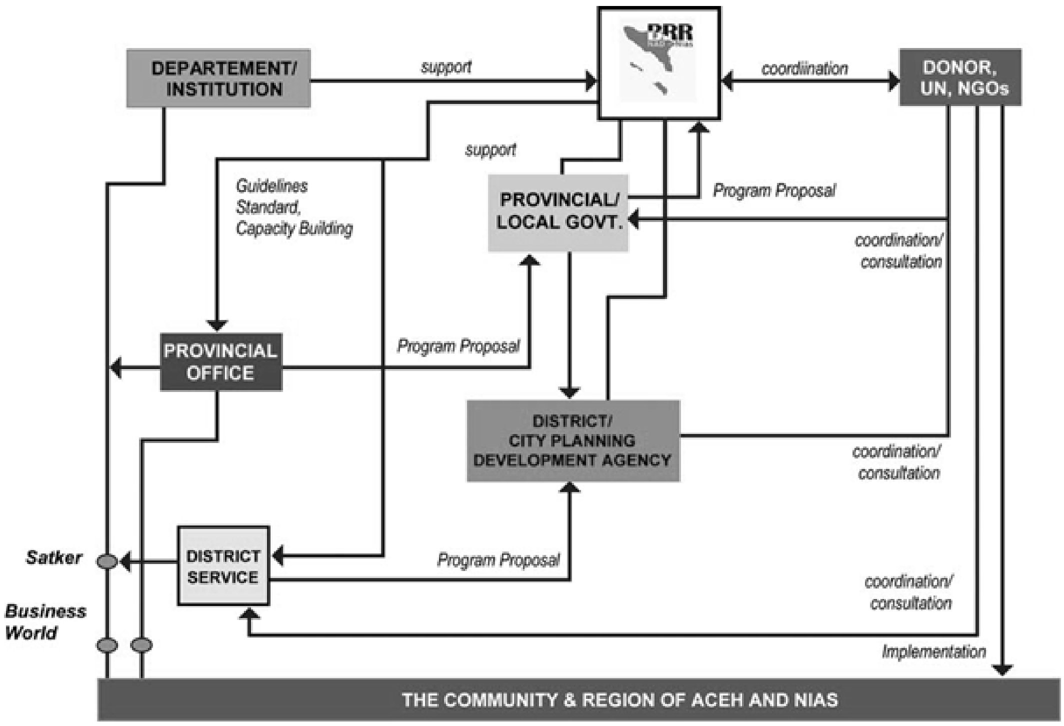

Figure 4-2 Relationships between stakeholders in Aceh reconstruction (BRR, 2006c)

Johnson (2007), in his study about temporary housing notes that temporary housing in post disaster reconstruction is generally implemented by a temporary multi organisation, a group of organisations with different mandates and objectives that come together to complete the project or programme and then dissipates once it is finished. Various government ministries, aid agencies, foreign and local NGOs, private contractors, private manufacturers, land owners and community leaders may be involved in temporary housing projects (Johnson, 2007).

Jha et al. (2010), in their publication about reconstruction following a natural disaster, identified stakeholder roles and responsibilities as follows:

a. Affected population
    - First responders during an emergency
    - Undertaking the majority of work on their own recovery

b. Government
    - Managing disaster response
    - Establishing policy to guide reconstruction programme
    - In certain situations, establish a dedicated organisation or task force to coordinate, reinforce, or in some cases, temporarily replace the responsibilities of line ministries.

c. The national military
    - Carry out initial rebuilding of bridges and essential infrastructure.
    - Rapid assessment capabilities and excellent communication

d. The humanitarian community
    - Implement coordination mechanism
    - NGOs support for implementation of response and reconstruction programme
    - NGOs facilitating the activities of communities
    - NGOs serving as executing agencies for all funding resources.

e. Bilateral and multilateral organisations
    - Participating in coordinating structures from the outset of the response.

f. IFIs (International Financial Institutions): The World Bank and regional development bank
    - Offering resources and mechanisms

Shaw (2003), in his model, includes three parties involved in the disaster management cycle: government, NGOs and people (disaster victims). Shaw classified NGOs into two main types. The first type is professional NGOs that have specific expertise and knowledge and consist of people from different professional backgrounds. The second type is social NGOs that are more related to the social and humanitarian activities. Both types can be divided into two further groups, national and international, based on their activity.

In the relief phase, it is very important to have proper coordination among different stakeholders: government, international organisations, people and international NGOs. A well coordinated relief operation can reach more needy people and reduce duplication of effort. In rehabilitation and reconstruction, NGOs can play an important role as the interface between people and government, by communicating the community's needs and priorities to the government (Shaw, 2003). There are concentrations of different NGOs in the relief and rescue stages, but Shaw notes long term commitments are needed by NGOs in rehabilitation and reconstruction stages. Shaw also notes that NGO activity is not always successful for long term recovery, for example, after the Latur earthquake in India (1993), approximately 350 NGOs gathered at the initial stage but only 35 organisations remained until the end of the recovery process.

Davidson et al. (2007) have studied community involvement in post-disaster housing projects using four case studies and have summarised participants' responsibilities in the projects as follows:

Table 4-3 The spread of responsibilities between project participants (adapted from Davidson et al. 2007)

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

Davidson et al.'s study shows different community (beneficiaries) participation levels, the highest level of participation is in the Colombian case where communities have decision making powers and were involved from the beginning of the reconstruction. In contrast, communities in Salvador had no involvement in the decision making process. Their study suggests that a high level of community participation leads to positive results in terms of building process and outcome.

From a construction project perspective, the key stakeholders in construction projects in Indonesia usually consist of the project owner, consultants, and contractors (Sandyavitri, 2008, Chandra et al., 2012). PDR projects are basically construction projects in an after disaster project environment settings (refer to section 5.2, page 131) and previous discussions in this section show that in PDR projects NGOs, donors, and disaster-affected communities are becoming important stakeholders in the reconstruction.

4.4. Involvement and effectiveness of stakeholders in PDRP (questionnaire survey)

This section sets out to explore the involvement of stakeholders in PDR projects. As mentioned in previous sections there are main stakeholders: contractors, NGOs, governments, consultants and beneficiaries or disaster victims. However, NGOs may act as the client or the consultants on such projects (Davidson et al., 2007, White, 2009), so in the questionnaire survey NGO has been omitted. On the other hand, the survey also wants to explore the involvement of a community, or beneficiaries in PDR projects.

4.4.1. Involvement of the stakeholders in PDR projects

The result of stakeholder involvement in PDR projects is presented in Table 4-4. Inspection of Table 4-4 (page 111) shows the various involvements of stakeholders in reconstruction projects. For the contractors, it shows that the contractors have more involvement at the construction stage, but this is similar to normal construction conditions, contractors will have less involvement in the planning and design stage. Table 4-4 clearly shows that contractors have a score of 4.38 for involvement in the construction stage, and 1.78 and 1.96 for involvement in the planning and design stage respectively. However, close examination of the level of involvement, based on the type of organisation, shows those respondents from contractors rated higher than the others in the contractors' involvement in the planning and design stage.

For the clients' involvement, the respondents perceived that the clients were very significantly involved at every stage of reconstruction projects. The scores for client involvement are 4.03 (planning stage), 4.07 (design stage), and 4.00 (construction stage).

Similar observation can be seen for consultants' involvement, the consultant has a significant level of involvement in the reconstruction process. The respondents rated the consultants' involvement as 4.15 (in the planning stage), 4.31 (design stage), and 3.59 (construction stage). Comparing the scores for consultants and clients and their involvement in the planning and design stage, it suggests that consultants have more involvement because the score is higher than the clients' score.

Interesting observation can be found in Table 4-4 on disaster victims' involvement in post-disaster reconstruction projects. Overall, the respondent rated the disaster victim' involvement as quite significant in the planning and design stage, with average mean scores of 2.88 and 2.77 respectively. In the construction stage, the respondents rated the disaster victims' involvement as being greater, with a mean score of 3.18.

However, close examination of the table shows some difference views in the responses of organisations. While respondents from contractors, government, and consultants rated near 'average involvement' for disaster victims' involvement in planning stage (mean scores of 2.43, 2.79, and 2.50 respectively), respondents from NGOs gave a higher score, mean 3.83, which indicates more involvement by disaster victims in planning stage.

A similar situation occurs in the design stage, respondents from NGOs gave a higher rating, average mean score of 3.69, for disaster victims' involvement in the design stage.

Observing the responses of respondents from NGOs on disaster victims' involvement, it seems that they consider the involvement of the disaster-affected community to be high in every stage of the reconstruction, from planning to construction. Community-based reconstruction is often proposed by NGOs in post-disaster reconstruction. According to Schilderman (2004), community-based involvement builds relationships which are important in the reconstruction process and he also pointed out the importance of communities; communities have local knowledge and memories about other disasters, they have better knowledge of who is more in need and what those needs are, and what resources are needed.

The individual response from respondents (contractor, NGOs, government, consultants) in Table 4-4 also indicates there are probably different views among respondents regarding involvement in PDR projects. For example in rating the disaster victims' involvement at the construction stage, respondents from contractors have given a mean score of 2.72, whereas respondents from governments have given a mean score of 4.24. A series of Kruskal-Wallis tests was conducted to find out if there is any statistical difference in the respondents' response. The results of the test are presented in Table 4-5, Table 4-6, and Table 4-7.

Table 4-4 Involvement and effectiveness of stakeholders

a. Involvement

	Planning Stage					Design Stage					Construction Stage				
	Overall	**CTR**	**NGO**	**GOV**	**CSL**	**Overall**	**CTR**	**NGO**	**GOV**	**CSL**	**Overall**	**CTR**	**NGO**	**GOV**	**CSL**
Contractor	1.78	2.06	1.83	1.50	1.54	1.96	2.15	2.42	1.59	1.46	4.38	4.70	3.94	4.29	4.54
Client	4.03	3.96	4.14	4.18	3.81	4.07	4.02	3.97	4.26	4.04	4.00	4.11	3.64	4.35	3.85
Consultant	4.15	4.28	3.83	3.97	4.58	4.31	4.34	4.06	4.24	4.73	3.59	3.53	3.39	3.50	4.08
Disaster victims	2.88	2.43	3.83	2.79	2.50	2.77	2.21	3.69	2.71	2.58	3.18	2.72	3.83	4.24	3.04

Scale: 1 (no involvement), 2 (Little involvement), 3 (average involvement), 4 (moderate involvement), 5 (full involvement)
ALL = Overall, CTR = Contractors, NGO = NGOs, GOV = Governments, CSL = Consultants

b. Effectiveness

	Planning Stage					Design Stage					Construction Stage				
	Overall	**CTR**	**NGO**	**GOV**	**CSL**	**Overall**	**CTR**	**NGO**	**GOV**	**CSL**	**Overall**	**CTR**	**NGO**	**GOV**	**CSL**
Contractor	2.17	2.77	2.22	1.62	1.73	2.31	2.74	2.61	1.79	1.77	4.22	4.53	3.64	4.29	4.35
Client	4.15	4.26	4.00	4.35	3.88	4.01	4.09	3.78	4.35	3.73	3.97	4.13	3.56	4.32	3.81
Consultant	4.15	4.47	3.94	3.79	4.31	4.29	4.47	4.03	4.21	4.42	3.83	3.98	3.67	3.68	3.96
Disaster victims	3.14	2.85	4.06	2.97	2.62	3.05	2.74	3.97	2.94	2.46	3.38	3.00	4.03	3.47	3.08

Scale: 1 (not effective at all), 2(less effective), 3 (fairly effective), 4 (effective), 5 (very effective)
ALL = Overall, CTR = Contractors, NGO = NGOs, GOV = Governments, CSL = Consultants

Table 4-5 Kruskal-Wallis test – involvement in planning stage by type or organisation

	Contractor (planning)	Client (planning)	Consultant (planning)	Disaster victims (planning)
Chi-Square	6.452	2.422	6.986	22.250
df	3	3	3	3
Asymp. Sig.	0.092	0.490	0.072	0.000*

Table 4-6 Kruskal-Wallis test – involvement in design stage by type or organisation

	Contractor (design)	Client (design)	Consultant (design)	Disaster victims (design)
Chi-Square	11.872	1.093	7.971	24.928
df	3	3	3	3
Asymp. Sig.	0.008*	0.779	0.047*	0.000*

Table 4-7 Kruskal-Wallis test – involvement in construction stage by type or organisation

	Contractor (construction)	Client (construction)	Consultant (construction)	Disaster victims (construction)
Chi-Square	9.959	10.082	5.023	14.065
df	3	3	3	3
Asymp. Sig.	0.019*	0.018*	0.170	**0.**003*

The three tables above show the results from Kruskal-Wallis tests and show that there are some differences in the perception of the disaster victims' involvement in planning, design and construction stages. Also, it can be seen from Table 4-6 that there is a statistical difference in contractor involvement in the design stage. The Kruskal-Wallis test in Table 4-7 shows that there is statistical difference in the clients' involvement at the construction stage. To find out the difference is a Mann-Whitney test was carried out for a pair-wise comparison and the result is presented in Table 4-8 to Table 4-11.

Table 4-8 Mann-Whitney test – contractors' involvement in PDR projects (p value)

Contractors' involvement in design stage			
	NGO	GOV	CSL
CTR	0.438	0.049	0.018
NGO		0.014	0.006*
GOV			0.495
Contractors' involvement in construction stage			
	NGO	GOV	CSL
CTR	0.005*	0.014	0.470
NGO		0.628	0.093
GOV			0.158

*results are statistically significant at p<0.008

From Table 4-8 above it can be seen that there is a statistical difference in the contractors' involvement at the design stage, the difference is between respondents from NGOs and consultants (p=0.006). Also, there is a statistical difference in the contractors' involvement at the construction stage between respondents from contractors and NGOs (p=0.005). Relating these two results to the mean score in Table 4-4 (page 111) there are two situations that can be inferred from the contractors' involvement. Firstly, it indicates that the NGOs perceive contractors to be greatly involved at the design stage, more so than the consultants perceived their involvement to be. Secondly, in the matter of the contractors' involvement at the construction stage the NGOs perceived contractors to be less involved (mean value 3.94) at the construction stage than the contractors perceived themselves to be (mean value 4.70).

From Table 4-7, the results from the Kruskal-Wallis show that the involvement of the clients at the construction stage requires a deeper examination. A Mann-Whitney test was conducted and the result is presented in Table 4-9 below.

Table 4-9 Mann-Whitney test – clients' involvement at the construction stage

	NGO	GOV	CSL
CTR	0.039	0.376	0.166
NGO		0.005*	0.434
GOV			0.029

*results are statistically significant at p<0.008

The results show that there is a statistical different view between respondents from NGOs and respondents from governments (p=0.005). This difference indicates that respondents from NGOs consider the clients' involvement at the construction stage to be lesser than respondents from governments that may have a role as the client in PDR projects.

The Kruskal-Wallis test in Table 4-6 shows there is a statistical difference in view of consultants' involvement at the design stage of PDR projects. A Mann-Whitney test was conducted to find what the difference is and this is presented in Table 4-10 below.

Table 4-10 Mann-Whitney test – consultants' involvement at the design stage (p value)

	NGO	GOV	CSL
CTR	0.144	0.982	0.103
NGO		0.174	0.004*
GOV			0.137

*results are statistically significant at p<0.008

The table above shows that there is a statistical difference (p=0.004), in point of view between the respondents from NGOs and consultants. By comparing the average mean value between them (see Table 4-4), it shows that respondents from NGOs rated lower (mean score 4.06) than the respondents from the consultants (mean score 4.73).

The results of the Kruskal-Wallis tests in Table 4-5, Table 4-6, and Table 4-7 show that there are statistical differences in the involvement of disaster victims at every stage of the reconstruction project (planning, design, and construction). A series of Mann-Whitney test were conducted to find out what the differences are. The results are shown in Table 4-11 below.

Table 4-11 Mann-Whitney test – disaster victims' involvement in PDR projects (p value)

Planning stage (p value)			
	NGO	GOV	CSL
CTR	0.000*	0.262	0.835
NGO		0.003*	0.000*
GOV			0.448
Design stage (p value)			
	NGO	GOV	CSL
CTR	0.000*	0.262	0.835
NGO		0.003*	0.000*
GOV			.448
Construction stage (p value)			
	NGO	GOV	CSL
CTR	0.000*	0.093	0.405
NGO		0.052	0.040
GOV			0.608

*results are statistically significant at p<0.008

As per the table above, it is apparent that at a 5% level of significance, the type of organisation of the respondents has contributed to the difference in levels of involvement of disasters victims in the reconstruction process. It can be traced in Table 4-11 that the differences are from respondents from NGOs which can be observed in Table 4-4 which has shown that the NGOs rated highly the level of involvement by disaster victims. In other words, NGOs consider disaster victims' involvement in post-disaster reconstruction to be important.

4.4.2. Effectiveness of involvement of stakeholders in PDR projects

An inspection of Table 4-4 (see page 111) reveals that there are some significant differences in mean scores from the responses from the questionnaire survey. For example, in effectiveness of the contractor at the planning stage, the mean score from the contractor is 2.77, but the respondents from the government organisations have registered an average mean value of 1.62. To test if there are statistical differences in the respondents' responses, a series of Kruskal-Wallis test was conducted and the results are presented in Table 4-12, Table 4-13, and Table 4-14.

Table 4-12 Kruskal-Wallis test for effectiveness at the planning stage by type or organisation

	Contractor (planning)	Client (planning)	Consultant (planning)	Disaster victims (planning)
Chi-Square	18.676	6.697	8.588	21.374
df	3	3	3	3
Asymp. Sig.	0.000*	0.082	0.035	0.000*

*results are statistically significant at p<0.05

Table 4-13 Kruskal-Wallis test for effectiveness at the design stage by type or organisation

	Contractor (design)	Client (design)	Consultant (design)	Disaster victims (design)
Chi-Square	14.864	9.759	4.250	22.350
df	3	3	3	3
Asymp. Sig.	0.002*	0.021	0.236	0.000*

*results are statistically significant at p<0.05

Table 4-14 Kruskal-Wallis test for effectiveness at the construction stage by type or organisation

	Contractor (construction)	Client (construction)	Consultant (construction)	Disaster victims (construction)
Chi-Square	11.538	13.493	1.565	13.571
df	3	3	3	3
Asymp. Sig.	0.009	0.004*	0.667	0.004*

*results are statistically significant at p<0.05

The Kruskal-Wallis tests show that there are some statistically differences in effectiveness of the stakeholders at various stages of the project. Table 4-12 shows the differences in effectiveness of contractors, consultants, and disaster victims at the planning stage. For the design stage, Table 4-13 shows the differences in perception of effectiveness of contractors, clients, and disaster victims. Similar observations in Table 4-13, shows various differences, except for the consultants' effectiveness at the construction stage.

Additional tests, a series of Mann-Whitney tests, were conducted to explore the differences; the results are presented in Table 4-15, Table 4-16, and Table 4-17. These tables highlight various differences in the responses of the respondents.

Table 4-15 Mann-Whitney test – effectiveness of stakeholders at the planning stage (p value)

a. Contractors' effectiveness			
	NGO	GOV	CSL
CTR	0.055	0.000*	0.001*
NGO		0.190	0.279
GOV			0.946
b. Consultants' effectiveness			
	NGO	GOV	CSL
CTR	0.055	0.000*	0.001*
NGO		0.190	0.279
GOV			0.946
c. Disaster victims' effectiveness			
	NGO	GOV	CSL
CTR	0.000*	0.700	0.556
NGO		0.002*	0.000*
GOV			0.345

*results are statistically significant at p<0.008

Table 4-15 above shows that there are statistically different views on the contractors' effectiveness at the planning stage, between respondents from contractor and government organisations (CTR-GOV). Linking these results with Table 4-4 (page 111), it indicates that respondents from consultant and government organisations do not consider the involvement of contractors at the planning stage to be as effective as it was perceived to be by respondents from contractors organisations. The mean score for contractors is 2.77, whereas the score from respondents from government organisations is lower, at 1.62.

Similar observation of Table 4-15 showing consultants' effectiveness at the planning stage, the Mann-Whitney test shows there are statistically positive results, i.e. there are different views among respondents.

Other positive results in Table 4-15 are the disaster victims' effectiveness at the planning stage. The table shows that respondents from NGOs have a different point of view on the involvement of disaster victims. Table 4-4 (page111) clearly shows that NGOs rated the involvement of disaster victims higher with a mean score of 4.06, whereas respondents from consultant organisations rated them with a mean score of only 2.62.

For the effectiveness at the design stage the results from the Mann-Whitney tests are presented in Table 4-16.

Table 4-16 Mann-Whitney test – effectiveness of stakeholders at the design stage (p value)

a. Contractors' effectiveness			
	NGO	GOV	CSL
CTR	0.664	0.001*	0.002*
NGO		0.039	0.035
GOV			0.584
b. Clients' effectiveness			
	NGO	GOV	CSL
CTR	0.140	0.140	0.142
NGO		0.008*	0.904
GOV			0.010
c. Disaster victims' effectiveness			
	NGO	GOV	CSL
CTR	0.000*	0.517	0.382
NGO		0.002*	0.000*
GOV			0.149

*results are statistically significant at p<0.008

As in the previous table, in Table 4-16 above, similar results can be observed. Firstly, for the effectiveness of contractor's involvement at the design stage, respondents from government (GOV) and consultant (CSL) organisations rated the effectiveness of contractors lower than the respondents from contractors perceived themselves to be. However, NGOs rated the effectiveness of the contractors' with a mean score of 2.61 (Table 4-4, page 111). Secondly, for the clients' involvement at the design stage, there is a positive result from the Mann-Whitney test indicating that there is a different viewpoint between respondents from NGOs and government. Looking back in Table 4-4, respondents from NGOs have a mean score of 3.78, while governments have higher mean score of 4.35. Thirdly, for the disaster victims' involvement at the design stage the results in Table 4-16 echoes the results from the previous table of the respondents from NGOs having rated the involvement of disaster victims higher at the design stage than other respondents.

The next table will present the effectiveness of the involvement of the stakeholders at the construction stage.

Table 4-17 Mann-Whitney test – effectiveness of stakeholders at the construction stage (p value)

a. Contractors' effectiveness			
	NGO	GOV	CSL
CTR	0.001*	0.625	0.374
NGO		0.018	0.050
GOV			0.699
b. Clients' effectiveness			
	NGO	GOV	CSL
CTR	0.010	0.386	0.073
NGO		0.002*	0.408
GOV			0.015
c. Disaster victims' effectiveness			
	NGO	GOV	CSL
CTR	0.001*	0.129	0.815
NGO		0.082	0.003*
GOV			0.219

*results are statistically significant at p<0.008

Table 4-17 above shows there is positive result from the Mann-Whitney test and there is a statistically different view between respondents from contractors and NGOs on the contractors' involvement at the construction stage.

Comparing this result with the mean scores in Table 4-4 (page 111), shows that respondents from NGOs rated the effectiveness of contractors lower (mean score of 3.64) than the contractors rated themselves (mean score of 4.53). Table 4-17 also indicates that there is a statistically different view between NGOs and governments on the clients' effectiveness at the construction stage where respondents from NGOs gave a lower rating (mean score of 3.56; Table 4-4, page 111) than governments' (mean score of 4.32). As in the previous two tables Table 4-17 indicates a different point of view from the respondents from NGOs on the effectiveness of disaster victims at the construction stage where they gave higher score that the others.

This section has presented the results from the questionnaire survey on the involvement and effectiveness of stakeholders in PDRP. The results from the Kruskal-Wallis tests and Mann-Whitney tests show the different perceptions among the respondents of the survey. Inferences and implications of the results will be discussed on the next section.

4.5. Discussion on stakeholders in post-disaster reconstruction projects

The discussion in section 4.3 (page 100) centred on the various stakeholders involved in post-disaster reconstruction projects. In disaster management the importance of involvement of government, NGOs, donors, and affected populations can be observed. Lettieri et al. (2009) in their systematic review added two more groups of stakeholder: media and researchers. However from a construction project perspective at the reconstruction stage the key stakeholders may be pinned to contractors, consultants, governments, NGOs, and affected populations. The previous section, 4.4, has presented the involvement and the effectiveness of the involvement of stakeholders in PDR projects. Based on that, the following sub-section will examine their involvement.

4.5.1. Contractors

Stakeholders' relationship in the Aceh reconstruction (Figure 4-2, page 105) indicates that the contractors or the construction industry in general, was labelled only as the 'business world' who implemented the reconstruction. This may imply an insignificant contribution by the construction industry; but in contrast, Ofori (2004) described the construction industry as an organisation who undertake the planning, designing, construction of facilities to reduce disaster vulnerability to save or protect lives, and restore infrastructure to reinstate the economy. It simply describes the important role of construction industry. Other authors (Haigh et al., 2006, Bosher et al., 2007, Haigh and Amaratunga, 2010, Bosher and Dainty, 2011, Haigh and Sutton, 2012, Kenny, 2012, Siriwardena et al., 2013) also have been highlighted the important role of the construction industry in disaster management.

Contractors are traditionally involved mostly at the construction stage and have less involvement at other construction stages as they act as implementer of the design or plan prepared by the consultants. Results from questionnaire survey on Table 4-4 indicate the same, the respondents rated the contractors' involvement as almost continuous involvement throughout the project (mean score 4.38), compared to lower involvement at the planning stage (mean score 1.78) and design stage (mean score 1.96). In the same table similar indications for effectiveness can be found where the respondents have considered contractors to be the most effective at the construction stage.

Table 4-4 also indicates more involvement by contractors at the design stage of PDR projects. As the projects are required to finish as soon as possible, design and construction are conducted almost simultaneously. Consultants work closely and discuss the design with the contractors. For low-technology projects, such as housing, contractors may be hired by a design and build procurement method which has the advantage of reduction in construction time (Anumba and Evbuomwan, 1997).

With the influx of funding from donors for the reconstruction new projects become available for the contractors following disaster events. From a business perspective contractors perceive that the reconstruction is the good business opportunity for their company, as indicated by one of respondents:

> *"Under normal conditions in one year we carry out only one job. But after the quake we got 7 or 10 jobs. We were busier." (R26-CTR-EO)*

The lucrative new projects attract the establishment of new contractors companies. BRR, in the Aceh reconstruction, received pre-qualification documents from 3000 contractors dominated by small local contractors. Only around a third (1,200) of them passed BRR's qualification process and worked for BRR. However, with so many new companies and a very limited time frame for the procurement process there were a number of problems at the construction stage:

> *"One of the consequences was that contractors proliferated. Not every contractor had the competency, experience or ability to complete the work. Their limited resources led them to neglect the work and leave their projects unfinished. Moreover, their financial management systems varied, and some of them had even submitted bank guarantees that were obtained under false pretences [sic], indicating that they were not recognised contractors. Their limited resources caused work delays and some of them eventually gave up and subcontracted their work to others. In some cases, contractors sold their BRR contract to other contractors. These sub-contracts resulted in substandard construction. In the end, housing construction was incomplete and materials were of poor quality."(BRR, 2009b, p.80)*

The abundance of work opportunities may also lead to fraud by contractors. White (2009) suggests many new contractors in the Aceh reconstruction were bogus companies and he implied that one company could submit ten applications to a tender in order to bias the tendering process.

4.5.2. Project owners/Clients

Clients or project owners on PDR projects are fully involved as indicated in Table 4-4 (page 111), and also considered to be effective by the respondents.

Local government organisations usually act as clients or project owners on PDR projects and it is not surprising when on examination of Table 4-4 it can be seen that respondents from government organisations gave a higher rating for the involvement and effectiveness of clients than other respondents. For example, for client involvement at the planning stage all respondents gave an average mean value score of 4.03, respondents from government organisations rated client involvement with a mean score of 4.18 while other respondents gave a mean score of 3.96, 4.14, and 3.81 (contractors, NGOs, and consultants respectively).

Local government plays an important role in disaster management. Very often disasters occur in small, local area, and centralised disaster management agencies have lead to an increased role for local governments in disaster management in developing countries (Bollin, 2003). Local governments organise the reconstruction process and provide guidance in term of laws and regulation for the reconstruction (Peng et al., 2013). However, the local governments have some issues, for example, lack of financial and human resource capabilities, a lack of knowledge of disaster risks and vulnerabilities, and lack of pre-disaster planning (Malalgoda et al., 2013). Research by Kusumasari (2010) assessed the capability of local government in Bantul district in Yogyakarta province. Her result show that local government has relatively low capability in disaster management by indications of no clear institutional arrangement, limited personnel who have knowledge of disaster management, and no local policy. But in the research Kusumasari also shows that the Bantul local government has much better capability in the recovery stage than the mitigation, preparedness, and response stage of disaster management. Perhaps the reason is that the recovery stage mostly consists of physical reconstruction which they are familiar with under normal conditions.

4.5.3. Consultants

Consultants along with the project owner (client) and contractors are considered to be main stakeholders in traditional construction projects.

Results from the questionnaire survey shows that consultants have a very high involvement and is very effective at every stage of PDR projects (see Table 4-4, page 111).

However, in the planning process Audefroy (2010) suggests that the involvement of the community in a participatory capacity is a key element in the reconstruction process which may lead to a better life for the community. He infers that planning, without community consultation, will result in abandoned finished projects.

In the reconstruction process consultants may have the following tasks (Davenport, 1992): conducting risk assessment and developing risk maps, using risk maps in planning, and also promoting and raising awareness of hazard-resistant construction.

The planning and design for the damaged buildings following a disasters may lead to two options; rehabilitation (retrofit) of the existing building or demolishing the building and constructing a new building. Decisions may be based on the damage assessment which is often based on visual assessment and is influenced by local politics. The damage level criteria usually has three levels: light, medium, heavy (Ismail et al., 2011); light and medium damage will be retrofitted and heavily damaged buildings will be demolished and rebuilt. However, the interviews revealed that consultants prefer to design new buildings than to undertake retrofitting. Because in retrofitting consultants must have drawings of existing buildings and make a damage assessment based on that. Damage to buildings following a disaster can mean that buildings are often difficult to access to make a damage assessment.

> *"..For the identification of the damage we have to go into the room where the office is often locked. ...To see the damage on the wall we have to move, in advance, the existing cabinets near the wall, and then take a picture for the administration. Or we have to dismantle the ceiling to see the damage on the roof." (R03-CSL-MD)*

The project owners also prefer to opt for new buildings. Traumatic conditions following disasters and uncertainty about building conditions are some of the reasons for this preference. From a cost perspective, new buildings offer more certainty about project costs that retrofitting. To some extent retrofitting has similar characteristic to refurbishment works, and as noted by Egbu (1994), cost control is the most difficult aspect in the refurbishment process.

4.5.4. NGO and donors

When comparing stakeholders under 'normal conditions' on projects with stakeholders on PDR projects, it is obvious that NGOs are becoming one of the main stakeholders in PDR projects. Von Meding et al. (2008) made similar observations in which they stated that NGOs have played an increased role in post-disaster reconstruction. However, they also noted that NGOs do not possess adequate operational and organisational competencies.

With regards to the approach to reconstruction it seems that the NGOs prefer to choose a community-based approach which offers substantial involvement by disaster-affected communities. For example, the Swiss Red Cross has goal "*to protect, safeguard and promote the lives, health and dignity of human beings*" and engage in the following areas of intervention in reconstruction: basic health, community-oriented infrastructure projects (community-oriented housing and settlement construction community centres, schools), and livelihood (Swiss Red Cross, 2008).

An inspection of Table 4-4 reveals that respondents from NGOs rated disaster victims' involvement in PDR projects higher than other respondents. Table 4-11 confirms that there is a statistical difference in the response of respondents regarding disaster victims' involvement. NGOs in PDR may create public awareness about disaster vulnerability and can accelerate physical and social construction of the disaster-affected area (Arslan and Ünlü, 2008).

The Sphere standards also emphasise disaster-affected communities' involvement in the reconstruction process. The Sphere standards are a set of humanitarian principles, standard of service and indicators, that have been widely implemented in emergencies worldwide (McDougal and Beard, 2011). The 2004 version of the standards stated participation by the community to be one of common standards (Sphere project, 2004), and this participation was made more important when 'people-centred humanitarian response' was placed first in the core standards in the 2011 version of Sphere standards (Sphere project, 2011).

Furthermore, there are several reasons that support the involvement of NGOs in disaster management (Benson et al., 2001):

- NGOs have a direct link with 'grassroots' communities and work with the most vulnerable communities;
- NGOs can easily identify potential threats and vulnerabilities;
- They support local people in developing coping strategies and raising people's capacities;
- NGOs offer a holistic approach to disaster management.

Hayles (2008) argues that the sustainability of the reconstruction is one area of involvement for disaster-affected communities in the reconstruction process, especially in the decision-making process, as local knowledge is essential to fulfil sustainability requirements. Hayles noted the important role of NGOs as an interface between the community and government by communicating the community's needs and priorities to the government (Hayles, 2008). From a similar standpoint, Dercon & Kusumawijaya (2007) concluded that a community-based approach in post-disaster housing reconstruction allows NGOs to respond to the urgent needs of the community, create social capital, achieve good planning which will lead to good quality housing, and competent monitoring of the process.

However, the involvement of NGOs in PDR is not without its critics. 3 respondents in the interviews (refer to Table 5-1, page 133) expressed their concern relating to high cost of involvement of NGOs, as illustrated by quotation from the following respondents:

> *"A coordinator of a NGO came to me and asked me where to find stone for his project. I showed him the location. He asked about the price, I said 250 [Rp 250.000/m3]. He's already got the information from me, and then he's looking for the stone. A few days later I met him again. I asked him if he had the stone. He answered he had already. I asked, "How much did you pay?" He said 750 [Rp 750.000/m3]. I said, "Very*

> *expensive, why have you bought it?" He answered, "It's okay, we've got a lot of money".*
>
> *Any emergency in any area in the world, which is already entered by the UN and NGOs, will leave a trail of high inflation, wherever it is. They went into Africa carrying aid; automatically for his services he issued a high cost. For him there is no problem. But after he leaves, the prices may not directly go down." (R13-NGO-FY)*
>
> *"…NGOs just spend a lot of money for [their] operations. Their salaries are high and big amount for operational are not appropriate in my opinion. If they want to help in supervising that is ok, but not everything should be done by them, so that [the project is in] high cost." (R24-CTR-AD)*

4.5.5. Disaster victims

With the involvement of NGOs in PDR projects, disaster victims or disaster-affected communities are becoming prominent stakeholders on the projects. Not only because they are the end-user of the finished project, but also being actively involved in planning and design and also at the construction stage of the project. The Aceh reconstruction used community driven the first basic principle of rehabilitation and reconstruction, where the reconstruction focused on community, participatory community involvement in the decision making process (BRR, 2005b, p.57).

Table 4-4 (page 111) shows the involvement and effectiveness of disaster victims in PDR projects. The mean value scores in the table indicates that disaster victims have more involvement at the construction stage (mean 3.18) than at the planning stage (mean score 2.88) and design stage (mean score 2.77). However, the respondents considered the involvement of disaster victims is quite effective in every stage of the reconstruction process with mean scores ranging from 3.05 to 3.8.

There are five levels of involvement for disaster victims in the reconstruction process, from 'empower' the community to 'manipulate' the community, as in the 'ladder of community participation' (Davidson et al., 2007, MacRae and Hodgkin, 2011). At the 'empower' level, the affected community has a greater amount of control in the decision making process of the reconstruction project. The opposite of 'empower' is 'manipulate'; where the community has no control over decision making (Davidson et al., 2007). People's participation may vary depending on the local situation (Ochiai and Shaw, 2009). However, effective community participation requires time and constant consultation with the community (Steinberg, 2007), therefore community planning and design may become prolonged. At the construction stage the affected community may be involved as labour in the construction procedure or actively involved in supervising the construction of their homes. Although there are many variations of community participation, Davidson et al (2007) research reveals the involvement of disaster affected communities at the construction stage in most cases in their study.

The result in Table 4-4 shows significant involvement of disaster victims in the reconstruction project, but it is worth finding out whether the involvement of disaster victims in PDR is based on the location of the reconstruction projects. The data from the respondents to the questionnaire was then grouped and based at the location of the reconstruction project where they were employed. The mean value was then calculated using SPSS software. The mean value of the level of involvement and effectiveness are presented in following Table 4-18.

Table 4-18 Disaster victims' involvement and effectiveness, based on location

	Aceh	**Yogyakarta**	**West Sumatra**
Involvement			
Planning	2.66	3.13	2.87
Design	2.43	3.21	2.47
Construction	2.75	3.79	2.67
Effectiveness			
Planning	2.93	3.36	3.20
Design	2.88	3.23	3.07
Construction	3.04	3.77	3.33

Observation of the above table shows there are some significant differences in the figures for involvement and effectiveness of disaster victims in Yogyakarta reconstruction which has an average mean value scores greater than the Aceh and West Sumatra reconstruction. For example, in involvement at the construction stage in the Yogyakarta reconstruction has an average mean score of 3.79 whilst for Aceh and West Sumatra reconstruction the mean scores were 2.75 and 2.67 respectively.

The big difference in the scores indicates there may be a statistical difference between those locations. To explore this a Kruskal-Wallis test and sub-sequent test, and a Mann-Whitney test, were conducted. The results are presented in Table 4-18 and Table 4-19.

Table 4-19 Kruskal-Wallis test – involvement of disaster victims by PDRP location

	Disaster victims (planning)	Disaster victims (design)	Disaster victims (construction)
Chi-Square	3.770	12.621	21.349
df	2	2	2
Asymp. Sig.	0.152	0.002*	0.000*

*results are statistically significant at p<0.05

Table 4-20 Mann-Whitney test – disaster victims' involvement

Involvement of disaster victims in design stage (p value)	
PDRP location	Level of involvement
Aceh - Yogyakarta	.001*
Aceh – West Sumatra	.965
Yogyakarta – West Sumatra	.044
*results are statistically significant at p<0.008	
Involvement of disaster victims in construction stage (p value)	
PDRP location	Level of involvement
Aceh - Yogyakarta	.000*
Aceh – West Sumatra	.853
Yogyakarta – West Sumatra	.005*

*results are statistically significant at p<0.008

The tests confirm that there is a statistical difference in involvement of disaster victims in the Yogyakarta reconstruction compared to the other two reconstructions. Disaster victims in the Yogyakarta reconstruction were more involved than disaster victims in the other two reconstruction locations.

Perhaps it is because in the Yogyakarta reconstruction there was sufficient skilled workers compared to Aceh and West Sumatra (Soelaksono, 2010). A previous study by Kaming et al. (1997b) supports this argument where in their study Kaming et al. conclude that the workers (artisans) from Java Island (where Yogyakarta is located) have better record for productivity compared to the West region of Indonesia (where Aceh and West Sumatra province are located).

One cultural aspect which leads to better reconstruction in Yogyakarta was the *gotong-royong* (working together, mutual aid) culture that is still strong in Yogyakarta, as mentioned by one of respondents:

> *"Culture of gotong royong (mutual aid) in the community is still strong in the areas of Imogiri and Bantul [in Yogyakarta], so that disaster response seems better in those areas. Nearly a year after the earthquake, almost no traces of the quake can be found at people's homes. It seems they have returned to normal activity. Yes, probably due to the strong foundation of* gotong-royong.*" (R25-GOV-RR)*

Another respondent from a local government organisation in West Sumatra province indicated the same condition:

> *"If we compare the empowerment of communities in West Sumatra is a bit lacking, a sense of* gotong-royong *is also somewhat lacking. That was very high in Yogyakarta." (R10-GOV-AI)*

Donahue (2012) argues that community participation is the key factor in housing reconstruction, especially when the reconstruction is dominated by outside aid providers. This was the case in the Yogyakarta reconstruction where the community has a high social conscience and local wisdom that made it the social capital of reconstruction (Kusumasari and Alam, 2012).

4.6. Summary

This chapter has investigated key stakeholders and their role in post-disaster reconstruction. Results from the questionnaire survey and semi-structured interviews are presented in this chapter.

This study shows that the involvement of NGOs and disaster victims in post-disaster reconstruction projects is becoming more prominent when compared with the traditional view of project stakeholders which is usually comprised of clients (or project owners), consultants, and contractors.

Respondents of this research rated the involvement of the disaster victims in the construction stage higher than in planning and design stage. The involvement of the victims in construction stage may as labours or workers; it is relatively less complex and less time consuming than the involvement in the planning and design stage. The respondents also rated the involvement of the disaster victims as 'fairly effective' in every stage of the reconstruction project.

The statistical tests show that there are positive results on the difference of the involvement and effectiveness of disaster victims in reconstruction projects where respondents from NGOs rated the involvement and the effectiveness higher than the others.

Statistical tests also revealed that there are differences on the level of involvement of disaster victims based on the reconstruction location. The involvement in the Yogyakarta reconstruction is higher than the others. It suggests that local culture greatly contributes to the level of involvement.

Having discussed PDR projects' stakeholders in this chapter, the next chapter will present the challenges that are encountered by the stakeholders in PDR projects.

CHAPTER 5. CHALLENGES ASSOCIATED WITH POST-DISASTER RECONSTRUCTION PROJECTS

5.1. Introduction

This chapter discusses and highlights the challenges faced by the stakeholders in post-disaster reconstruction (PDR) projects based on the questionnaire survey and the interviews. In order to understand the challenges of PDR section 5.2 in this chapter will discuss the characteristics of PDR projects according to the semi-structured interviews and findings from the questionnaire survey. The section is followed by section 5.3 which discusses the challenges in PDR projects based on the questionnaire survey and the interviews.

5.2. Understanding the characteristics of PDR projects

When observing PDR projects the first question that arises is to what extent do post-disaster reconstruction projects differ from normal (i.e. not in a disaster context) projects because both are basically construction projects? Further discussion will take place in the following sub-chapter to explore the answer to that question.

5.2.1. PDR projects versus 'normal' projects

One way to understand the characteristics of PDR projects is to explore the difference between management of PDR projects and conditions after the disaster in relation to a 'normal' project. 'Normal' means the conditions within which most construction projects take place.

In the interviews the respondents were asked for their opinion, based on their experience, of the differences between project management in PDR and normal projects (refer to question number 3, Appendix D. The interview questions, page 355).

The interviews revealed mixed explanations about the differences; 6 of the 33 interviewees considered the management of PDR projects is no different than normal projects, while the others argued the opposite.

One of the project managers from a contracting company answered, simply, that there is no difference between normal projects and PDR projects:

> *"For me, there are no differences; it's the same." (R02-CTR-LR)*

Another respondent also echoed his opinion:

> *"Technical difficulties are normal at the time of reconstruction. After the tsunami that was caused by the earthquake development is likely to stay away from the current location, away from the beach. Local authorities provided a new location. Our initial technical difficulty is implementing a project in a location that has not been developed. Actually, this is the same difficulty as in other projects, so in general, there is no significant difference." (R28-CTR-ES)*

However, the other 27 respondents indicated there are some differences. Analysis of the interviews in NVivo reveals 13 themes connected to the differences between project management on PDR projects and normal projects. The result is presented in Table 5-1 (page 133).

The first difference is in the tendering process and contract administration for PDR projects. In Table 5-1 6 of the 27 interviewees mentioned the different contract and tendering processes on PDR projects, as mentioned by the following respondents:

> *"From my opinion, there is no significant difference. Only after the disaster project becomes privileged; they are special. For example, in terms of budgeting and implementation rules there may also be projects that are not through the tender stage." (R11-GOV-TF)*

> *"It was very different, [In the projects after the disaster] the administrative process becomes easier." (R05-CSL-IT)*

Table 5-1 Differences between PDR projects and normal projects revealed by the interview

Characteristics	No. of sources	No. of references
Contract & tendering	6	8
Careful in construction	4	6
Community based	6	9
Concern to quality	19	39
Pressure and Fast-track design	5	5
Health & Safety	2	2
High cost of NGO	3	4
Materials and resources availability	10	13
Over design	7	8
Project management organisations	3	3
Supervision	7	9
Time dimension	2	4
Traumatic	2	3

The tendering and contract administration processes refer to the Presidential Decree (*Keputusan President*) number 80/2003 which is the standard regulation for the public procurement system (OECD, 2007). In the regulation there are two approaches for procurement, i.e. direct procurement and the tendering process. The threshold value to determine the approach for procurement is a project value of Rp.100 million (equivalent to around £6700 in May 2013) where above this value the procurement method must be through a tendering process. However, in cases of disaster response the regulation enables direct procurement, regardless of the project value, in case there is a need for immediate action and the tendering processes would be protracted.

In the Aceh reconstruction the Government of Indonesia (GOI) produced three additional Presidential Decrees to accelerate the reconstruction process (Tempo, 2005), i.e. Presidential Decree 70/2005, 69/2005, and 15/2005. Decree number 70/2005 is a revision of regulation number 80/2003 which was specifically drafted for the Aceh reconstruction. With this revision, for housing projects in Aceh reconstruction, contractors may be appointed without going through the tendering process and block grants were released to the community for self-build housing projects (BRR, 2005c). The revision has a better procedure for funding multi-year projects so as to increase the speed of implementation in BRR multi-year contracts (BRR, 2009a).

The destruction following the 2004 Aceh earthquake, the 2006 Yogyakarta earthquake and the 2009 West Sumatra earthquake was very serious. At least 100,000 houses were damaged in each earthquake that also claimed thousands lives. It is no surprise, when asked about the difference between PDR projects and normal projects, that 19 of the 27 respondents implied that there was more concern about the quality of the construction in PDR projects than in normal projects (Table 5-1, page 133). Furthermore, 4 interviewees stated 'more careful in construction' on the PDR projects and 'over-design' which was indicated by 7 respondents in the interviews.

Respondents from contractor companies related the situation:

> *"Now, when I carry out work I try to be more careful. Because there is a building that I have built that cracked. Project owners now also pay more attention to the quality aspect of the job."(R01-CTR-DK)*

> *"In terms of management there is no significant difference, but in terms of design it seems to be better. Reinforced concrete design and all other stuff tend to be stricter." (R17-CTR-BS)*

A similar observation from a respondent from NGOs:

> *"The implementation of reconstruction projects is really strict, so there is no leeway. So after NGOs were involved after the Aceh tsunami and earthquake in Padang, the project management was strengthened and tightened." (R19-NGO-NN)*

5 of the 27 interviewees revealed that 'pressure and fast-track design' in PDR projects. From the Government's point of view reconstruction projects are more

pressured than normal projects, because, for example, the Government has to restore damaged infrastructure immediately.

> *"The main difference is that our normal work is not suppressed by operational needs. For example, a faulty port on the island of Semeleu, was damaged by the earthquake, and the port connects the island to Aceh. We had to rehab it as soon as possible so that the port could be used to cross into Aceh. Provided that can be used first. So it does not follow the pattern of the design consultant, in the field we have to make adjustments." (R07-GOV-JA)*

As a consequence of the pressure for a quick response, the Government executes the planning-design and construction stages of PDR projects almost concurrently, often called a 'fast-track' system, in the same financial year. In normal conditions the construction stage of a Government funded project is usually conducted a year after the planning-design stage.

> *"The difference is the nature of the work after the earthquake crash-programme, the design and implementation can be said to be carried out simultaneously. Because if you wait for the project design to be finalised it cannot be implemented. While under normal conditions, the design is complete and has been arranged so that the required data already exists so work could begin." (R27-CTR-IZ)*

Difficulties in finding adequate construction materials and resources differentiate management in PDR projects to normal projects. Table 5-1 shows that 10 interviews mentioned these difficulties.

One of respondents noticed the difficulty in finding resources for PDR projects compared to normal projects and argues that there should be a higher budget allocated to PDR projects than normal projects due to resource constraints and inflation, as expressed in the following comment:

> *"The difference is in the cost factor in the budget for work on the infrastructure in the disaster-affected areas. Such costs should be multiplied, there is need for a multiply factor. Firstly, it is due to resource constraints, the demand exceeds*

> *production factor in the area. Secondly, because of the fact that there are many projects inflation in the region should be counted in as well. So there is a difference in terms of the project budget." (R22-NGO-AS)*

An interesting finding from the interview is that the reconstruction projects may be viewed as good opportunities for contractors to increase the number projects than under normal conditions when the number of projects they undertake is low. Respondent R26 revealed this when explaining the difference in tendering and contract administration on PDR projects:

> *"...Much different. Under normal circumstances as a single company we may only get one project a year. But in the reconstruction after the disaster we had 7 to 10 jobs, so our management system became more hectic. Income money for us is a lot and the work is not worth the money. I mean it this way, for example, a work has a Rp. 50 million budget, but for the projects after the earthquake the same work could have a budget of Rp. 200 million. It is not only because of the rise in material prices; the most important thing for the government is how to exhaust the reconstruction money." (R26-CTR-RR)*

However, two of the respondents, as shown in Table 5-1, suggest that the time factor is the determinant factor which affects the difference between PDR projects and normal projects. The more time that elapses between the disaster happening and the time the project starts, the less the disaster will affect the project.

> *"Because my project in Padang is far from the (time) of the earthquake, there is no difference. The project (started) one year after the earthquake. Reinforcement-bars that we use we buy from Jakarta, the road that we use is also the same as before the disaster. So it was not very influential, because it's been a year and there have been recovery activities in the transportation."(R28-CTR-ES)*

This section has discussed the difference between projects managed under normal conditions and those following a disaster. The next section will present the characteristics of post-disaster reconstruction and their effect the management of PDR projects.

5.2.2. Nature of PDR and its effect on management of the PDR projects

From the literature review a number of characteristics of PDR projects have been identified. They are the complexity of reconstruction projects, the chaotic conditions following the disaster, public pressure on the redevelopment, limited availability of resources, and unstable economic conditions. Some descriptions of the nature of PDR projects are presented in Table 5-2 below.

Table 5-2 Nature of post-disaster reconstruction projects

Nature	Author(s)
Complexity	"...The Aceh post-disaster context was complex and likely unique, especially with regard to the free influx of many international organisations with more funding available than could often be spent within a reasonable time frame." (UN-Habitat, 2009)
	"...They [disasters] created complexity that often went beyond the comprehension of local authorities. In the context of developing countries it has been observed that big catastrophes invite external organisations to come and help the survivors. The increasing involvement of hundreds to thousands of non-state and non-governmental actors after big catastrophes in developing countries may create more complex realities beyond the comprehension and the capacity of the respective actors, such as governments and local disaster response authorities" (Lassa, 2012)
	"Such strategic and long-term planning and the needs, assets, and involvement of the community should not be ignored in the post disaster stage of recovery. But the case study showed clearly that recovery is complex and requires patience."(Sofyan, 2012)
	"...disaster is defined as a sudden event, very complex in nature and causing fatalities, loss of properties or environment and causes morbidity in the local society. This event

Nature	Author(s)
	requires frequent and intense handling that involves resources, tools and manpower from many agencies with effective coordination which probably involves complex actions and long period of duration." (Rahman, 2012)
Chaotic conditions	"Natural disasters on the scale of Katrina inevitably bring chaos and suffering" (Broadbent and Broadbent, 2006) "However, we should not forget that housing provision is a complex and difficult problem, particularly in the chaos and suffering that follow disasters." (Twigg, 2006) "Community participation processes require time and ample public communication, which are both in short supply in the chaos and urgency after complex disasters" (UN-Habitat, 2009, page 50) "NGOs operating in post-disaster scenarios are faced with extremely unstable environments. From local economic conditions to regional politics, all areas of society face chaos in the aftermath of a disaster. To effectively match such an environment, the internal capabilities of an organisation must be flexible, adaptive and diverse." (Von Meding et al., 2009)
Public pressure	"Although agencies that opt for contractor driven reconstruction tend to prefer to construct new villages on clear ground, public pressure meant that most rebuilding was done on existing sites (hence 'in situ')." (Barenstein, 2006) "In the tsunami response, media coverage drove the funding from both the public and official sources. The media coverage influenced public generosity directly and produced public pressure on politicians to grant government funds. While the public gives generously for disasters that attract attention and touch a chord, emergencies that get little media attention get little money from the public." (Cosgrave, 2007, p.34) "BRR was under public pressure, in particular from the disaster victims, to provide new houses in rapid succession." (BRR, 2009c) "government officials often succumb to public pressure to place controls on the very goods and services that are most needed after a natural disaster" (Chang, 2012)
Limited availability of infrastructure	"The ensuing tsunami swept debris and sea

Nature	Author(s)
	water into homes and buildings up to 5 kilometres inland, crushing them and further damaging roads, bridges, telecommunications, water and electricity systems, crops, irrigation, fishery infrastructure, food and fuel outlets." (Bappenas, 2005) "The effort to supply the often rare materials and other problems related to logistics, and the limited manpower available have all contributed to the difficulties experienced by the rehabilitation and reconstruction program." (BRR, 2006b) "...the Tsunami in most affected countries damaged the following local government social and economic infrastructure: pre-schools/child care centres, health clinics, public markets, drinking water systems (wells, pipes etc.), playgrounds and public parks, libraries, slaughterhouses, streets and minor roads, training centres (e.g. vocational training), crematoriums/cemeteries, community buildings/conference halls, sanitation (sewage systems and public toilets), street lights, bus stands, etc." (UNDP, 2006) "However the remoteness of many sites, lack of infrastructure and poor living conditions (some imported labourers lived in emergency barracks vacated by tsunami-affected households) meant labourers were only prepared to work a few weeks or months at a time." (Da Silva, 2010)
Unstable economic conditions	"Post tsunami, prices have increased more sharply than nationwide, in particular in Banda Aceh, where year-on-year inflation in October 2005 reached 37.5 percent - largely due to the heavy demand for construction materials and skilled labour. The construction boom has also led to a 30-40 percent surge in wages across all professions." (BRR, 2005a) "The unexpected appearance of inflation has been the main trigger of aid volatility in Aceh and has had a direct effect on the ability of international reconstruction agencies to deliver on their planned promises. Year-on-year inflation peaked in November 2005, reaching 41 percent, with the result that several reconstruction gaps became apparent." (Masyrafah and McKeon, 2008) "The issue of cost increases is an important

Nature	Author(s)
	one because recent reports from other places in the world hit by disasters (Pakistan, US/Katrina, and even in Yogyakarta/Indonesia after the Yogya earthquake) indicate that sharp cost increases in disaster zones are not unusual.” (Nazara and Resosudarmo, 2007, p.17)
	“In the wake of a disaster, the majority of manufacturing-supply facilities and operational systems in up-stream industries in the impacted areas are likely to be damaged and the construction market tends to be in disorder, contested and highly adversarial. This, if combined with disruption of transportation and energy supply, and historical problems of the local industry, could significantly exacerbate the difficulty in project sourcing within the construction industry” (Seville et al., 2010)

As a system, processes in construction projects may be affected by the environment which also may affect the output. Thus, the characteristics of PDR projects, as mentioned in table above, will to some extent influence the management of the project.

Project managers do managerial tasks on the project which include planning, organising, directing, and controlling (Fryer et al., 2004). In planning a project managers anticipate future works and develop ways to achieve the project’s targets. They organise resources for the project where plant, materials, and components are purchased, stored, handled, and used efficiently. The project managers also focus on people in the project; they direct people working on the project to implement the plan. Then project managers control the project by comparing performance with the plan (Fryer et al., 2004).

In this research one of questions in the questionnaire survey explored the extent to which the conditions following a disaster affect the managerial task of project managers. By using the Likert Scale 1 (no impact at all) to 5 (a very high impact) the results are presented in the following Table 5-3.

Table 5-3 Nature of disasters affecting management

Nature of the disasters	Impact on planning					Organising resource					Directing people					Controlling project				
	ALL	CTR	NGO	GOV	CSL	ALL	CTR	NGO	GOV	CSL	ALL	CTR	NGO	GOV	CSL	ALL	CTR	NGO	GOV	CSL
Complexity	**3.99**	3.77	4.14	3.91	4.27	**3.90**	3.81	3.86	3.91	4.08	**4.02**	4.02	4.06	3.97	4.04	**4.31**	4.38	4.22	4.29	4.35
Chaotic conditions	**3.94**	3.81	4.03	4.03	3.92	**4.06**	4.02	4.17	4.26	3.69	**3.99**	3.81	4.14	4.29	3.73	**4.19**	4.09	4.17	4.47	4.04
Public pressure	**3.45**	3.51	3.28	3.44	3.58	**3.50**	3.64	3.11	3.44	3.85	**3.55**	3.64	3.25	3.47	3.92	**3.87**	4.09	3.47	3.74	4.19
Limited availability of infrastructure	**3.57**	3.49	3.64	3.62	3.54	**3.90**	3.91	3.75	4.12	3.81	**3.84**	3.87	3.31	4.29	3.92	**4.06**	4.28	3.42	4.44	4.08
Unstable economic conditions	**3.49**	3.57	3.31	3.59	3.46	**3.82**	3.94	3.47	4.00	3.85	**3.69**	3.98	2.94	4.00	3.81	**3.90**	4.19	3.14	4.26	3.96

Scale: 1 (No impact at all), 2 (Low impact), 3 (Little impact), 4 (Some impact), 5 (A very high impact)

ALL = Overall, CTR = Contractors, NGO = NGOs, GOV = Governments, CSL = Consultants

An inspection of Table 5-3 shows respondents to the questionnaire survey rated the effect of disaster conditions on the management of the project with an average score above three in almost all of the aspects. It indicates that the nature of the disaster has quite a significant impact on management of the project.

From the table, it seems that the nature of the disaster has a higher impact on controlling the project. The complexity situation after the disaster had the highest score (mean score 4.31) for project control. Similar observations may be seen in Table 5-3. 'Chaotic condition' has the highest score for 'controlling the project' with a mean score of 4.19. 'Public pressure', 'limited availability of infrastructure' and 'unstable economic conditions' also had the highest average score got 'controlling the project'.

In contrast, the nature of the disaster has relatively less significant impact on planning which, from the table, is seen as 'chaotic conditions', 'public pressure', 'limited availability of infrastructure', and 'unstable economic conditions' which had the lowest score on 'impact on planning'.

A research by Dvir & Lecher (2004) revealed an interesting finding about project planning. They argue that with regard to the nature of the project it is impossible to perform tasks in a project without changes. Plan-changes are usually provoked by the environment which prevents adherence to the original project plan. For example, changes of plan may caused by shortage of materials, strikes, weather conditions, and delays. Dvir & Lecher argue that the changes are more important than the plan, "*plans are nothing, changing plans are everything*" (Dvir and Lechler, 2004). Their results imply that controlling the project is more important than planning, as the changes are basically adaptations to the changing environment for controlling project. Therefore, the nature of the disaster will greatly affect controlling the project than planning the project.

Table 5-3 also provides the impact of the nature of the disaster on the management of the project on a disaggregate level based on the organisations' point of view. It can be seen that the contractors have an average score of more than four for controlling the project in all the variables of the nature of the disaster. It indicates the nature of the disaster has a significant impact on the contractors controlling the project.

Close examination of Table 5-3 shows there are some differences in the average score among the respondents. For example, what impact does the 'limited availability of infrastructure' have on 'controlling the project? The overall average score is 4.06. Respondents from government organisations have an average score of 4.44 which indicates that the limited availability of infrastructure significantly impacts controlling the project. On the other hand, respondents from NGOs perceived it to be of less significance with average score of 3.42.

To find out whether there are statistically different views among the respondents, a series of Kruskal-Wallis tests was conducted. The results are presented in Table 5-4, Table 5-5, Table 5-6, and Table 5-7.

Table 5-4 Kruskal-Wallis test for the nature of PDRP effects on planning the project

	Complexity	Chaotic conditions	Public pressure	Limited availability of infrastructure	Unstable economic conditions
Chi-Square	4.807	1.925	1.557	.768	1.977
df	3	3	3	3	3
Asymp. Sig.	.186	.588	.669	.857	.577

*results are statistically significant at $p<0.05$

Table 5-5 Kruskal-Wallis test for the nature of PDRP effects on organising resources

	Complexity	Chaotic conditions	Public pressure	Limited availability of infrastructure	Unstable economic conditions
Chi-Square	2.121	3.905	8.194	3.077	4.948
df	3	3	3	3	3
Asymp. Sig.	.548	.272	.042	.380	.176

*results are statistically significant at $p<0.05$

Table 5-6 Kruskal-Wallis test for the nature of PDRP effects on directing people

	Complexity	Chaotic conditions	Public pressure	Limited availability of infrastructure	Unstable economic conditions
Chi-Square	.584	4.670	4.836	14.841	19.212
df	3	3	3	3	3
Asymp. Sig.	.900	.198	.184	**.002***	**.000***

*results are statistically significant at p<0.05

Table 5-7 Kruskal-Wallis test for the nature of PDRP effects on controlling the project

	Complexity	Chaotic conditions	Public pressure	Limited availability of infrastructure	Unstable economic conditions
Chi-Square	1.109	3.668	8.561	23.426	24.522
df	3	3	3	3	3
Asymp. Sig.	.775	.300	.036	**.000***	**.000***

*results are statistically significant at p<0.05

Examining Table 5-6 it shows that there are statistical differences to be found in the respondents' responses. Similar observations can be found in Table 5-7, where 'limited infrastructure' and 'unstable economic conditions' have different responses. To find where the difference is, a series of Mann-Whitney tests was conducted and the results are presented in Table 5-8.

Table 5-8 Mann-Whitney test – the effect of limited availability of infrastructure and unstable economic conditions on controlling the project

Limited availability of infrastructure			
	NGO	GOV	CSL
CTR	.000*	.434	.483
NGO		.000*	.009
GOV			.186
Unstable economic conditions			
	NGO	GOV	CSL
CTR	.000*	.725	.357
NGO		.000*	.005*
GOV			.256

*results are statistically significant at p<0.008

In the results of the tests in Table 5-8 there are statistical positive results that indicate that the respondents from NGOs have a different view on the effect of 'limited availability of infrastructure' and 'unstable economic conditions' for controlling the project. By inspecting Table 5-3 (page 141) it shows that the average value for respondents from NGOs is smaller than the others which infers that the NGOs perceived 'limited availability of infrastructure' and 'unstable economic conditions' has a lower significant impact on controlling the project than the other respondents. Perhaps it because the NGOs, mostly international NGOs, are well equipped for disaster responses. For example, they use satellite telephones for communication (AusAid, 2012) and four-wheel drive vehicles (Davidson et al., 1996) that reduce the impact that 'limited availability of infrastructure' has controlling the project. One of the respondents in the interview reveals that:

> *"Although the location of the project may be remote we are given adequate means to monitor the work, we are given a four wheel drive car so there was no reason not be able to supervise the project. For monitoring staff that should be at the project site every day they were given a kind of bike trail for regions that are difficult to reach."*

This section has reported the impact that the nature the disaster can have on managing PDR projects. The following section will specifically discuss the challenges in PDR projects.

5.3. Challenges in post-disaster reconstruction from the literature review

The recovery phase in disaster management begins after the emergency response has ended; a stage to restore and, where possible, to improve facilities, livelihoods and the living conditions of disaster-affected communities. Reconstruction is a task in the recovery phase with the purpose of rebuilding structures that have been damaged by the disaster event.

The reconstruction phase offers the opportunity for affected communities to rebuild with consideration of preparation for the next disaster and also the ability to improve living conditions by building better facilities. Jargon such as 'build back better' was introduced after the 2004 Indian Ocean tsunami reconstruction project even though the word 'better' has different interpretations (Kennedy et al., 2008). Kennedy et al. ask: does better mean more modern, more environmentally friendly, more resistant to disaster, more oriented towards livelihoods, or a combination these? They also suggest that it is difficult to fulfil all those characteristics of 'build back better' where there is a trade off between characteristics. It seems that post-disaster reconstruction is heavily tagged with the expectation of providing better conditions. However, the nature of the reconstruction is quite different, commonly with the addition of chaotic conditions, scarcity of resources and many simultaneous projects underway(Davidson et al., 2007, Siriwardena et al., 2009). With regards to size of the disaster, the reconstruction faces challenges that are different to common construction projects. In Table 5-9, the list of challenges to the reconstruction are shown; these were identified from recent journals and other publications on post-disaster reconstruction.

Table 5-9 Challenges to reconstruction projects identified across 40 publications (Hidayat and Egbu, 2010)

No.	Challenges	Authors	Number of citations
1	Coordination between stakeholders	(Alexander, 2004, Shaw and Goda, 2004, Wu and Lindell, 2004, Oloruntoba, 2005, Baradan, 2006, GAO, 2006, Masurier et al., 2006, Moe and Pathranarakul, 2006, Pardasani, 2006, Pheng et al., 2006, Rotimi et al., 2006, Shaw, 2006, Lakshmi and Bau, 2007, Ratnasooriya et al., 2007, Steinberg, 2007, Kennedy et al., 2008, Koria, 2009, Ochiai and Shaw, 2009, Ophiyandri et al., 2009, Rotimi et al., 2009)	20
2	Availability of resources	(Alexander, 2004, Hadi, 2005, GAO, 2006, Johnson et al., 2006, Moe and Pathranarakul, 2006, Pardasani, 2006, Rotimi et al., 2006, Davidson et al., 2007, Johnson, 2007, Lakshmi and Bau, 2007, Ratnasooriya et al., 2007, Kennedy et al., 2008, Zuo et al., 2008, Lyons, 2009, Siriwardena et al., 2009, Zuo et al., 2009, Chang et al., 2010a)	17
3	Capacity of local government/agency	(Jigyasu, 2002a, Hadi, 2005, Oloruntoba, 2005, GAO, 2006, Moe and Pathranarakul,	12

No.	Challenges	Authors	Number of citations
		2006, Pardasani, 2006, Barenstein and Pittet, 2007, Johnson, 2007, Nakazato and Murao, 2007, Ratnasooriya et al., 2007, Cheema and Issa, 2008, Zuo et al., 2009)	
4	Quality of the construction and its inspection	(Jigyasu, 2002a, Alexander, 2004, Baradan, 2006, Khatam, 2006, Barenstein and Pittet, 2007, Ratnasooriya et al., 2007, Kennedy et al., 2008, Koria, 2009, Lyons, 2009, Siriwardena et al., 2009)	10
5	Reconstruction that is a cultural fit with local people	(Sharma, 2001, Jigyasu, 2002a, Boen and Jigyasu, 2005, Badri et al., 2006, Pardasani, 2006, Shaw, 2006, Johnson, 2007, Steinberg, 2007, Siriwardena et al., 2009)	9
6	Conducive safety and political situation in the reconstruction region	(Hadi, 2005, Oloruntoba, 2005, GAO, 2006, Pheng et al., 2006, Nakazato and Murao, 2007, Ratnasooriya et al., 2007, Koria, 2009, Ochiai and Shaw, 2009, Siriwardena et al., 2009)	9
7	Organisation of reconstruction	(Johnson et al., 2006, Moe and Pathranarakul, 2006, Davidson et al., 2007, Johnson, 2007, Steinberg, 2007, Takahashi et al., 2007, Koria, 2009, Siriwardena et al., 2009)	8
8	Land acquisition and location	(Hadi, 2005, GAO, 2006, Johnson, 2007, Nakazato and Murao, 2007, Ratnasooriya et al., 2007, Steinberg, 2007, Lyons, 2009, Ochiai and Shaw, 2009, Ophiyandri et al., 2009)	9
9	Adequate number of qualified people	(Masurier et al., 2006, Rotimi et al., 2006, Green et al., 2007, Steinberg, 2007, Takahashi et al., 2007, Kennedy et al., 2008, Lyons, 2009, Siriwardena et al., 2009)	8
10	Regulations and legislation that apply to large disasters	(Alexander, 2004, Oloruntoba, 2005, Masurier et al., 2006, Moe and Pathranarakul, 2006, Rotimi et al., 2006, Takahashi et al., 2007, Thiruppugazh, 2007, Rotimi et al., 2009)	8
11	Financing the reconstruction	(Hirayama, 2000, Freeman, 2004, Wu and Lindell, 2004, Barenstein and Pittet, 2007, Green et al., 2007, Ratnasooriya et al., 2007, Thiruppugazh, 2007)	7
12	Information and communication	(Jigyasu, 2002a, Oloruntoba, 2005, Moe and Pathranarakul, 2006, Lakshmi and Bau, 2007, Nakazato and Murao, 2007, Ratnasooriya et al., 2007, Kennedy et al., 2008, Ophiyandri et al., 2009, Siriwardena et al., 2009, Zuo et al., 2009)	10
13	Adequate skills for	(Shaw and Goda, 2004, Ingirige et al., 2008,	6

No.	Challenges	Authors	Number of citations
	reconstruction	Kennedy et al., 2008, Koria, 2009, Lyons, 2009, Rotimi et al., 2009)	
14	Rising materials, labour costs	(GAO, 2006, Pheng et al., 2006, Steinberg, 2007, Takahashi et al., 2007, Lyons, 2009, Ophiyandri et al., 2009, Chang et al., 2010a)	7
15	Start reconstruction as soon as possible; tight schedule	(Wu and Lindell, 2004, Oloruntoba, 2005, Davidson et al., 2007, Johnson, 2007, Nakazato and Murao, 2007, Kennedy et al., 2008)	5
16	Establish property rights (land ownership, leaseholds and tenant)	(Hirayama, 2000, Wu and Lindell, 2004, Steinberg, 2007, Ingirige et al., 2008, Ophiyandri et al., 2009)	5
17	Corruption	(Jigyasu, 2002a, Hadi, 2005, Lakshmi and Bau, 2007, Lyons, 2009)	4
18	Lack of services, facilities and infrastructures	(Green et al., 2007, Johnson, 2007, Lakshmi and Bau, 2007, Steinberg, 2007)	4
19	Accountability and transparency	(Pheng et al., 2006, Green et al., 2007, Ratnasooriya et al., 2007, Thiruppugazh, 2007, Ophiyandri et al., 2009)	5
20	Constructing houses that can withstand future disasters	(Sharma, 2001, Jigyasu, 2002a, Alexander, 2004, Davidson et al., 2007)	4
21	Transportation and distribution logistics coordination	(Oloruntoba, 2005, Moe and Pathranarakul, 2006, Pheng et al., 2006)	3
22	Turn the reconstruction into development opportunities	(Shaw, 2006, Davidson et al., 2007, Thiruppugazh, 2007)	3
23	Selection of beneficiaries	(Jigyasu, 2002a, Steinberg, 2007, Ochiai and Shaw, 2009)	3
24	Introduce and implement new technology (e.g. materials) in reconstruction	(Jigyasu, 2002a, Boen and Jigyasu, 2005)	2
25	Limited site information	(GAO, 2006, Masurier et al., 2006)	2
26	Meet the minimum standard of house design requirements	(Hirayama, 2000, Johnson, 2007)	2
27	Keep reconstruction process equal	(Hirayama, 2000, Nakazato and Murao, 2007)	2
28	Governance	(Jigyasu, 2002a, Ochiai and Shaw, 2009)	2
29	Planning as a whole	(Kennedy et al., 2008, Lyons, 2009)	2

No.	Challenges	Authors	Number of citations
	system of reconstruction		
30	Social-cultural difference (i.e. language and religion) between organisations and disaster victims	(Oloruntoba, 2005, Nakazato and Murao, 2007)	2
31	To clear debris and its disposal	(Sharma, 2001, Oloruntoba, 2005)	2
32	Community participation in local decisions	(Baradan, 2006, Ophiyandri et al., 2009)	2

It can be seen from Table 5-9 that coordination is the most cited challenge to reconstruction in the publications. Many organisations are involved in the reconstruction process and it makes it difficult for local government to coordinate them in the chaotic conditions that follow a disaster. In the Aceh reconstruction after the 2004 tsunami more than 100 organisations were involved in housing reconstruction and in general almost 500 organisations were involved in the recovery process. Coordination problems led to gaps, duplication, inefficiencies and areas of uncertainty (BRR, 2005a). Masurier et al (2006) stated that routine construction has proved adequate for small-scale disasters but reconstruction projects following large-scale disasters require a higher level of coordination and management.

NGOs play an important role in the reconstruction process as the interface between the affected communities and the government (Shaw, 2003). However, many NGOs received large amounts of private funds that allowed them to start the reconstruction process without funding from bilateral and multilateral organisations and with minimal coordination with the government (GAO, 2006). There is also a reluctance by NGOs to coordinate with the government (Ophiyandri et al., 2009) as perhaps they consider themselves to be being independent organisations (Shaw, 2003).

The second most pertinent challenge in reconstruction is the availability of resources. Davidson et al (2007) considers the challenges to housing projects in reconstruction is similar to those challenges that are met in low-cost housing projects in developing countries. The massive scale of destruction after the 2004 Indian Ocean tsunami in Aceh paralysed the supply chain for construction projects as the impact (damage and losses) to the GDP ratio in Aceh province was almost 100 percent (BRR, 2005a). Shortage of materials for construction was the most common problem and they had to be imported from outside Aceh. For example, Zuo et al. (2008) noted the shortages and problems with timber procurement in the Aceh reconstruction.

Local governments were also affected by the disaster. Members of staff were also victims and office buildings were also heavily damaged in the disaster. Hadi (2005) estimated that 9% of the local governments' staff perished and some office buildings were washed away, though he points out that it was the low level of capacity, not the losses, that made local governments a less important player in the relief and reconstruction operations. As a result, despite having a large budget there was poor planning and a lack of focus on the needs of reconstruction operations and the occurrence of corruption. Perhaps it was because public officials had little experience of disaster management (Oloruntoba, 2005), or another possibility is as Koria (2009) revealed, that it was due to the lack of appropriate technical and managerial expertise and knowledge in the organisations involved in the reconstruction process.

Also, it can be seen from Table 5-9 that the quality of the construction is also one of the challenges in to reconstruction. The scale of the reconstruction work was far beyond the ability of available inspectors to handle. Alexander (2004) noted that normal regulations, design procedures and building permits processes are suspended following a disaster in order to speed up the reconstruction process. This may lead to careless conditions which are exacerbated by poor quality building inspection systems and a small number of inspectors with large workloads (Alexander, 2004). In his review of housing reconstruction in Aceh, Indonesia, Steinberg (2007) highlights the problem of quality in the reconstruction. The NGO-produced housing units were not acceptable to communities and one NGO had to demolish more than 300 poorly constructed houses. Steinberg's study also supports the study by Alexander (2004) that no system of building permits existed.

Several studies have revealed that reconstruction often does not fit culturally with local people (Jigyasu, 2002a, Boen and Jigyasu, 2005, Pardasani, 2006, Johnson, 2007). In extreme conditions, houses in the relocation area were abandoned by disaster affected communities because the houses did not fit into their culture and the communities returned to their original, vulnerable, locality. A study by Boen and Jigaysu, (2005) report several examples of reconstruction projects which had not taken social, cultural and economic considerations into account. The introduction of new technology, e.g. concrete material to local people that was perceived to be 'modern' also posed problems of vulnerability due to the lack of skills of local people.

As a system, reconstruction is also affected by its environment. Progress of the 2004 tsunami reconstruction in Sri Lanka and Indonesia were influenced by political factors as Aceh and Sri Lanka were conflict areas. The increase of violence in the north and east of Sri Lanka slowed the reconstruction process. Similarly, Aceh had been an area of conflict for a long time and that affects the attitude of the people and increases distrust in the national government (Ochiai and Shaw, 2009).

From Table 5-9, the next challenge in the reconstruction process elicited from the literature are land acquisition and location and an adequate number of qualified people. Destructive disasters, for instance earthquakes and tsunamis, often turn the disaster location into an unbuildable area. The victims relocate to a new area as a temporary measure while the disaster location is cleared or the relocation area becomes a permanent location for the disaster victims. Because an appropriate location had not been identified prior to the disaster event it took time to find a suitable location, and as a result, it slowed the reconstruction process (Johnson, 2007).

There are many factors that contribute to the outcome of a project, however coordination is considered to be an important factor by project participants engaged on several projects (Jha and Iyer, 2006). Furthermore Jha & Lyer (2007) conclude that excellent coordination is the attribute most needed to manage mega projects involving multiple stakeholders. Good coordination is not only required for internal members of the organisation but is needed by external agencies as well. Lack of coordination on both fronts may result in exceeding the budget for the project (Jha and Iyer, 2007). This is supported by the findings of the literature review in over 40 publications on post-disaster reconstruction. The challenge of excellent coordination was cited the most.

Because coordination needs current information to be communicated within and across organisations, there is a need for an integrated communication and information system for disaster management (Meissner et al., 2002). Information and communication is also a big challenge in reconstruction projects as revealed by the literature review. Research by Sandhu et. al. (2011) on knowledge sharing in the Malaysian context reveals interesting facts about knowledge sharing barriers. The greatest barrier, from an individual perspective, was "general lack of time to share knowledge". This is followed by "lack of interaction between those who can provide and those who need knowledge". Knowledge communication could not run properly if coordination was not well managed.

Furthermore, as can be seen from Table 5-9, the lack of capacity and skills of local people is also a major challenge. Their capacity is almost always limited thus, it is the external actors' role to transfer knowledge to local people (Ingirige et al., 2008).

From the literature review for this research 32 challenges were identified in PDR projects and these are presented in Table 5-9 (page 146). The table provides a basis for formulating questions in the questionnaire survey. Considering the limitation of number of pages in the questionnaire design (see section 3.9.1.1, page 69), the 32 challenges were modified and reduced to 20 challenges, based on frequency of citation, at the questionnaire development stage. During the pilot test of the questionnaire it was found that there was one double barrelled question and it was decided to split one challenge into two separate challenges in the question on the questionnaire. As a result 21 challenges were used in the questionnaire survey (Appendix C, page 345). The next section will discuss the findings from the questionnaire survey regarding the challenges in PDR projects.

5.4. Challenges associated with PDR projects from the questionnaire survey

In the previous section, the challenges to post-disaster reconstruction, as identified from publications, were presented. The twenty one most cited challenges were included in the questions in the questionnaire survey. The results from the survey are shown in Table 5-10 below.

Table 5-10 Challenges to post-disaster reconstruction projects

Challenges	N	Overall Mean Score	Rank
Achieving planned construction quality	3.90	3.90	1
Starting the construction project timely/immediately	3.85	3.85	2
Avoiding corruption in the reconstruction process	3.83	3.83	3
Working with limited or poor conditions, facilities and infrastructure at project location.	3.77	3.77	4
Improving the capacity of local government/agency	3.73	3.73	5
Dealing with the rising costs of materials and labour	3.70	3.70	6
Having clear accountability in the reconstruction process	3.66	3.66	7
Having adequate quality inspection of construction work	3.64	3.64	8
Having clear transparency in the processes in the reconstruction project	3.61	3.61	9
Working with poor or restricted access to location	3.59	3.59	10
Building construction projects that culturally fit the needs of local people	3.57	3.57	11
Establishing property rights	3.52	3.52	12
Finding suitable land/location for the reconstruction project	3.43	3.43	13
Minimising the negative effects of political instability	3.42	3.42	14
To have good coordination with other stakeholders/parties	3.35	3.35	15
Improving information and communication processes	3.34	3.34	16
Securing finance for the reconstruction project	3.30	3.30	17
Securing adequate resources (materials and machinery)	3.27	3.27	18
Following regulations related to the reconstruction process	3.25	3.25	19
Putting in place an appropriate organisational structure	3.23	3.23	20
Securing an adequate labour force	3.20	3.20	21

The scale: 1 (Not challenging at all), 2 (Less challenging), 3 (Fairly challenging), 4 (Challenging), 5 (Very challenging)

From the Table 5-10 above, the respondents rated the challenges varying from 3.20 to 3.90 which range from 'fairly challenging' to 'challenging'. None of the overall mean scores are above 4 or 'challenging'. The challenges with a mean score above 3.75 are related to construction quality, starting the construction project, avoiding corruption and working with limited or poor condition, facilities and infrastructure.

The reconstruction process is the responsibility of local government and agencies, so improving the capacity of local government and agencies is one of the main challenges in PDR projects. Cheema and Issa (2008) observed that reconstruction following earthquake in 2005 in Pakistan and noted that agencies lacked the capacity to take design matters in hand and this lead to delays in the reconstruction project.

By examining the bottom part of the table, it can be seen that the five least challenging barriers in PDR projects are 'securing finance' ranked at 17th, followed by 'securing adequate resources (materials and machinery)', 'following reconstruction regulations related to the reconstruction process', 'putting in place appropriate organisational structures' and ranked 21st is 'securing an adequate labour force'.

Having considered the challenges to post-disaster reconstruction on an aggregate level the next section of this chapter will focus on the disaggregate level, i.e. challenges by different stakeholders: contractors, governments, NGOs, and consultants.

5.4.1. Degree of challenge in post-disaster reconstruction projects by the type of organisations

The approach to analysing data for the dis-aggregate level uses the same method used for analysing the overall, aggregate levels. Mean scores are calculated for each type of organisation: contractors, NGOs, governments and consultants. As the mean score increases the degree of challenge also increases.

To begin analysis of the challenges the results from the questionnaire survey are presented in Table 5-11. The table shows the mean scores for each type of organisation and its rank.

Through observation of Table 5-11, achieving the planned quality is considered to be the most challenging factor by contractors, and was rated the second highest challenge by governments and consultants. However, it is ranked fifth by NGOs.

It seems there are some different points of view regarding the challenges in post-disaster reconstruction. To have a better understanding of the survey results the ranks in Table 5-11 have a coloured background using the conditional formatting of Ms-excel. The challenge with the biggest mean score is coloured red and the smallest mean score is coloured green.

Visually, it is obvious from Table 5-11, that there are a number of differences in the challenges faced by different stakeholders. For example, respondents from NGOs ranked ‘to have good coordination with other stakeholders’ at number 2, but respondents from contractor, government and consultant organisations ranked it at 21, 18, and 15 respectively.

However, it is important to test statistically to see if there is a significant difference in the challenges faced by the different stakeholders during post-disaster reconstruction projects. The Kruskal-Wallis test is an appropriate statistical test and it is employed to test a null hypothesis and that the level of the challenges does not differ according to the type of organisation.

Table 5-11 Challenges faced by different stakeholders in post-disaster reconstruction projects

Challenges	Mean Score					Rank				
	ALL (N=143)	CTR (N=47)	NGO (N=36)	GOV (N=34)	CSL (N=26)	ALL	CTR	NGO	GOV	CSL
Achieving planned construction quality	3.90	3.89	3.44	4.12	4.23	1	1	5	2	2
Starting the construction project timely/immediately	3.85	3.85	3.56	4.06	4.00	2	3	3	3	4
Avoiding corruption in the reconstruction process	3.83	3.66	3.64	3.88	4.31	3	9	1	8	1
Working with limited or poor conditions, facilities and infrastructure at project location.	3.77	3.87	3.39	4.15	3.62	4	2	7	1	14
Improving the capacity of local government/agency	3.73	3.66	3.47	3.94	3.92	5	8	4	5	5
Dealing with the rising costs of materials and labour	3.70	3.83	3.39	3.76	3.81	6	4	6	13	10
Having clear accountability in the reconstruction process	3.66	3.70	3.11	4.00	3.92	7	5	14	4	6
Having adequate quality inspection of construction work	3.64	3.60	3.19	3.79	4.12	8	10	11	12	3
Having clear transparency in the processes in the reconstruction project	3.61	3.53	3.17	3.94	3.92	9	11	13	6	8
Working with poor or restricted access to location	3.59	3.68	3.19	3.91	3.54	10	7	12	7	19
Building construction projects that culturally fit the needs of local people	3.57	3.68	2.94	3.82	3.92	11	6	18	11	7
Establishing property rights	3.52	3.21	3.39	3.85	3.85	12	16	8	10	9
Finding suitable land/location for the reconstruction project	3.43	3.40	3.06	3.68	3.69	13	14	16	16	12
Minimising the negative effects of political instability	3.42	3.47	2.94	3.88	3.38	14	12	19	9	21
To have good coordination with other stakeholders/parties	3.35	2.89	3.64	3.47	3.62	15	21	2	18	15
Improving information and communication processes	3.34	3.06	3.08	3.71	3.73	16	19	15	14	11
Securing finance for the reconstruction project	3.30	3.11	3.00	3.71	3.54	17	18	17	15	20
Securing adequate resources (materials and machinery)	3.27	3.23	3.39	2.97	3.54	18	15	9	21	18
Following regulations related to the reconstruction	3.25	3.43	2.72	3.32	3.58	19	13	21	19	17
Putting in place an appropriate organisational structure	3.23	3.11	2.83	3.50	3.65	20	17	20	17	13
Securing an adequate labour force	3.20	3.06	3.22	3.06	3.58	21	20	10	20	16

The scale: 1 (Not challenging at all), 2 (Less challenging), 3 (Fairly challenging), 4 (Challenging), 5 (Very challenging)

ALL = Overall, CTR = Contractors, NGO = NGOs, GOV = Governments, CSL = Consultants

Table 5-12 Kruskal-Wallis statistic test for the level of challenges by different stakeholders

Challenges	Chi-Square	df	Asymp. Sig.
To have good coordination with other stakeholders/parties	10.57656405	3	0.014*
Securing adequate resources (materials and machinery)	4.508818777	3	0.212
Securing an adequate labour force	3.035084101	3	0.386
Improving the capacity of local government/agency	4.890298265	3	0.180
Achieving planned construction quality	13.71895902	3	0.003*
Having adequate quality inspection of construction work	13.97221242	3	0.003*
Building construction projects that culturally fit the needs of local people	15.81419059	3	0.001*
Putting in place an appropriate organisational structure	15.01297969	3	0.002*
Minimising the negative effects of political instability	14.72695035	3	0.002*
Finding suitable land/location for the reconstruction project	7.616175704	3	0.055
Following regulations related to the reconstruction process	12.47004419	3	0.006*
Securing finance for the reconstruction project	8.936720565	3	0.030*
Improving information and communication processes	12.82658539	3	0.005*
Dealing with the rising costs of materials and labour	3.787590283	3	0.285
Starting the construction project timely/immediately	3.975395605	3	0.264
Establishing property rights	9.498071884	3	0.023*
Avoiding corruption in the reconstruction process	6.737228858	3	0.081
Having clear accountability in the reconstruction process	13.50625164	3	0.004*
Having clear transparency in the processes in the reconstruction project	12.11149564	3	0.007*
Working with limited or poor conditions, facilities and infrastructure at the project location.	9.74616318	3	0.021*

*result are statistically significant at $p<0.05$

As Table 5-12 shows, some challenges have p value <0.05 which indicates there is a difference in perception of challenges among stakeholders.

The Kruskal-Wallis test results only explain that there are differences in the respondent groups. However, the test does not show how they differ. Therefore, the Mann-Whitney test was carried out for pair-wise comparison.

As mentioned earlier, the challenge to achieve planned construction quality is considered to be the biggest challenge at the aggregate (overall) level. But the results from the Kruskal-Wallis test in Table 5-12 indicate there is a difference in the level of the challenges among stakeholders. Furthermore, a series of Mann-Whitney test was carried out to find out how this challenge differs from the others and the results of the test are presented in the Table 5-13 below.

Table 5-13 Mann-Whitney tests comparing the level of the challenges in different organisations (p value)

Achieving planned construction quality			
	NGO	GOV	CSL
CTR	0.017	0.606	0.267
NGO		0.001*	0.001*
GOV			0.482
Having adequate quality inspection			
	NGO	GOV	CSL
CTR	0.088	0.416	0.061
NGO		0.004*	0.000*
GOV			0.210
Culturally fit the needs of local people			
	NGO	GOV	CSL
CTR	0.003*	0.557	0.412
NGO		0.001*	0.001*
GOV			0.827
Putting in place an appropriate organisational structure			
	NGO	GOV	CSL
CTR	0.135	0.055	0.025
NGO		0.003*	0.001*
GOV			
Minimising the negative effects of political instability			
	NGO	GOV	CSL
CTR	0.014	0.39	0.631
NGO		0.001*	0.073
GOV			
Following regulations related to the reconstruction			
	NGO	GOV	CSL
CTR	0.001*	0.811	0.514
NGO		0.039	0.002*
GOV			0.517
Securing finance for the reconstruction project			
	NGO	GOV	CSL
CTR	0.525	0.029	0.177
NGO		0.010	0.056

GOV			0.483
Improving information and communication processes			
	NGO	GOV	CSL
CTR	0.969	0.013	0.022
NGO		0.005*	0.011
GOV			0.963
Establishing property rights			
	NGO	GOV	CSL
CTR	0.487	0.024	0.035
NGO		0.025	0.046
GOV			0.791
Having clear accountability			
	NGO	GOV	CSL
CTR	0.015	0.109	0.423
NGO		0.002*	0.006*
GOV			0.513
Having clear transparency in processes			
	NGO	GOV	CSL
CTR	0.125	0.024	0.121
NGO		0.006*	0.011
GOV			0.449
Working with limited or poor conditions			
	NGO	GOV	CSL
CTR	0.042	0.159	0.287
NGO		0.006*	0.373
GOV			0.041
To have good coordination with other stakeholders/parties			
	NGO	GOV	CSL
CTR	0.005*	0.033	0.011
NGO		0.780	0.912
GOV			0.896

It is apparent from Table 5-13 that there are positive results on 'achieving planned construction quality'. Respondents from NGOs have responded differently to challenges in achieving planned construction quality. In other words, only NGOs' views differ on 'achieving planned construction quality'. Examining Table 5-11, it shows that the mean score for NGOs are lower than the others, i.e. NGOs perceived that 'achieving planned construction quality' is not as challenging as other stakeholders perceived it to be.

Similar observation can be made in Table 5-13 regarding 'having adequate quality inspection'; there some positive statistical results which indicate respondents from NGOs have different views of quality inspection. In the same vein as ‘achieving planned quality’ the NGOs perceived that to have adequate quality inspection is not as challenging as the other respondents perceived it to be.

However, Table 5-11, Table 5-12, and Table 5-13 reveal that respondents from NGOs consider ‘to have good coordination with other stakeholders’ to be a significant challenge in PDR projects. The NGOs ranked it as the 2nd most challenging aspects with a mean score of 3.64, whereas contractors have ranked the challenge in 21st place with a mean score of 2.89. As Table 5-9 (page 146) shows coordination is most cited challenge in post-disaster reconstruction.

It is worth finding out if there are any differences in the challenges between housing projects and non-housing projects. Data about the type of construction originating from the questionnaire survey was converted into new variables in SPSS where the responses that stated other than housing (e.g. offices, roads, and dock projects) were converted into ‘non-housing’ projects. Comparison of the average mean value of the challenges in housing and non-housing projects is presented in Table 5-14.

Table 5-14 Challenges in housing and non-housing projects

Challenges	**Mean Score**			**Rank**		
	ALL	**Housing (N=61)**	**Non-housing (N=82)**	**ALL**	**Housing (N=61)**	**Non-housing (N=82)**
Achieving planned construction quality	3.90	3.90	3.89	1	2	1
Starting the construction project timely/immediately	3.85	3.90	3.82	2	3	2
Avoiding corruption in the reconstruction process	3.83	3.97	3.72	3	1	5
Working with limited or poor conditions, facilities and infrastructure at project location.	3.77	3.79	3.76	4	4	4
Improving the capacity of local government/agency	3.73	3.69	3.76	5	7	3
Dealing with the rising costs of materials and labour	3.70	3.70	3.70	6	6	6
Having clear accountability in the reconstruction process	3.66	3.64	3.68	7	8	8
Having adequate quality inspection of construction work	3.64	3.57	3.68	8	10	7
Having clear transparency in processes in the reconstruction project	3.61	3.64	3.59	9	9	10
Working with poor or restricted access to location	3.59	3.52	3.63	10	12	9
Building construction projects that culturally fit the needs of local people	3.57	3.56	3.59	11	11	11
Establishing property rights	3.52	3.75	3.35	12	5	14
Finding suitable land/location for the reconstruction project	3.43	3.41	3.45	13	16	12
Minimising the negative effects of political instability	3.42	3.43	3.41	14	15	13
To have good coordination with other stakeholders/parties	3.35	3.52	3.22	15	13	18
Improving information and communication processes	3.34	3.48	3.24	16	14	17
Securing finance for the reconstruction project	3.30	3.31	3.29	17	18	15
Securing adequate resources (material and machinery)	3.27	3.34	3.21	18	17	19
Following regulations related to the reconstruction	3.25	3.20	3.29	19	21	16
Putting in place an appropriate organisation structure	3.23	3.30	3.18	20	19	21
Securing an adequate labour force	3.20	3.21	3.18	21	20	20

The scale: 1 (Not challenging at all), 2 (Less challenging), 3 (Fairly challenging), 4 (Challenging), 5 (Very challenging)

From Table 5-14 it can be clearly seen there are some differences in the perception of challenges pertaining to housing projects and non-housing projects. The most challenging factor in housing projects is 'avoiding corruption' (3.97) whereas this challenge was ranked in 5th position for the non-housing projects (average value 3.72).

Similar observations can be made on 'improving the capacity of local government/agency'. Whilst respondents undertaking non-housing projects considered it was quite challenging (ranked in 3rd position), it was ranked in 7th position by those undertaking housing projects.

On 'establishing property rights', respondents within housing projects considered it was challenging with average score of 3.75 and ranked in 5th position. In contrast, 'establishing property rights' was ranked in 14th position by those working on non-housing projects with average value of 3.35.

By observing the scores of the average value between housing and non-housing projects it indicates that there may be different characteristics between them. To find out, because only two variables were compared (housing and non-housing projects), a series of Mann-Whitney test were conducted and the results are shown in Table 5-15 (page 163).

Surprisingly, the Table 5-15 below, with a confidence level of 0.05, has shown that there is no statistical difference in challenges between housing projects and non-housing projects. However, the Mann-Whitney test result for 'establishing property rights' is near the threshold level (<0.05), and has a value of 0.052.

Table 5-15 Mann-Whitney test for challenges in housing and non-housing projects

Challenges	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
To have good coordination with other stakeholders/parties	2166.5	5569.5	-1.40478	0.160
Securing adequate resources (materials and machinery)	2256.5	5659.5	-1.03877	0.299
Securing an adequate labour force	2477	5880	-0.10065	0.920
Improving the capacity of local government/agency	2434	4325	-0.28606	0.775
Achieving planned construction quality	2478	4369	-0.09841	0.922
Having adequate quality inspection of construction work	2356.5	4247.5	-0.6137	0.539
Building construction projects that culturally fit the needs of local people	2468	4359	-0.13982	0.889
Putting in place an appropriate organisational structure	2394	5797	-0.45848	0.647
Minimising the negative effects of political instability	2485	4376	-0.06783	0.946
Finding suitable land/location for the reconstruction project	2430.5	4321.5	-0.29698	0.766
Following regulations related to the reconstruction	2366	4257	-0.57218	0.567
Securing finance for the reconstruction project	2476.5	5879.5	-0.10276	0.918
Improving information and communication processes	2239.5	5642.5	-1.11263	0.266
Dealing with the rising costs of materials and labour	2482.5	5885.5	-0.07883	0.937
Starting the construction project timely/immediately	2421.5	5824.5	-0.33963	0.734
Establishing property rights	2042.5	5445.5	-1.93908	0.052
Avoiding corruption in the reconstruction process	2261.5	5664.5	-1.02276	0.306
Having clear accountability in the reconstruction process	2448	4339	-0.22395	0.823
Having clear transparency in processes in the reconstruction project	2427	5830	-0.3127	0.755
Working with limited or poor conditions, facilities and infrastructure at project location.	2450.5	5853.5	-0.21425	0.830

a. Grouping Variable: housing project or non-housing

5.5. Identification of the challenges for PDR projects from the interviews

As mentioned in the data analysis section of this report (refer to section 3.10.2.3, page 86), identification of challenges in PDR projects gained from the interviews is by assigning nodes in the NVivo software. The interviewees were asked what the most challenging aspect of PDR projects was (refer to question no 2, Appendix D. The interview questions, page 355). The results are presented in the table below.

Table 5-16 NVivo matrix coding of challenges in PDR projects

Challenges	Number of references in NVivo				
	A : Contractors	B : NGOs	C : Governments	D : Consultants	ALL
1 : Access	0	1	1	1	3
2 : Beneficiaries	0	4	3	2	9
3 : Communication	0	0	0	2	2
4 : Coordination	2	1	0	4	7
5 : Corruption	8	5	1	2	16
6 : Culture	0	3	1	0	4
7 : Experience	2	5	1	3	11
8 : Finance	1	0	3	1	5
9 : Infrastructures	1	3	2	0	6
10 : Local condition	2	0	3	2	7
11 : Location	1	3	1	0	5
12 : Material	2	3	4	5	14
13 : Owner involvement	2	0	0	3	5
14 : Workmanship	5	10	4	5	24
15 : Planning & design	3	2	6	4	15
16 : Quality	0	1	3	0	4
17 : Rising of cost	1	2	3	5	11
18 : Security at site	1	4	1	0	6
19 : Social issues	0	2	2	0	4
20 : Tendering	4	1	0	1	6
21 : Time pressure	0	1	2	4	7

Table 5-16 above provides an insight in to what the interviewees regarded as challenges in PDR projects. A number of challenges have merged from the interviews, they are challenges related to workmanship, corruption, planning and design, availability of material, and the skill of workers.

Matrix coding in NVivo also highlights a different view from the challenges culled from the interviews based on the type of organisation. For example, for challenges in 'workmanship' and 'experience', it can be seen that interviewees from NGOs mention more about these challenges compared to other types of organisations.

Examination of Table 5-16 also reveals that interviewees from contractor organisations and NGOs more often referred to 'corruption' compared to government and consultant organisations. Contractor organisations and NGOs have 8 and 5 references respectively but corruption has only 1 and 2 references for interviewees from government and consultant organisations respectively. Research by Van Klinken & Aspinall (2011) revealed the level of corruption in the Indonesian construction industry; where contractors pay bribery money to government officials at almost every stage of the construction project. In the context of disaster reconstruction humanitarian relief is delivered in a challenging environment following a disaster which often overwhelmed the capacity of the disaster-affected country. As a result there is a significant risk of corruption in disaster recovery projects (Willitts-King and Harvey, 2005).

Challenges associated with PDR projects which were identified from the interviews are presented in Figure 5-1 (page 166).

5.6. Discussion about challenges in PDR projects

The post-disaster management process is often beset with problems which lead to increased costs and delays (Pheng et al., 2006). This section discusses the challenges in post-disaster reconstruction.

The data from the questionnaire survey and the interviews was analysed and revealed a number of challenges. They are challenges to finding adequate materials, lack of workmanship, achieving the specified quality and reducing corruption in the PDR projects.

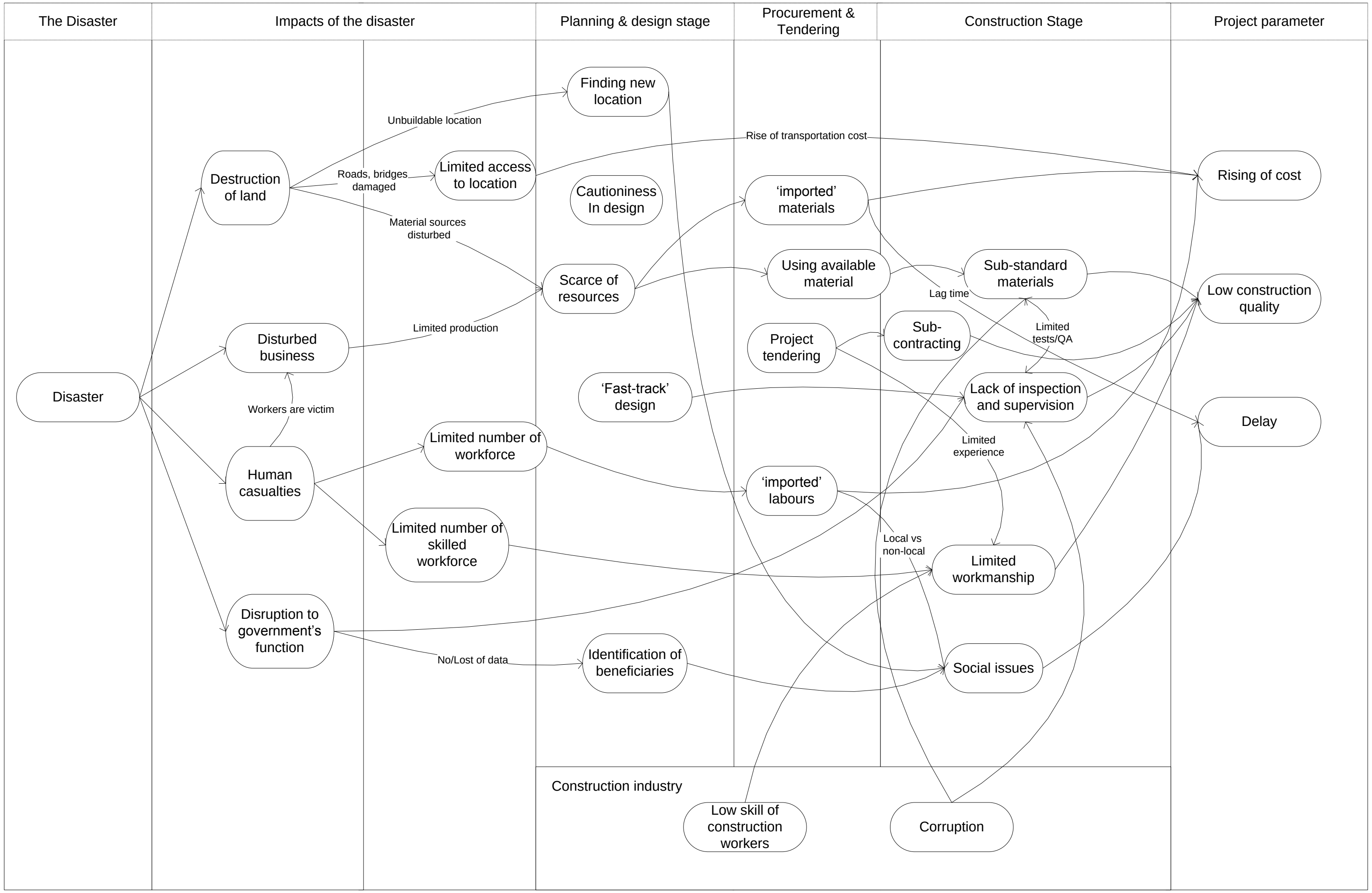

Figure 5-1 Challenges in post-disaster reconstruction projects

5.6.1. Resources availability

Singh and Wilkinson (2008) argue that the availability of resources is as important as the availability of finance and will greatly affect the success of disaster reconstruction. Use of substandard materials, inferior designs and construction, and poor maintenance are key causes of structural failure (ADPC, 2011). Poor quality materials are structurally too weak to resist the forces of earthquakes as weak materials was the factor that caused most of destruction in 2010 in the Haiti earthquake (Audefroy, 2011).

The disaster can affect an area in form of damages to resource production facilities and, ultimately, can result in workers becoming disaster victims. As a result resources for the reconstruction process become scarce where demand becomes higher because many projects occur in the same period but supplies of resources are lower. For example, a cement factory in Lhonga, Aceh was severely damaged by the earthquake and tsunami and more than half of its 625 employees were missing (Bappenas, 2005, p.61)

Materials for the reconstruction, such as sand, aggregate, cement, steel, and wood usually become rare as production may be disturbed as result of the disaster event. BRR (2005a p. 34), one year after the 2004 tsunami, recognised that acquiring the resources was a constraint in the reconstruction process. A similar situation may be found in other disasters, for example Chang et al. (2010b) reports shortfalls in building material supplies in disaster-stricken areas after the Wenchuan earthquake.

The results from the interviews shown in Table 5-16 (page 164) reveal that 14 interviewees mentioned securing construction materials as a challenge in PDR project. One of interviewee explains the problem of securing material for the reconstruction project:

> *"Material is the issue, in which people have a high demand, while the yields were few. For example, there are people who used to dig sand, his families become victims of the disaster and he then did not work anymore." (R03-CSL-MD)*

Acquiring the labour for the reconstruction project was also one of difficulties, as one of interviewees said:

> *"The number of rehabilitation and reconstruction projects was unusually large for the size of Aceh. Labour had to be imported from outside Aceh. Usually it is not easy to obtain labour. There are colleagues who had difficulty in obtaining workers. [When they got the workers,] Later in the project they [workers] were surprised again by earthquake aftershocks and so on, so that the workforce was lost again. It's hard to work normally because of the tsunami and earthquakes that caused some difficulties and labour had to be brought in from outside Aceh." (R07-GOV-JA)*

In the general housing context, the interface between contractors and suppliers is often a source of problem due to poor communication between the site and the supplier (Bates et al., 1999). It suggests working closely with suppliers to reduce the occurrence of the scarcity of construction materials.

5.6.2. Workmanship

The interviews reveal that there is a challenge in achieving adequate levels of workmanship in PDR projects. Construction workers in Indonesia are mostly poorly skilled and unproductive. This condition is exacerbated by workers who become victims; as a result there is limited availability of workers. But in PDR it is usual that many projects are implemented at the same time that makes demand for construction workers higher so workers with little or no construction experience can move between PDR projects. According to ADPC (2011) the non availability of skilled workers may lead to poor design and construction of houses and infrastructure resulting in faulty designs, weak construction materials, poor maintenance, and non conformity with building regulations.

In 2011 there were more than six million construction workers in Indonesia, which represents 5.7% of the total Indonesian workforce (BPS, 2011b). Indonesian construction workers traditionally evolved from farmers who looked for temporary jobs after the crop harvest. Their level of education level is poor and more than half of the workers received only an elementary educational background, or less, and furthermore 1.5% of them have never received any formal education at all (Soemardi et al., 2011).

Similar observation about poor levels of education can be drawn from the result of a census of workers in Aceh in 2005, which is presented in Table 5-17 below. There are more than 1.4 million workers in Aceh province and the vast majority of workers (70.9%) have an educational level that is lower than a high school education. More than 167,000 workers (11.8%) did not finish elementary education or never went to school at all.

Table 5-17 Educational background of workers in Aceh Province in 2005 (Modified from AGDC et al., 2005)

No	**District/City**	**No School**	**Did not finish elementary school**	**Elementary school**	**Junior High**	**High School**	**Univ.**	**Not Answered**	**Total**
1	Simeulue	361	1,554	11,809	4,832	4,713	1,107	79	24,455
2	Aceh Singkil	3,829	9,748	17,489	7,243	7,859	1,660	159	47,987
3	Aceh Selatan	4,141	10,919	26,191	13,236	12,839	3,631	447	71,404
4	Aceh Tenggara	3,688	7,430	18,430	17,720	18,884	2,676	77	68,905
5	Aceh Timur	3,577	13,616	50,407	21,372	13,026	2,468	173	104,639
6	Aceh Tengah	1,055	7,005	25,512	17,109	20,408	4,768	79	75,936
7	Aceh Barat	4,383	8,437	20,061	9,811	12,288	3,496	407	58,883
8	Aceh Besar	2,976	7,469	21,364	19,095	28,199	10,391	0	89,494
9	Pidie	13,560	20,828	52,770	38,812	31,574	10,090	0	167,634
10	Bireun	2,988	10,972	44,530	25,908	24,765	7,645	453	117,261
11	Aceh Utara	5,507	24,212	68,940	28,258	22,119	6,563	262	155,861
12	Aceh Barat Daya	2,849	8,207	17,208	6,684	7,346	2,096	142	44,532
13	Gayo Lues	5,818	6,611	10,877	4,793	3,821	1,196	64	33,180
14	Aceh Tamiang	2,108	9,809	31,625	15,571	17,722	3,554	426	80,815
15	Nagan Raya	5,082	8,582	18,070	10,146	7,323	1,751	367	51,321
16	Aceh Jaya	1,920	3,069	9,934	4,017	2,190	702	265	22,097
17	Bener Meriah	589	3,621	19,969	15,204	11,933	1,794	47	53,157
18	Banda Aceh	218	681	3,774	7,404	30,852	15,998	82	59,009
19	Sabang	297	413	2,448	2,337	4,512	1,672	0	11,679
20	Langsa	328	1,730	8,993	6,723	16,026	5,887	0	39,687
21	Lhokseumawe	554	2,486	11,141	7,390	16,948	6,215	22	44,756
	Total	65,828	167,399	491,542	283,665	315,347	95,360	3,551	1,422,692
	Percentage	4.6%	11.8%	34.6%	19.9%	22.2%	6.7%	0.2%	100.0%
	Accumulative	4.6%	16.4%	50.9%	70.9%	93.0%	99.8%	100.0%	

The impact of disaster events not only brings destruction to buildings and infrastructure, but also claims lives which include construction workers. BRR as the reconstruction agency in Aceh recognised that the reconstruction projects require a massive amount of materials as well as manpower (BRR, 2009b). Dahuri (2006) estimates 600,000 to 800,000 people, which constitute 25% of the Aceh workforce, lost their job.

Research by Joshi (2012) shows that there was a change in peoples' occupations after the tsunami in Aceh. Because farms and fields were damaged by the tsunami more people moved to work in trading or construction which was widely available during the Aceh reconstruction project. Table 5-18 illustrates the shift in occupations after the tsunami in Aceh.

Table 5-18 Shift in occupations in West Aceh six months after the tsunami (Joshi, 2012)

Sub-district	**Fishery**	**Rice-farm**	**Hard-plant**	**Farm**	**Labour**	**Trading**
Arongan Lambalek	5	-28	-2	2	35	23
Samatiga	3	-33	-5	3	17	10
Johan Pahlawan	6	-11	-2	0	20	-3
Meureubo	-5	-28	5	3	17	5
Average	2.3	-25	-1	2	22.3	8.8

Note: positive value is increasing, negative value is declining

When fishermen, farmers and woodmen take on construction work it becomes a challenge for NGOs to get qualified workers (CHF International, 2008, p.7). This situation was noted during the interviews as the reason why workers on reconstruction projects have inadequate skills. Result from the interviews (Table 5-16, page 164) show that 24 of 33 interviewees noted the lack of workmanship as a concern. One of respondent stated:

> *"...the problem is when vegetable farmers become the contractor, or fishermen become contractor" (R13-NGO-FY)*

Another respondent, that is a member of committee of a contractor association in Aceh, also recognised that the poor skills of construction workers due to them do not coming from a construction background. Sometimes workers enter the construction industry when there are job opportunities or when a relative or friend works in a government office and can arrange employment. As he mentioned:

> *"These small contractors on average do not have any office; their office is on a motorcycle or in a car. Why can every Acehnese be a contractor? Because it depends on who is the head of the government office. If today you become the head of department, your nephew who used to be a farmer or merchant, now becomes a contractor. Because it is now easier to make a living as a contractor than as a trader" (R18-NGO-TA)*

5.6.3. Construction quality in PDR projects

There are various definitions of quality and the choice of definition used depends on the domain and purpose for its use (Maria and Bártolo, 2000, Battikha, 2003). However, the widely accepted definition of quality in construction is "conformance with requirements" (Davies et al., 1989, Chileshe et al., 1999, Battikha, 2003). The requirement may come from the clients' needs or expectations (Battikha, 2003) which are translated into contracts, specifications, drawings, codes and standards (Chileshe et al., 1999). There are costs associated with achieving quality which covers quality-related activities in the form of quality assurance and quality control and requires expenditure of approximately 1% to 5% of a construction project's total cost (Davies et al., 1989). However, Telford & Cosgrave (2006) warn that the concept of quality in a normal business does not operate in the disaster assistance sector. Quality in a normal business is driven by its customers, but for disaster assistance the disaster-affected populations do not have control of what aid agencies do (Telford and Cosgrave, 2006).

Maria and Bartolo (2000) also recognise that there are various definitions of quality, although they also identified two distinct aspects of quality. The first aspect is referred to as the tangible aspects; which can be described as those characteristics that can be measured and used to determine conformance of the product against predetermined goals. The second aspect is the intangible aspect or the dimension of quality based on peoples' perception of space, scale, and colour and light and therefore it is difficult to quantify.

Customer satisfaction is a broader concept than quality. Gunning (2000) differentiates customer satisfaction and quality; where customer satisfaction is a value laden phenomenon and dependent on price, whereas service quality is not generally dependent on price. Customer satisfaction is a cumulative experience based on the past, present and anticipated future experience. However, service quality is related to current perception of goods or services. The other distinction of quality is as a predecessor of customer satisfaction.

Quality in construction is affected by several factors. Pheng and Ke-Wei (1996) presented ten important factors that can affect quality and three of the most important factors are poor workmanship by contractors, defects in drawings and specifications and more attention paid by contractors to schedules and cost rather than quality in completing projects. Pheng (1997) proposes nine factors that lead to construction quality based on the book 'The Samurai Way' by Miyamotho Musashi. These factors imply that knowledge and skill are needed to attain good construction quality. Abdel-Razek (1998) identified sixteen factors that are required to improve construction quality in Egypt. Three of the most important factors are improving the design and planning stage during the pre-construction phase, developing and improving quality control and assurance systems, and improving the financial status and standard of living of employees.

Defects in construction may be caused by nature and human error. The research undertaken by Pheng and Wee (2001) shows that there are eleven human-error related failings and the three main causes are ignorance and lack of knowledge, lack of training and skills and lack of motivation and conscientiousness.

There are three levels of quality that affects projects at implementation: meeting the specification, meeting the 'real' requirements and learning and improving from the project experience (Flett, 2001). Quality control is the most basic quality model for a project which based on inspection and control to achieve a minimum level of specified quality.

Reconstruction projects often include a large number of structures to be built in a limited time. Quality of construction may be overlooked in order to achieve the target on time with limited resources and construction workers. As noted by Twigg (2006), the donors have limited time to spend funds to achieve a quantifiable target (e.g. number of houses built) which may compromise the quality.

Research by Pribadi & Soemardi (1996) revealed a number of contributors who lack quality in reconstruction work: incomplete detailed drawings that may lead to misinterpretation by contractor/tradesmen, unsuitable local materials, difficult terrain and climate and lack of skill of local tradesmen.

In the case of the Aceh reconstruction, Pribadi et al. (2008) implied that there are three sources that may lead to lack of reconstruction quality. Firstly, use of poor quality materials, and they gave examples of poor grade sand and gravel obtained directly from the river. Secondly, poor workmanship also contributes to poor quality. Construction workers were limited and traditionally they learn about construction processes from previous generations. Thirdly, lack of qualified quality inspectors and the large number of projects happening at the same time made quality inspection and control difficult.

With regard to the quality of materials, Soemardi (2007) found several aspects which contributed to poor quality:

- Logistic problems may lead to substitution of quality materials by sub-standard materials.
- Size of sand and aggregates are not of good proportions as in the sieve analysis bigger sizes were being used and as a result the concrete is not compact and consistent.
- Inadequate storage of aggregates which allow the aggregate to be contaminated by soil and other organic matter.
- Excessive use of water in the concrete mix and poor water quality (e.g. water from the sea) also affected construction quality.
- Bricks were not of a standard size and quality, 45% of the brick sample failed the laboratory minimum strength test.

- Use of poor quality reinforcement bars with a diameter of 8mm and 4mm, ideally the minimum size is a diameter of 10mm.

Since most of construction workers in Indonesia have learned their trade from previous generations of workers, they rarely follow specifications for earthquake resistant housing construction. They have little knowledge of earthquake resistant house design and have learned 'false standards' then implemented the false standards instead of the correct design detail (Suarjana and Sengara, 2008). NGOs implemented their own guidance and manual for earthquake resistant houses but neglected to include the government building codes (Steinberg, 2007). The agencies also brought in new materials and technologies (Chang et al., 2011) which makes it more difficult to achieve the specified quality.

Building codes in Indonesia which relate to earthquakes is the Indonesian seismic design code SNI.03-1726-2002 (Badan Standardisasi Nasional (BSN), 2001). This code contains the methodology for designing structures that can resist earthquake forces and also includes an Indonesian seismic map. However, the scope of the code is considered to exclude single storey residential houses. So, after the Aceh earthquake in July 2005 the Ministry of Public Work (*Departemen Pekerjaan Umum*, DPU) published a Building Code for Aceh which covers single storey residential houses (DPU, 2006). This code covers design and technical requirements for residential houses including:

- Building type and form; including minimum size 36m2, minimum space/person 9m2.
- Type and minimum dimension of foundations.
- Minimum column and beam dimensions (e.g. 150x150mm)
- Minimum reinforcement quantities and spacing (e.g. 4 no 12mm diameter main bars with 8mm links at 150mm centres).
- Requirement for diagonal bracing.
- Types of concrete mixes permissible.

In relation to quality, Boen (2008) reveals interesting observations from his regular visits to the Aceh reconstruction sites. He argues that the community based reconstruction approach poses difficulties in controlling the quality of the work. Poor quality materials and poor workmanship were the main problems that he noted during his visits, which in turn led to poor quality housing. Furthermore, Boen (2008) also criticised the introduction of new building technology and materials in the Aceh reconstruction; what he referred to as alien construction methodologies. The methodologies such as precast construction, interlocking masonry, and light steel construction do not fit, culturally, with local people and due to poor workmanship he was concerned about the quality of the finished product when using the new methodologies. He concludes that the target for the Aceh reconstruction was the number of houses built not the provision of quality, seismic safe housing. This implies that the Aceh reconstruction failed to grasp the opportunity to reduce the vulnerability of housing to future earthquakes because most of the house constructed are not earthquake resistant (Boen, 2008).

In contrast, UN-habitat (2009) has produced a lengthy review report on settlement and housing recovery in Aceh-Nias following the 2004 tsunami. Chapter 2 of the report reveals monitoring systems conducted by the Unsyiah University that produced ‘scorecards on settlement recovery (SSR)’. The scorecards evaluate the following indicators during the reconstruction: construction quality, satisfaction, and accountability. The score for construction quality ranges from 1 to 4 and is measured against the official building code. A score of 4 indicates that the quality exceeds the standards in the official building code, a score of 3 denotes that the reconstruction is ‘in compliance’, while a score of 2 or less is considered to be substandard quality. Their survey in 2006 indicated that the average construction quality score is 2.65 which is ‘broadly acceptable’ (UN-Habitat, 2009, p.73). Interestingly, one of the survey findings, the quality-satisfaction matrix, UN-habitat argue that no clear relationship exists between construction quality and house beneficiaries’ satisfaction (UN-Habitat, 2006).

UN-Habitat (2009) acknowledge the demanding nature of the building standard whilst recognising that the Aceh construction workers’ expertise was poor. To raise the construction score, UN-Habitat suggest the construction quality specification be significantly higher than the standard to cover errors in implementation or to apply very strict supervision.

One year after the 2006 Yogyakarta earthquake, Arfiadi et al. (2008) conducted a survey to evaluate the result of the reconstruction which was mostly implemented by the community. They surveyed 42,056 houses in Yogyakarta and Central Java province where the survey was based on direct observation and interviews with the home owner. The survey consisted of 40 questions in 11 sections which reflected the structural quality of the house. In the survey they concluded that the quality of the houses was relatively good, although only 6.4% (in Yogyakarta) and 6.8% (in Central Java) of the houses surveyed met all seismic requirements. However, more than 87% (in Yogyakarta) and 94% (in Central Java) of the houses exceeded 60% of the specified requirements. Smaller sized RC bars and connections between structural components were the main concerns in the survey findings.

ARUP (2006) conducted a quality assessment for housing projects in Aceh. They implemented FEMA154 methods in the assessment; however, because the projects were in the construction stage they only assessed design and construction issues. The result of the survey is presented in Table 5-19 below. From the table, all ten cases in ARUP's survey met the minimum 36m2 space requirement. But, the survey found out that quality of design and workmanship of the houses was poor. Most of the houses were not well designed and had not been supervised during construction.

Table 5-19 ARUP's housing quality survey result (modified from ARUP (2006))

No	Provider	Survey findings
1	World vision	Permanent house 36m2 T+RC frame with masonry infill walls. RC beams and columns are small 100x100mmm, have smooth 10mm reinforcement bars and 6mm links about 300mm spacing. Masonry is single skin and of poor quality. The window and door openings are too large for wall panels and generally not symmetrically spaced. No lintel beams are provided above openings. Construction quality is generally very poor. The house will not meet life safety criteria.
2	KJRC	Permanent house, 36m2 RC frame with masonry infill walls

No	Provider	Survey findings
		No details of beams and columns' reinforcement. Gable is timber rather than masonry. Masonry walls are single skin and do not look to be reinforced. Window and door opening small and symmetric. Construction quality reasonable. Due to the use of unreinforced masonry walls this house will not meet life safety criteria.
3	Caritas	Traditional 45m2 timber house. Structure rest directly onto individual concrete plinths. It is not clear how timber connections between columns and beams are meant to work. Construction quality appears reasonable. This house probably meets life safety criteria, though some connection details may need to be changed.
4	IOM	Permanent 36m2 precast RC frame house with unreinforced brick masonry walls. RC ring beam foundation. Precast elements ensure good quality concrete. The structure relies on the strength of steel bolts in tension. The frame probably works well with the light weight panels, but it is not clear how will it perform with unreinforced masonry walls. This house may meet life safety criteria, though the use of unreinforced masonry is questionable.
5	CRS	Permanent house 45m2 RC frame masonry infill walls. Columns are 250x150mm with 6ø12 bars and 8mm links at 150mm centres. Windows and doors are generally small and lintel beams are provided. There is evidence that limited reinforcement is provided within the masonry panels. Construction quality is good and there is a supervisor on site ensuring the contractors achieve the design requirement. The cost is Rp75 million. The house probably meets life safety criteria.
6	BRR	Permanent house 36m2 RC frame masonry infill walls, cost Rp38 million. Columns and beams are 100mmx100mm with 10mm plain bars and 4mm links at 250mm spacing. Generally masonry panels are large, and no lintel beams are provided. Internal ply walls to reduce cost. Windows and doors are very large compared to the wall panel. Windows with nails round frames to supposedly tie into masonry. This is ineffectual.

No	Provider	Survey findings
		Construction quality average. The house will not meet life safety criteria.
7	Mercy Malaysia	Semi permanent 36m2 house. Foundation is a RC ring beam. Due to the nature of the construction, low masonry walls and timber frames and walls, the building should be life safe in an earthquake. This house probably meets life safety criteria.
8	Oxfam	Semi permanent 36m2 house. Foundation is a RC ring beam. Due to the nature of the construction, low masonry walls and timber frames and walls, the building should be life safe in an earthquake. Showing significant signs of termite attack in the timber walls. This house probably meets life safety criteria.
9	UNHCR	Permanent 36m2 reinforced blockwork 'core' house. Foundation is a RC ring beam. The structure is designed to survive a zone 6 earthquake and a 1.3m high tsunami wave. Windows and doors are generally small and symmetrically spaced. Gable ends are timber, so falling hazard is reduced. Construction quality is good. This house probably meets life safety criteria.
10	Zero-to-one	Permanent 36m2 precast RC 'core' house. Foundation is a RC beam This is a precast RC structure using columns and wall panels with steel roof trusses. They are interlinked using grooves in the columns. Certified for zone 6 earthquakes. This appears to be a well thought out design, and better than concrete frame and masonry both in terms of build time (5days/house) and structural integrity. The house probably meets life safety criteria.

Another factor that affected the quality of the reconstruction was contractors sub-contracted the contract to another contractor, in some cases up to 4-5 times, which lead to compromised quality (Boen, 2006).

Another assessment about quality was conducted by Potangaroa (2010), who conducted structural tests on almost 1,000 houses, as quality control for seismically safe house. Using portable devices they tested soil bearing capacity, concrete strength and concrete cover width. Their test results show that it was mostly difficult to achieve minimum concrete strength; in other words the quality was inadequate.

It becomes apparent that quality is an important issue in post-disaster reconstruction and inadequate levels of quality in the reconstruction can be traced back to human related factors which include improper handling and storage of material, poor construction workmanship and inadequate supervision (Hidayat and Egbu, 2013). To overcome the quality problems, the NGOs and the government provide training and also publications or manuals on construction quality. Examples of the manuals may be found in various publications (e.g.: DPU, 2006, Kuriakose, 2006, Build Change, 2009).

5.6.4. Corruptions in PDR projects

Observation on the results of the questionnaire survey (section 5.4) and the interviews (section 5.5) show that avoiding corruption is a significant challenge in the post-disaster reconstruction projects.

Challenges in PDR projects as shown in Table 5-10 (page 153) reveal that avoiding corruption was ranked 3rd by the respondents. Closer examination of Table 5-11 (page 156) shows that avoiding corruption was ranked at no. 1 by respondents from NGOs and consultants. In contrast, it was only ranked at 8th and 9th by respondents from contractors and governments respectively.

Corruption is a major obstacle in social and economic development which is sometimes considered to be a culture that exist in many countries (Server, 1996). Server observed that corruption has been accepted as an ingredient of 'managing the affairs of life', 'grease' for growth or corruption as an inevitable fact of life.

From the semi-structured interviews (Table 5-16, page 164), 16 respondents mentioned corruption as a challenge in PDR projects. One of the respondents implied that the corruption in the construction projects has been practised for a long time, probably since the country was founded:

> *"So the government..., I think you also know, from time immemorial time, from the Sukarno*

> *era [Indonesian first president] to the present day era of SBY [Indonesian current president], each project is subject to fee of 10, 15, up to 20%."(R18-NGO-TA)*

The fee which was mentioned by the respondents is the fee for the officials, the tendering committee, and their superior associates. The fee is well known as '*jatah pimpro*', which means 'project leader's share' (Aspinall, 2009). The respondent R18-NGO continues by saying that the corruption will affect the quality of the work:

> *"Yes automatically where will the contractors take that from? It will automatically be at the expense of quality. So the projects undertaken directly by the NGOs are good (quality of work) projects. Projects undertaken by local governments, the central government through BRR the quality is moderate to poor. So there is no good (quality), especially for the housing projects." (R18-NGO-TA)*

No country is immune to the damage of corruption (Transparency International, 2011) and Indonesia is considered to be a prone country to corruption. Based on the corruption perception index published annually by Transparency International in 2011, Indonesia is ranked 100th in 183 countries, with a score of 3 out of 10 (Transparency International, 2011). In 2005 it was ranked 137th in 158 countries.

Server (1996) defines corruption as the use of public resources for private purposes that includes monetary, political and administrative. He gives an example of an official who uses his/her status, prestige and authority for personal profit, appointing family and friends to lucrative posts. A similar definition of corruption is echoed by Transparency International which defines corruption as "the abuse of entrusted power for private gain" (Transparency International, 2010).

The tendering process is a stage that is vulnerable to corruption in the Indonesian construction industry. Corruption, or in more familiar terms the Indonesian 'funding leakage', according to (Udoyono, 2012), is proportionally ten to fifty percent of the construction budget. He gave several examples of corruption practices at the tendering stage: bribery to win the tender, fixed/collusive tendering, undisclosed tendering, and unqualified company winning the tender.

Massive resources are pouring into resource-poor environments following disaster events and this presents opportunities for corruption by disaster victims, local authorities or aid workers (Hees, 2011). Furthermore, she mentions the corruption act in terms of bribes, kickbacks or threats to alter the choice of suppliers of goods and service and may result in the higher cost of supplies or supplying substandard goods. A report by Kenny (2009) shows how corruption damages infrastructure projects by skewing spending priorities with substandard construction operations.

A report by Erwin et al. (2006) for Transparency International and the U4 Anti-Corruption Resource Centre discusses corruption as being a humanitarian action. One of sectors discussed is the shelter sector which is a capital-intensive activity and often requires compliance with regulations that make this sector vulnerable to corruption. In the report they mapped corruption risks in this sectors as provided in Table 5-20.

There are several factors that affect occurrences of corruption for emergency event or following a disaster event; Schultz and Soreide (2008) have identified those factors and they are listed below:

- Size and location of contract;
- Complexity;
- Discretion;
- Reduced financial controls;
- Increased demand for emergency supplies;
- Pressure to spend;
- Country of emergency;
- Agency experience in the country/sector;
- Firm's country of origin.

Table 5-20 Corruption risk in provision of shelter (Ewins et al., 2006)

Activity	Risk	Who Gains What
The allocation of land and obtaining a secure title	Non-beneficiaries influences others to obtain commercially valuable land e.g. disputes land titles	Individuals within the authorities may receive bribes or favours to allocate land, enriching non-beneficiaries at the expense of those who have suffered losses as a result of the crisis.
	Bribes or ‘deals’ by NGOs or individuals to local, regional or national authorities to secure or speed up an allocation of land and the title to it.	Individuals within the authorities receive bribes or agreement to a course of action and beneficiaries gain access to land
Design of permanent shelters	Bribes or ‘deals’ by NGOs or individuals to local, regional or national authorities to secure or speed up approval for shelter design	Individuals within the authorities receive bribes or agreement to a course of action. Beneficiaries/NGO gain approval for their preferred design, and beneficiaries gain access to shelter more speedily
Tendering process for shelter construction		
Construction	Sub-standard materials or inadequate adherence to standards – with/without bribery to have these accepted by the agency	Contractors gain financially by substituting inferior materials or completing sub-standard work. Agency staff may receive bribes.
Compliance with local building regulations, licenses and permits	Bribes required by authorities to approve work	Individuals within authorities gain financially
	Bribes given to pass non-compliant activity or sub-standard work	Individuals within authorities gain financially
Monitoring by independent professionals	Bribery by the contractor to gain approval for sub-standard work or early payment	Both the contractor and the independent professional gain financially
Payments to contractor: interim and final	Agency staff are bribed to pay for more work than has been done	Agency staff gain financially

Olken and Barron (2009) investigated corruption behaviour in Aceh province in Indonesia. They accompanied 300 trips of trucks transporting goods in Aceh and observed 6,000 bribes and illegal payments to police, military officers and officials which cost about 20 percent of the trip cost.

5.7. Inference and implication from the findings

From previous sections in this chapter there are possible inferences and their implication can be drawn from the research result.

5.7.1. Inferences of challenges in PDR projects

- To some extent, the characteristics of PDR projects are different than projects under normal conditions.
- Characteristics of the environment after the disaster puts more pressure on management of the project of which the highest impact is controlling the project.
- Three main challenges in PDR projects that emerged from the questionnaire survey and the interviews are 'achieving planned quality', 'working with low level of workmanship', and avoiding corruption.
- Avoiding corruption is a major concern for consultants and NGOs, and was ranked 1st in challenges in PDR projects. Contractors and governments ranked 'avoiding corruption' in 9th and 8th place respectively.
- Kruskal-Wallis tests in this research show that respondents from NGOs have statistically different challenges in PDR projects. The five most challenging tasks for the NGOs are 'avoiding corruption in the reconstruction process', 'to have a good coordination with other stakeholders', 'starting reconstruction immediately', 'improving the capacity of local government/agency', and 'achieving planned quality'.
- Mann-Whitney tests in this research show there are no statistically different challenges between housing and non-housing projects in post-disaster reconstruction.

5.7.2. Implication of challenges in PDR projects

- Projects managers or stakeholders in PDR projects should view and expect a PDR project to be different than a project under normal condition. For example, this chapter has shown that there will be resource problems and a rise in costs, and in general, the characteristics of the post-disaster environment will present difficulties in project control.
- It is getting more difficult to achieve the planned quality of construction in PDR projects compared to normal construction projects due to poor

workmanship and lack of availability of construction materials. Corruption may also affect reconstruction quality.

5.8. Summary

This chapter discusses the challenges associated with post-disaster reconstruction projects. It commences with a discussion of the characteristics of post-disaster projects and is then followed by the challenges in PDR projects which have been identified from reconstruction projects in other countries and is followed by challenges identified from the questionnaire survey and the interviews.

The PDR projects may have different characteristics compared with projects under normal condition and thus, will present difficulties in managing projects. In this research three main challenges have emerged that are associated with PDR projects which are; achieving planned construction quality, starting the construction immediately, and avoiding corruption.

The characteristics and challenges in PDR projects will affect the process and outputs of PDR projects. Therefore, the next chapter will discuss critical success factors (CSFs) associated with post-disaster reconstruction projects and the success criteria for the projects.

CHAPTER 6. CRITICAL SUCCESS FACTORS RELATED TO POST-DISASTER RECONSTRUCTION PROJECTS

6.1. Introduction

This chapter reflects objectives number three of this research: to investigate and document critical the success factors (CSFs) for effective management of post-disaster reconstruction projects.

The previous chapter has discussed the fact that post-disaster reconstruction (PDR) projects have different characteristics compared to normal construction projects and controlling a project can be significantly affected by the nature of the project. Challenges associated with PDR projects have also been discussed in chapter five. These characteristics and challenges can influence the success of post-disaster reconstruction projects and therefore, this chapter will discuss the critical factors that lead to successful PDR projects.

The literature review in chapter two showed that there are two features needed for the successful outcome of projects: success factors and success criteria. Success factors are features that are input into management systems that lead directly or indirectly to the success of the project. Success criteria are the measures by which the success of a project will be judged (Cooke-Davies, 2002).

Chapter two presented the CSFs that were identified in publications relating to construction projects in general. The next section (6.2) describes the CSFs relating to post-disaster reconstruction projects which were identified from the literature review. This section will be followed by section 6.3 that will present and discuss the CSFs gathered from the questionnaire survey and the interviews, and the CSFs required for PDR projects will be discussed in section 6.4. Section 6.5 presents the inferences and implications from the findings and the chapter will close with section 6.6 which summaries the discussions and findings on CSFs and success criteria.

6.2. CSFs in post-disaster reconstruction projects from previous studies

Lloyd-Jones (2006) in his widely cited report identifies the gaps between humanitarian relief and post disaster reconstruction. The gaps are in funding, management and delivery which makes reconstruction following disasters seems to take a long time. "*...permanent reconstruction is often inefficiently managed, uncoordinated and slow to get off the ground*" (Lloyd-Jones, 2006).

Lloyd-Jones also argues that the effectiveness of long term reconstruction is influenced by a lack of planning; which can occur before or after a disaster. Wu & Lindell (2004) compared housing reconstruction in the city of Los Angeles and Taichung in China and they suggest that having a pre-impact recovery plan may increase the speed of reconstruction. The importance of having a plan is also suggested by several others authors (Sharma, 2001, Alexander, 2004, Badri et al., 2006, Ghafory-Ashtiany and Hosseini, 2008, Rotimi et al., 2009, Tas et al., 2010).

Long term recovery programmes in developing countries often fail because of a lack of resources and capabilities in terms of finance and intellectual expertise (Keraminiyage et al., 2008). Furthermore, in the case of the reconstruction in Sri Lanka following the 2004 tsunami, Keraminiyage et al., suggest the lack of intellectual expertise lies within local institutions which lack knowledge, expertise and training related to disaster recovery. A similar observation by Hayles (2010), on reconstruction programmes in Sri Lanka and Pakistan, found that a lack of expertise combined with scarcity of materials and skilled labour resulted in major difficulties in supplying permanent housing. However, the success of any project depends on coordination at local and regional level within and between organisations (Hayles, 2010).

Surveys conducted by Tas et. al., (2010), on the construction of a permanent housing project in Kocaeli, after the 1999 Marmara earthquake, revealed that the problems were created by the limited time allowed for the reconstruction and difficulties and restrictions in purchasing materials. They suggest that the critical factors affecting success is the ability to make efficient use of all the resources, in all sectors.

The Asian Development Bank (ADB), through its Earthquake and Tsunami Emergency Support Project (ETEPS), recognised community contracting to be the key to its housing reconstruction programme in South Nias, Indonesia (Asian Development Bank, 2010).

Community contracting allows disaster victims, the beneficiaries, to act as the implementers for housing reconstruction. Once the beneficiaries had been identified and certified by the local leader, they formed self-help housing groups (*Kelompok Swadaya Masyarakat Perumahan* [KSMP]) charged with the responsibility of reconstructing or rehabilitating the housing units.

ADB experienced some obstacles during reconstruction which are mentioned below (Asian Development Bank, 2010):

- Land tenure and ownership.
- Unbuildable land.
- Selection of beneficiaries.
- Environmental problems at some sites.
- Cost escalation.
- Construction materials.
- Construction specification.
- Insufficient budgetary allocation for residential habitat-related infrastructure.
- Absence of livelihood reconstitution.
- Provision for renters.
- Uncertainties concerning the home rehabilitation component.
- Housing without village planning.
- Community-based development in a difficult context.

Implementation of community contracting offers benefits in maximising beneficiaries' participation, solving problems related to the supply of material, skilful rehabilitation of historic buildings and the introduction of appropriate innovations in building technology.

A study conducted by Nissanka et al. (2008), on reconstruction in Sri Lanka following the 2004 tsunami, interviewed five leading governmental organisation and five NGOs. They identified several factors that affect housing reconstruction, which are:

- Inconsistencies in housing policy;
- Disputes about land titles;
- Ineffectiveness in monitoring funds;
- Affected community's behaviour;
- Lack of planning and recovery strategies by government;
- Lack of communication and coordination among stakeholders;
- Existence of conflicts and violence.

They suggest that good planning – "*careful and deep consideration*" - is necessary to determine the success of the reconstruction process.

Baradan (2006) evaluated post-disaster housing reconstruction following the 1999 Marmala and Bolu earthquake in Turkey. Baradan suggested the success of the reconstruction was significantly related to the successful of organisation the reconstruction process. Baradan also echoed the findings of other authors that all the mistakes during reconstruction were caused by the lack of preparation in the pre-disaster period.

Jayasuriya et al. (2006) highlighted concerns about funding, in particular cost escalation and fiscal pressure which greatly affected the reconstruction of housing and infrastructure after the 2004 tsunami in Sri Lanka. The fund for the reconstruction was initially estimated on the basis of costs and prices that prevailed after the tsunami disaster. However, the reconstruction costs rose rapidly after a few months due to dramatic increase in the demand for labour and material. The rises in costs are illustrated in Table 6-1 below.

Table 6-1 Cost escalation of housing reconstruction in Sri Lanka (Jayasuriya et al., 2006)

Donor	Unit Area (sq.ft)	Initial estimate (Rs.)	Current [August 2005] estimate (Rs.)	% change	Comments
Red Cross	600	625,000 (March)	1,000,000	76	Houses with all basic infrastructure facilities (electricity, water supply, sanitation for each house, roads, etc)
Tri Star Apparel Exports	550	200,000 (May)	260,000	30	Cost only for building materials, all other inputs by their own company
Gift for Givers	500	400,000 (May)	400,000	-	Contract taken 3 months ago. Contractors attempting to complete houses with great difficulty. According to them, not possible to build in the future at this rate
CARE International	550	450,000 (March)	850,000	89	Jaffna
			600,000	33	Hambantota
			550,000 – 650,000	22-44	All other areas (houses with little basic infrastructure)
Aitken Spence Co Ltd	550	450,000 (March)	>500,000	>11	With basic infrastructure (with electricity but no water supply)
World Vision Lanka	500	550,000 (March)	700,000	27	With basic infrastructure
CARITAS Sri Lanka	500	500,000 (May)	650,000	30	A basic house (no mention of infrastructure)
Lodestar	>500	>800,000		60	Two-story houses built outside buffer zone
Sarvodaya Movement	500	500,000 (May)	650,000	30	With only a few basic infrastructure facilities
Forut Institute	550	500,000 (April)	550,000	10	Only for the house (not with basic infrastructure)

Source: IPS survey, August 2005

Another important aspect in post-disaster reconstruction projects is organisational design. After reviewing post-disaster reconstruction projects in several countries, Johnson et al., (2006) argue that the organisational design of the programme and of the project team are more important than technical design. However, they also recognised that the organisation of most post-disaster reconstruction projects is on an ad-hoc basis, a formation of various organisations from government departments, NGOs, army and disaster victims.

Moe and Pathranarakul (2006) suggest disaster management is similar to public project management where the government acts as the key stakeholder.

They propose an integrated approach to disaster management which includes activities prior to the disaster (pro-active approach) and activities after the disaster (reactive approach). They also propose ten CSFs for successful disaster management, as follows:

- Effective institutional arrangements
- Coordination and collaboration
- Supportive laws and regulations
- Effective information management system
- Competent managers and teams members
- Effective consultation with key stakeholders and target beneficiaries
- Effective communication mechanisms
- Clearly defined goals and commitment by key stakeholders
- Effective logistic management
- Sufficient mobilisation and disbursement of resources

Nazara and Resosudarmo (2007) observed reconstruction in Aceh after the 2004 tsunami and suggest the importance of close coordination between all of the agents involved, a peaceful socio-political environment and the active involvement of the community.

Koria (2009) suggests that the key factor to an effective recovery and reconstruction operation is adequate human resources; she also suggested a certification scheme to ensure the competencies of field staff. She implies that human resource policies have an important role to play in attracting qualified professionals to become involved in the successful management of large and complex operations.

A study by Ahmed (2011) explored a number of guidelines and good practice techniques used in post-disaster permanent reconstructions in several disaster affected countries. He recognised that many factors contribute to success in post-disaster reconstruction programmes, e.g., the context, scale of the programme, budget, political will, and the cooperation of communities. However, he implies that the most significant factors are to 'understand local conditions' and 'participatory processes'. "*It would be difficult to find examples* *where success has been achieved without such consultation or participation*", but it must be practiced adequately (Ahmed, 2011).

Similar findings were mentioned by Chan et al., (2011), where participants in their research regarded community participation and influence as being important factors for a successful resourcing exercise. Their research into donor-driven resource procurement shows that one of three factors which hinder donor-driven resource procurement is lack of community participation and influence; participation would allow the community to bring their skills, networking, and capabilities to reconstruction activities.

From all the above mentioned publications, the critical success factors for post-disaster reconstruction projects are summarised in Table 6-2 below.

Table 6-2 CSFs for post-disaster reconstruction projects, identified from publications

No	CSFs	Authors
1	Planning	(Sharma, 2001, Alexander, 2004, Wu and Lindell, 2004, Badri et al., 2006, Baradan, 2006, Lloyd-Jones, 2006, Nissanka et al., 2008, Rotimi et al., 2009, Gharaati, 2010, Tas et al., 2010)
2	Community or stakeholder involvement	(Moe and Pathranarakul, 2006, Asian Development Bank, 2010, Ahmed, 2011, Chang et al., 2011)
3	Coordination	(Moe and Pathranarakul, 2006, Nazara and Resosudarmo, 2007, Hayles, 2010)
4	Human resource	(Moe and Pathranarakul, 2006, Keraminiyage et al., 2008, Koria, 2009)
5	Adequate resource	(Keraminiyage et al., 2008, Tas et al., 2010)
6	Organisation	(Baradan, 2006, Johnson et al., 2006)
7	Cost escalation	(Jayasuriya et al., 2006)

From Table 6-2 above, planning is the topic most often mentioned in publications relating to post-disaster reconstruction projects as the factor that contributes to the success of projects. Planning is important because it reduces uncertainty and increases the likelihood of project success; although planning does not guarantee project success, lack of planning may well guarantee project failure (Dvir et al., 2003).

Most of the publications about post-disaster reconstruction projects are based on the reconstruction following the 2004 tsunami which caused immense damage. Most of the affected countries, such as Indonesia and Sri Lanka had never experienced a disaster on such a scale and did not have disaster management systems. This omission made planning very difficult and this was then exacerbated by difficulty in coordinating the many organisations involved in the reconstruction process.

Since reconstruction following a disaster is aimed at restoring the victims' lives to normal conditions the success of the reconstruction is usually determined by the level of satisfaction experienced by the victims regarding the final product of the reconstruction. Barenstein (2006), in her paper in relation to housing reconstruction in post-earthquake Gujarat, shows that the highest levels of satisfaction were found in 'subsidiary housing approaches' and 'owner driven approaches' where the disaster victims had a greater involvement in the reconstruction process. It implies the importance of community (disaster victims) involvement in contributing to the success of the reconstruction process.

Another characteristic of post-disaster reconstruction is the limited availability of resources, including human resources. Supply and distribution of resources are often disturbed by the effects of the disaster. Since project processes rely greatly on resources as inputs to produce outputs (e.g. house), the availability of the resources are key factors which determine the success of post-disaster reconstruction projects.

Several CSFs have been identified from publications about general project management procedures (please refer to Table 2-6, Chapter 2, page 34). When comparing the ten most cited CSFs from the post-disaster context outlined in Table 6-2, there are only a few CSFs that are rarely cited as critical for project success, as illustrated in Table 6-3. Effective project control and monitoring, feedback capabilities in the system and management support were found to be rarely cited as CSFs in a post-disaster reconstruction context.

Table 6-3 CSFs in post-disaster reconstruction context

No.	CSFs	Cited in post-disaster context publication
1	Effective project control and monitoring	X
2	Effective project planning	✓
3	Competent project manager	✓
4	Appropriate project organisation	✓
5	Competent project team	✓
6	Involvement of stakeholder/ community	✓
7	Personnel	✓
8	Sufficient resources	✓
9	Top management/parent company support	X
10	Feedback capabilities in the system	X

6.3. Identification of the success factors associated with PDR projects

This section identifies critical success factors for PDR projects by analysing the results from both the questionnaire survey and the interviews. Section 6.3.1 will present the result from the survey, section 6.3.2 will present the results from the and following that section 6.3.3 will discuss CSFs in PDR projects.

6.3.1. CSFs from the questionnaire survey

From the questionnaire survey, the success factors associated with post-disaster projects are presented in Table 6-4 below. Respondents of the survey were asked to rate the criticality of the factors on a scale of 1 (not critical at all) up to a scale of 5 (very critical).

An inspection of Table 6-4 shows that ‘effective project monitoring and control’, ‘adequate funding’, and ‘competent project manager’ are the three most critical factors in successful PDR projects which have mean score above 4.50.

Table 6-4 Success factors associated with post-disaster reconstruction projects

Success Factors	N	Overall mean score	Rank
Effective project monitoring and control	143	4.55	1
Adequate funding	143	4.52	2
Competent project manager	143	4.50	3
Effective project planning	143	4.39	4
Sufficient resources	143	4.32	5
Good communication	143	4.31	6
Appropriate project coordination	143	4.25	7
Skilled and sufficient project team	143	4.23	8
Adequate consultation	143	4.22	9
Good tendering method	143	4.17	10
Well written contract	143	4.14	11
Active involvement of stakeholder/community	143	4.10	12
Support from top management/parent company	143	4.08	13
Learning from previous experience	143	4.06	14
Political stability	143	4.01	15
Economic stability	143	3.87	16
Less bureaucracy in the reconstruction process	143	3.84	17
Less negative influence in the physical environment	143	3.73	18
Manageable size and complexity of project	143	3.71	19
Use of technology and IT	143	3.64	20

The scale: 1 (Not critical at all), 2 (Less critical), 3 (Fairly critical), 4 (Critical), 5 (Very critical)

Further down on the table ranked 4th and 5th are ‘effective project planning’ with a mean score of 4.39 and ‘sufficient resources’ with a mean score of 4.32. Furthermore, ranked 6th to 9th are the factors ‘good communication’ with a mean value of 4.31, ‘appropriate project coordination’ (4.25), ‘skilled and sufficient project team’ (4.23), and ‘adequate consultation’ (4.22). The tendering process is considered by the respondents to be a medium factor in 10th place. At the bottom of the table there are several factors which have a mean value lower than 4. Ranked at 16th is ‘economic stability’ with a mean score of 3.89. This is followed by ‘less bureaucracy’ at 17th, ‘less negative influence in the physical environment’ at 18th, and ‘manageable size and complexity of project’ in 19th place. Technology and information technology (IT) is perceived to be less important by respondents as it is ranked 20th by the respondents.

Success factors and organisation types

The data on the success factors by different organisations are presented in Table 6-5. As the mean score increases this indicates a more critical success factor. Observation of the table shows that contractor and government organisation are ranked highest in 'adequate funding' as a success factor. Respondents from NGOs rated 'effective project planning and control' as the highest success factor, while consultants rated 'effective project planning' as the most critical factor in PDR projects.

Further examination of the ranking column in Table 6-5 shows a visual indication of the differences in perception of the success factors among the survey respondents. For example, respondents from NGOs ranked 'active involvement of stakeholder/community' in third place, while contractors, governments and consultants ranked it in 13th, 14th, and 15th place respectively. However, the Kruskal-Wallis test (Table 6-6) shows that there is no difference between the respondents' type of organisation on the 'active involvement of stakeholder/community' success factor.

It can also be seen in Table 6-5 that respondents from consultants rated 'effective project planning' as the most critical success factor. T The respondents considered 'good communication' as one of most critical success factors, while the other respondents rated this at 6th, 7th, and 10th for respondents from contractors, NGOs, and governments respectively.

Down to the bottom of Table 6-5, ranked in 20th place in this research is 'use of technology and IT'. This result implies that in PDR projects, technology and IT, are relatively insignificant to the project's success.

Table 6-5 Success factors for PDR projects and organisation types

Success Factors	Mean Score					Rank				
	ALL (N=143)	CTR (N=47)	NGO (N=36)	GOV (N=34)	CSL (N=26)	ALL (N=143)	CTR (N=47)	NGO (N=36)	GOV (N=34)	CSL (N=26)
Effective project monitoring and control	4.55	4.53	4.61	4.65	4.35	1	2	1	2	5
Adequate funding	4.52	4.60	4.36	4.74	4.35	2	1	4	1	4
Competent project manager	4.50	4.53	4.50	4.53	4.38	3	3	2	4	3
Effective project planning	4.39	4.30	4.33	4.56	4.42	4	5	6	3	1
Sufficient resources	4.32	4.43	4.28	4.38	4.12	5	4	8	9	12
Good communication	4.31	4.28	4.31	4.32	4.38	6	6	7	10	2
Appropriate project coordination	4.25	4.26	4.11	4.47	4.15	7	7	10	5	9
Skilled and sufficient project team	4.23	4.21	4.33	4.26	4.08	8	8	5	12	13
Adequate consultation	4.22	4.13	4.19	4.41	4.19	9	11	9	6	8
Good tendering method	4.17	4.15	4.06	4.26	4.23	10	10	11	13	7
Good written contract	4.14	4.13	4.00	4.29	4.15	11	12	13	11	10
Active involvement of stakeholder/community	4.10	3.94	4.42	4.06	4.04	12	13	3	14	14
Learning from previous experience	4.08	4.19	4.06	4.06	3.96	13	9	12	15	16
Support from top management/parent company	4.06	3.87	3.83	4.41	4.23	14	16	14	7	6
Political stability	4.01	3.81	3.83	4.41	4.12	15	18	15	8	11
Less bureaucracy in the reconstruction process	3.87	3.89	3.69	3.94	4.00	16	14	17	18	15
Economic stability	3.84	3.89	3.50	4.03	3.96	17	15	19	17	17
Less the negative influence in the physical environment	3.73	3.62	3.61	4.06	3.65	18	19	18	16	20
Manageable size and complexity of project	3.71	3.49	3.75	3.94	3.77	19	20	16	19	18
Use of technology and IT	3.64	3.87	3.17	3.76	3.73	20	17	20	20	19

The scale: 1 (Not critical at all), 2 (Less critical), 3 (Fairly critical), 4 (Critical), 5 (Very critical)
ALL = Overall, CTR = Contractors, NGO = NGOs, GOV = Governments, CSL = Consultants

Table 6-6 Kruskal-Wallis test for success factors and organisation type

Success Factors	Chi-Square	df	Asymp. Sig.
Effective project planning	5.69505	3	0.127
Effective project monitoring and control	1.77459	3	0.620
Competent project manager	0.69736	3	0.874
Sufficient resources	2.93626	3	0.402
Skilled and sufficient project team	1.94931	3	0.583
Support from top management/parent company	11.17959	3	0.011*
Appropriate project coordination	3.78831	3	0.285
Active involvement of stakeholder/community	7.21700	3	0.065
Good communication	0.40051	3	0.940
Well written contract	1.90099	3	0.593
Learning from previous experience	1.41686	3	0.702
Use of technology and IT	12.87610	3	0.005*
Adequate funding	4.83288	3	0.184
Adequate consultation	3.40284	3	0.334
Political stability	10.32332	3	0.016*
Less negative influence in the physical environment	7.01501	3	0.071
Manageable size and complexity of project	4.19758	3	0.241
Economic stability	8.98267	3	0.030*
Less bureaucracy in the reconstruction process	2.44769	3	0.485
Good tendering method	1.86461	3	0.601

*results are statistically significant at $p<0.05$

As previously mentioned visual examination of Table 6-5 shows there might be some differences in perception between the respondents. A Kruskal-Wallis test was conducted and is presented in Table 6-6, it reveals four different perceptions of three factors: ‘support from top management’, ‘political stability’, ‘use of technology and IT’, and ‘economic stability’. To find out what the differences are a series of Mann-Whitney test was conducted and the results are presented in following table.

Table 6-7 Mann-Whitney test for critical success factors

Support from top management			
	NGO	GOV	CSL
CTR	0.710	0.012	0.202
NGO		.001*	0.082
GOV			0.293
Use of technology and IT			
	NGO	GOV	CSL
CTR	0.001*	0.733	0.408
NGO		0.010	0.016
GOV			0.686
Political stability			
	NGO	GOV	CSL
CTR	0.900	0.013	0.328
NGO		0.002*	0.184
GOV			0.101
Economic stability			
	NGO	GOV	CSL
CTR	0.045	0.317	0.770
NGO		0.005*	0.027
GOV			0.459

*significant

The critical success factor 'use of technology and IT is ranked last in this research but Table 6-7 above confirms there is a statistically different perception between respondents from contractors and NGOs. By examining the mean values in Table 6-5 it shows that contractors have a mean value of 3.87 which is higher than the NGOs' mean value of 3.17. This indicates that contractors regard technology and IT as important factors for project success. Technology and IT help contractors to work more efficiently and therefore, to be more effective. On the other hand, as discussed in chapter four, NGOs are more focussed on the human factor in PDR projects which includes the disaster-affected community in the reconstruction process. Table 6-5 clearly shows active involvement by the community and is ranked 3rd by NGOs as a critical success factor.

6.3.2. CSFs from the interviews

In the interviews the respondents were asked what to identify a critical factor in post-disaster reconstruction projects (refer to question number 5, Appendix

D. The interview questions, page 355). Fourteen themes emerged from the interviews and they are presented in Table 6-8 below.

Table 6-8 CSFs from the interviews

Success factors	No. of sources	No. of references
Communication	2	2
Coordination	4	6
Equipment	2	2
Government support	1	1
Human resource	6	8
Integrity	2	2
Leadership	1	1
Material availability	1	1
Good planning	9	10
Project management	8	9
Stakeholder involvement	4	4
Supervision	2	2
Team work	1	1
Work by guidance	1	1

One of themes that frequently emerges from the interviews is 'good planning' as critical factor for successful reconstruction project. As can be seen from Table 6-8 above, 9 of the 33 interviews mentioned planning as CSFs. Respondent R23-CTR stated:

> *"The most important factor in my opinion is the planning factor. Problems with [construction] materials are reasonable on a project, but as long as there is good planning I guess there will be no problem, the project will be a success. But if planning is not good I doubt the project will be a success because at the end there will be an addendum or contract termination." (R23-CTR-CO)*

Another important factor is project management as Table 6-8 shows that 8 interviewees noted about project management as being an important. A project manager indicates in his response that good project management is a critical factor for a successful project:

> *"The main thing is the PDCA. The basic principle of project management is the PDCA. Plan, do, control, action, that its, sir. We "hold" internal team and external teams, and then we apply it [PDCA]." (R17-CTR-BS)*

Other interviewees considered 'human resources' to be critical factors which are related to the skills of the construction workers. Six interviewees mentioned human resource as being a critical factor, as presented in Table 6-8. Respondent R01-CTR stated:

> *"For the implementation of the project the most important thing is a professional workforce, the workforce management, as well as good supervision" (R01-CTR-DK)*

Specifically in the human resource factor, respondent R26-CTR pointed about the importance of the project manager in pursuing a successful project. He argued that project managers should have appropriate skills that include the ability to work with top management and lower management in the reconstruction projects:

> *"Project managers who can master the field of successful reconstruction projects. Project managers who understand the work, which is the "up" and "down" approach. The 'up' means he is in coordination with the consultant and the owner. 'Down' means he should have a good relationship with the site engineer and foreman. So the project managers job is very strong here, so many duties. It is the PM who I think can be relied upon for the quality and success of the project". (R26-CTR-EO)*

Respondent R01-CTR noted, in a previous quotation, 'professional workforces' and also indicated that 'good supervision' was an important factors in achieving a successful reconstruction project. This view is supported by respondent R32-GOV who thought that the supervising consultant guided the contractor through the planning consultant's design:

> *"If we look at the actors in the project, it's comprised of planning consultant, supervision consultant, and contractor. But of the three the*

> *vital one is the supervising consultant. Because when they are differences in the field from what is in the design drawings, the planning contractor often uses the excuse "sir, my work is based on the existing planning". But according to the engineer the information from the planning consultant was not suitable. For example, the height level of the road from the house floors is on the plan drawing, but the intellectual work of the supervisory consultant in the field should be "this is supposed to be reviewed, we cannot do that". But if the consultant supervisor cannot be like that, the design will fail, the contractor will also have failed. That's the key point there in the middle, in the supervision consultants." (R32-GOV-RI)*

One of approaches in post-disaster reconstruction is community-based reconstruction which depends on the involvement of the affected community in the reconstruction process. In Table 6-8 (page 199), four interviewees mentioned the stakeholder's involvement as being a critical factor for a project's success. One of the interviewees stated that:

> *"I think the most decisive is our relationship with the community, as users. Because if the contractor or consultant ... the consultant works with the contractor for a limited period and the contractor works during a contract term that we have set. So the point is don't let problems exist in the community. There should be intensive communication with the public, and socialisation (of our work) with the community. Most of our programme is successful because of the focus on the community." (R16-NGO-DT)*

Four interviewees stated that the criticality of 'coordination' was important for successful reconstruction projects (refer to Table 6-8). One interviewee mentioned:

> *"One word, organise. The government should organise the implementation of the reconstruction. The parties involved must also be willing to be regulated by the government. The role should within the Indonesian government, as the party who suffered the disaster. If it can be organised (the result) will*

> *be good. The money (funding, in reconstruction) was very much available and it was liquid. I obtained advance payment, and do not think again about payments. That is it, the money is there, but why it is not utilised as quickly as possible.*
>
> *NGOs which participate in reconstruction should be regulated by the government. Many NGOs are just spending money on the operation. Their high salaries and their high operational costs are in my opinion not appropriate. If they want to help in supervising that is ok, but if it was all done by them it will be a high-cost (project)." (R24-CTR-AD)*

Another interesting theme that has emerged from the interviews is the 'integrity' of the personnel involved in reconstruction projects which is critical to project success. Two interviewees mentioned this factor as can be seen in Table 6-8 (page 199). Besides having adequate skills the personnel should also be 'immune' to corruption on the project which, according to some interviewees, greatly affects the success of the project. Respondent R03-CSL had a similar view to R32-GOV about supervision but he stressed the effect that a dishonest supervision consultant had on the project:

> *"Supervision consultants should be honest. If the supervising consultants had make "commitment" by the contractor, I'm sure the work would not have been completed." (R03-CSL-MD)*

Another respondent, R04-NGO, also expressed a similar view as can be seen in his response below. He also illustrated how corruption threatens the project and how the good integrity of other personnel will help to reduce the probability of corruption:

> *"I think the main thing is the integrity of the project owner and any parties involved in the project. Integrity here means... projects such as a construction project is loaded with "temptations" such as corruption and all sorts of "games" like that. "Cracks" [opportunities] for it in the project are too much. If we have a pretty solid team, the people who have very high*

> *integrity who are willing to work with the intention of helping reduce corruption, it should be utilised. So at every stage of the selection we carry out we do it honestly, there will be no future problems. Because if we are not honest at the beginning of the tender, the future is not going to be good, there will be problems." (R04-NGO-FF)*

6.3.3. Discussion of CSFs in PDR projects

In sections 6.3.1 and 6.3.2 the results regarding the CSFs of PDR projects collected from the questionnaire survey and the interviews have been presented. This section will discuss the CSFs for PDP project by reflecting the results from both methods.

Table 6-5 (page 196) shows the result from the questionnaire survey and the five most critical factors to success which are 'effective project monitoring and control', 'adequate funding', 'competent project manager', 'effective project planning', and 'sufficient resources'. When these results are imposed onto the results from the interviews, the findings are quite similar.

'Effective project monitoring and control'

The nature of PDR projects has a significant impact on project control as has been discussed in section 5.2.2 (page 137). To minimise the impact an effective project monitoring and control system is needed to achieve the project's goals. Monitoring may lead to better organisation in the project which enable employees to work more effectively and efficiently (Mahaney and Lederer, 2010).

'Adequate funding'

The availability of funds is very important because without sufficient funds the project will not progress and will be delayed. Research by Le-Hoai et al., (2008) shows that the owner's financial difficulties were the third important cause of project delays in Vietnam. Similar findings by Frimpong et. al., (2003) showed that the owner's difficulty in meeting monthly payments lead to project overruns in Ghana.

‘Competent project manager’

The project manager has an important responsibility to achieve project success as “the success or failure of a project, to a large degree, depends on who manages it” (Patanakul, 2011). A competent project manager has been acknowledged as one of critical success factors as revealed in the review of publications (refer to Table 2-6, page 34).

Competence combined with skills and knowledge is the attributes which should be possessed by project managers. One of earliest studies on management skills was by Katz, (1955) entitled ‘Skills of an Effective Administrator’. Katz suggests that effective management depends on three basic personal skills, namely technical skills, human skills, and conceptual skills. Technical skill involves specialised knowledge, analytical ability within that speciality, and the facility to use the tools and techniques of the specific discipline. Human skills are mainly concerned with working with people which includes the ability to work effectively as a group member and to build cooperative effort within a team. The third skill by Katz is conceptual skill which is the ability to see the organisation as a whole, includes recognising how the various functions of the organisation depend on one another and how changes in one part affect of all the others (Katz, 1955).

Changes very often occur on a project, thus the leadership role of the project manager is important (Anantatmula, 2010). Leadership includes convincing people about the need for change, aligning them to new directions, and motivating them to achieve the project objective under difficult and demanding project environments (Anantatmula, 2010).

There are generic knowledge areas in project management which are needed by the project manager, as proposed in PMBOK (PMI, 2008). However, specifically for the construction industry, Edum-Fotwe and McCaffer (2000) proposed, in their research, the following essential knowledge and skill elements for a project manager:

- Technical skills: planning and scheduling, construction management activities, basic technical knowledge in own field, productivity and cost control;

- Managerial skills: leadership, delegation, negotiation, decision making, motivation and promotion, team working, time management, top management relations;
- Financial skills: establishing budgets, reporting systems.
- Legal skills: drafting contracts;
- Communication skills: presentation, general and business, correspondence, report writing;
- General skills: chairing meetings, understanding of organisation.

In the chapter 5 it was shown that achieving the desired quality is the most challenging issue in PDR projects. Anderson (1992) argues that construction quality is affected by many factors and one of them is the quality of the project manager. The quality of the project manager is critical to achieve project success (Anderson, 1992, Ehsan et al., 2010, Yang et al., 2011).

Beside the competence of the project manager, the competence of project teams is also important as was found in the questionnaire survey and the interviews. This critical factor has been acknowledged in previous publications (Fortune and White, 2006, Jefferies, 2006, Toor and Ogunlana, 2009). One of project manager emphasised the same point and said:

> *"We are working as a team, not just a project manager. Under me we have a technical section, draftsmen; there are divisions of quantity surveyors, and contract administration. There are implementers for architectural and ME works. There are divisions of logistics and equipment. So, all must work together to achieve success." (R27-CTR-IZ)*

'Effective project planning'

Planning is an essential part of project management as planning reduces uncertainty and increases the likelihood of project success (Dvir et al., 2003, Zwikael and Sadeh, 2007). Research by Doloi et al. (2011) also confirmed that technical planning and the expertise of contractors is the key to achieving project success. Using a project management system may improve effectiveness and efficiency in terms of better planning (Raymond and Bergeron, 2008).

'Sufficient resources'

Availability and quality of resource is an important factor for project success, since lack of resources will hinder project performance (Patanakul, 2013), and shortage of construction materials may lead to project delays (Kaming et al., 1997a, Enshassi et al., 2009, Hwang et al., 2013).

6.4. Success criteria for post-disaster reconstruction projects

What are the criteria to judge whether the reconstruction project is success or not? Section 6.4 presents and discusses the results on the success criteria assembled from the questionnaire survey and the interviews.

6.4.1. The success criteria from the questionnaire survey

In the questionnaire survey eight criteria were suggested as a way of measuring the success of a reconstruction project and the respondents were asked to rank the criteria in order of importance. The result from the survey is provided in Table 6-9.

Table 6-9 Success criteria for post-disaster reconstruction projects

Success criteria	N	Overall mean score	Rank
Completion of reconstruction project within specified quality	143	4.65	1
Completion of reconstruction project within the budgeted cost	143	4.55	2
Completion of reconstruction project within the allocated time period	143	4.49	3
End user (disaster victims) satisfaction with final product	143	4.48	4
End user (disaster victims) satisfaction with reconstruction process	143	4.41	5
Stakeholders satisfaction	143	4.36	6
Minimum disputes and conflicts between stakeholders	143	4.08	7

The scale: 1 (Not important at all), 2 (Less important), 3 (Fairly important), 4 (Important), 5 (Very important)

From Table 6-9, it can be seen that the traditional criteria, the golden triangle (time, quality and cost), are ranked in the top four of the success criteria. Completion of the project to the specified quality is considered to be the most important success criterion.

Success criteria may vary depending on the type of organisation. Further data was extracted by dividing the success criteria according to the type of organisation. The result is presented in Table 6-10. The table shows that respondents from contractors and consultants are more concerned with achieving planned quality and ranked this as the main criteria for successful projects. Meanwhile respondents from government organisations consider completion of the project within the budgeted cost to be the most important criteria. On the other hand respondents from NGOs rated the satisfaction of disaster victims for the final product as the most important criterion.

Further inspection of the 'rank' column in Table 6-10 suggests that there are different views on the importance of success criteria. The Kruskal-Wallis test was implemented to ascertain if the differences in the importance of success criteria depended on which organisation the respondent represented. The result of Kruskal-Wallis test is provided in Table 6-11. With a significant level of 0.05, the differences between the different organisations are statistically tested for the success criteria.

Table 6-10 Success criteria and organisation type

Success Criteria	Mean Score					Rank				
	ALL (N=143)	CTR (N=47)	NGO (N=36)	GOV (N=34)	CSL (N=26)	ALL (N=143)	CTR (N=47)	NGO (N=36)	GOV (N=34)	CSL (N=26)
Completion of reconstruction project within specified quality	4.65	4.79	4.36	4.74	4.69	1	1	2	2	1
Completion of reconstruction project within the budgeted cost	4.55	4.55	4.33	4.76	4.54	2	4	4	1	2
Completion of reconstruction project within the allocated time period	4.49	4.68	4.06	4.68	4.50	3	2	7	3	3
End user (disaster victims) satisfaction with final product	4.48	4.55	4.56	4.56	4.15	4	3	1	4	6
End user (disaster victims) satisfaction with reconstruction process	4.41	4.55	4.36	4.47	4.15	5	5	3	6	5
Stakeholders satisfaction	4.36	4.45	4.22	4.50	4.23	6	6	5	5	4
Minimum disputes and conflicts between stakeholders	4.08	3.85	4.22	4.24	4.12	7	7	6	7	7

The scale: 1 (Not important at all), 2 (Less important), 3 (Fairly important), 4 (Important), 5 (Very important)
ALL = Overall, CTR = Contractors, NGO = NGOs, GOV = Governments, CSL = Consultants

Table 6-11 Kruskal-Wallis test for success criteria and organisation type

Success Criteria	Chi-Square	df	Asymp. Sig.
Completion of reconstruction project within the allocated time period	17.084597	3	0.001*
Completion of reconstruction project within the budgeted cost	10.421946	3	0.015*
Completion of reconstruction project within specified quality	10.424176	3	0.015*
Stakeholders satisfaction	3.013440	3	0.390
End user (disaster victims) satisfaction with reconstruction process	4.271322	3	0.234
End user (disaster victims) satisfaction with final product	5.629473	3	0.131
Minimum disputes and conflicts between stakeholders	4.704717	3	0.195

*results are statistically significant at p<0.05

The Kruskal-Wallis test only reports any difference, but does not report whether difference is significant. A series of Mann-Whitney tests were conducted to find out if the differences are significant and the results are as presented in Table 6-12 below.

Table 6-12 Mann-Whitney test for success criteria

Completion within specified time			
	NGO	GOV	CSL
CTR	0.001*	0.637	0.166
NGO		0.001*	0.067
GOV			0.091
Completion within budgeted cost			
	NGO	GOV	CSL
CTR	0.223	0.015	0.785
NGO		0.001*	0.244
GOV			0.079
Completion within specified quality			
	NGO	GOV	CSL
CTR	0.005*	0.938	0.437
NGO		0.013	0.094
GOV			0.048

From the results found in the Kruskal-Wallis test the table above shows whether the differences are statistically significant. For the criterion 'completion time' there are statistical differences between contractors-NGOs and NGOs-governments. For the criterion 'completion within budgeted cost' there is a different opinion between NGOs and governments. Similarly, for the criterion 'completion within specified quality', there is a difference between contractors and NGOs.

It seems that the NGOs have different opinions about the three criteria compared to the other organisations. Examination of Table 6-10 shows the extent of the difference. For the criterion 'completion within specified time', the average mean value for the contractors is 4.68, the government is 4.68, for consultants it is 4.50, but for the NGOs it is 4.06. This means the respondents from NGOs consider the criterion, 'completion within allocated time', is not as important as the other organisations perceived it to be. Similarly, the other two criteria cost and quality, Table 6-10 shows the mean scores for NGOs are lower than the other three respondents. This infers that respondents from NGOs do not consider 'the golden triangle' to be important criteria for a successful project outcome.

6.4.2. The success criteria from the interviews

In the previous section the results from the questionnaire survey about success criteria in the PDR projects were presented. Similar questions were asked of the respondents in the interviews (refer to question number 6 in Appendix D. The interview questions, page 355) and the criteria obtained from them are presented and discussed in this section.

The interview data was analysed using NVivo software and eight themes emerged on the criteria required for a successful project as presented in Table 6-13 below. Most of responses indicate the 'the golden triangle' of cost, time, and quality are the most important criteria for measuring the success of a project.

Table 6-13 Success criteria revealed by the interviews

Criteria	No. of sources	No. of references
Built units	3	3
Client's satisfaction	1	1
Cost	14	16
Health & Safety	2	3
Less dispute	3	3
Utilisation and Project benefits	13	15
Quality	11	11
Time	13	13

One of respondents from a contractor company expressed his opinion about 'the golden triangle' as the success criteria:

> *"If we in the company..., which criteria is categorised into success criteria depends on the policy of each firm. In our company, success criteria are first, time (target) is reached, the quality is achieved. Then it's obvious, because this is a business, the business orientation is achieved." (R28-CTR-ES)*

As implied by the above response, a contractor company is also a business entity which has to aim to make a profit in order to grow the business. Hence, cost becomes one of most important criteria. As shown in Table 6-13 fourteen interviewees mentioned cost as being a success criterion and respondent R01-CTR indicated the following:

> *"Companies (contractors) are commercial enterprises. They join the tender of a project and then they make an offer at a price so they could work on the project. With the price they have offered, of course they expect a profit.*
>
> *After all, anyone who is engaged in business is definitely looking for profit." (R01-CTR-DK)*

However, one interesting response emerged from another respondent from a contractor organisation who that said that profit is not always the case. Respondent R27-CTR's company is a BUMN (*Badan Usaha Milik Negara*, a stated-owned enterprise) type of contractor. In the reconstruction programme after the disaster the government dispersed its resource to accelerate the reconstruction process, including BUMN companies. The respondent mentioned:

> *"In a BUMN company as we are, in certain conditions such as a disaster, we do not think about profit. That is, as long as the costs we have been dispersed are fulfilled, paid, that's enough. Different with businesses, of course there is a profit proportion for the company. In certain circumstances, the BUMN does its job like that." (R27-CTR-IZ)*

Beside the cost, quality is also an important criterion for measuring the success of the reconstruction project. 11 of the 33 interviewees in Table 6-13 mentioned meeting the planned quality as a criterion for project success. A project is considered successful if the final product meets the desired quality as defined in the specification. This was stated by following interviewees:

> *"We termed the project successful if it qualifies in accordance with the standards of what was desired, as per specification." (R26-CTR-EO)*

> *"In my opinion, the first criterion for success is the building stand (built) as planned and its quality was maintained. I consider it a success." (R23-CTR-OO)*

It may be noted from R23-CTR's response above, he simply related the quality with whether the building is still stand or not after the disaster, in this case the earthquake. Sumatra Island and Java Island are very prone to earthquakes and is not unusual to have aftershocks following the main earthquake or to experience other earthquakes during or after the reconstruction.

Finishing the project within the specified time is also one of the criteria in 'the golden triangle', the most important criteria for project success, as shown in Table 6-13 (page 210). One interviewee stated that:

> *"Successful project is..., first, on time. After that it's quality in accordance with the specification used, and there is no problem with the owner. Work on time, administration on time, it was a successful project." (R02-CTR-LR)*

> *"Actually, from our side (the success) is that we can finish (the project) in accordance with the target schools that had been promised to the owner.*
>
> *In terms of time, we promise to finish (certain number school) in a certain number of years. So he (Owner) packaged the works into certain schools built in certain years, with quality specifications in accordance with quality planned." (R14-CTR-LR)*

Another theme that emerged from the interviews is operational or use of the reconstruction product as indicator of success. Examination of Table 6-13 (page 210) shows that 13 of 33 interviewees noted that 'utilisation and project benefits' to be important criterion for project success. The reconstruction process is aimed at restoring a functioning a disaster-affected community, by rebuilding houses, buildings, and infrastructures to return the community to its previous life. For example, restoring or retrofitting a bridge that was damaged by the earthquake and which is hindering transportation in the area restores local life to near normal. That is considered to be a success. A similar illustration was given by one of respondent from the government:

> *Okay... when talking about success go back to the project, see its first goal, the goal... For example, I make shelters, shelters to be used by people. So if, for example, they are not occupied, it seems to be a failure for me. (R13-NGO-FY)*

Further exploration of the theme 'utilisation and project benefits' in the NVivo analysis reveals that benefits for the community from reconstruction projects are considered to be a criterion of success. This is mostly articulated by respondents from NGOs. This criterion is outside 'the golden triangle' where the criterion is mostly focused on after the project finish, in the operational stage of the finished project. One of respondents illustrated:

> *"For me, I see that the project was a success or not from the benefit received by the local community or the community itself. Which as I said earlier we have two projects, the one we are directing for the public, the second is us with PMI (Indonesian Red Cross).*
>
> *For PMI (project), I think is very successful. From the time before the tsunami, PMI branches in each county or city do not have a (permanent) office. They always rent, or move to all sorts of places. With the office they become more organised, so staff and managers are structured and they always go the office and where its activities are centred. So people do not ask again where the PMI office is, has they moved yet? So they are already settled there. So, I see the benefits to the larger society as well, because there is more leverage in serving the people now, they do not need to think again about the rental office or other matters, they only need to provide assistance to the community." (R04-NGO-FF)*

Similarly to the above responses respondent R22 also indicates the benefits for the community to be a criterion for success in the reconstruction. Specifically he pointed out two sub-themes, sustainability and the multiplayer effect:

> *"In my opinion, I think the successful project consists of two things. First is sustainability. The second is I can get a multiplayer effect.*
>
> *The first is sustainability, so if we have to teach the techniques of construction or doing recovery, say the project was only running for 6 months, we managed to locate agents in the field from government or community leaders who can carry on the work from the NGO after they go. We found this in a few places.*
>
> *The second is the multiplayer effect. Let's say we only work on the reconstruction of the houses like that, but it has multiplayer effect. There are people working on the house frame, there are people working on other businesses, such as the PKK (women group) who could make crib bedding or bed linen.*
>
> *That is multiplayer effect that we are looking for. Indeed, it's difficult to get, I only get a few in Aceh at the time. And if those two worked that's what I call success." (R22-NGO-US)*

6.4.3. Discussion on success criteria

Research by Takim (2005) suggests a set criteria for project success where she differentiates the criteria by efficiency and effective measurements. In the efficiency measurement there are following criteria: time, cost, quality, safety, and productivity. For the effectiveness measurement Takim suggests the client's satisfaction with service, client's satisfaction with product, project effectiveness, project functionality, and free from defect as the success criteria.

Results from the questionnaire survey and the interviews suggest that the disaster affected community's satisfaction is an equally important criterion as 'traditional' criteria of time, quality, and cost.

Research by Muller and Turner (2007) indicates similar results; that customer satisfaction is significant as success criteria on high complexity projects. Another research by Moe et. al., (2007)) adopted a balanced scorecard approach to measuring the performance of disaster management projects in their research. Their findings show that at the reconstruction stage performance can be measured from the beneficiaries' perspective by a simple measurement: their life condition is restored back to pre-disaster conditions. In his literature review, Burnell (2012) suggests five factors which may be used to review the benefits disaster victims achieved to measure how well the reconstruction programme has been conducted. The factors are durability (How well has it lasted?), process (How was it delivered and how were local people involved?), likeability (What do people think of living in them?), adaptability (How has it been used, changed or amended over the years?), and usability (How the shelter was used, for what purpose and how did it impact on their livelihood?) (Burnell, 2012).

This research also shows that the quality of reconstruction is also an important success criterion. As discussed in chapter 2 (section 2.2.2, page 14) reconstruction plays an important role in disaster management where the quality of the reconstruction product affects the capacity to deal with the next disaster. Thus, it is understandable that the quality of the reconstruction becomes the main concern, as the main criterion for the project success. However, the quality criterion combined with disaster victims' satisfaction criterion may lead to a higher challenge in the reconstruction process, since satisfaction is more difficult to achieve and different from quality. For example, a house made with a wooden structure is considered more seismic resistant than a concrete structure, and the wooden structure is desired by the disaster victims.

As discussed in chapter four, the NGOs and Donors are becoming prominent stakeholders in PDR projects, whereas it used to be the project owner, contractor, and consultant in normal condition projects. NGOs seem to view a construction project as 'a vehicle' or a medium to achieve the goal to restore the living conditions of the disaster-affected community back to normal condition. The NGOs built schools in order that children in affected communities may back to get into education. The success of reconstruction is may often be judged by NGOs by the percentage of pupils going back to school. This criterion indicates that NGOs view a post-disaster reconstruction project from a broader view, where success in a project is success, not only project management success. That may explains why NGOs have different about 'the golden triangle' as project success criteria.

6.5. Implications and inferences from the result

From the previous sections, inferences and implication that can be drawn from research results and analysis are discussed in the following sub-sections.

6.5.1. Inferences of CSFs and success criteria of PDR project

- The most critical success factors (CSFs) for reconstruction projects are 'effective project monitoring and control', 'adequate funding', and competent project manager'.
- Meeting the planned construction quality is considered to be the most important criterion for the success of the reconstruction project.
- NGOs seem to set different success criteria compared to contractors, government and consultants where NGOs main criterion is the disaster victims' satisfaction.

6.5.2. Implication of CSFs and success criteria of PDR project

Since disaster victims' satisfaction is one of the significant criteria it suggests that there should be more involvement by victims or disaster affected communities in the reconstruction process.

6.6. Summary

This chapter presented the critical success factors associated with post-disaster reconstruction projects. The questionnaire survey revealed findings that showed that respondents perceived project monitoring and control, funding, and having a competent project manager to be the three most critical factors for success in the post-disaster reconstruction projects.

For the success five criteria were perceived to be the most important criteria for measuring the success of a project and they are: completion within specified quality, completion within budgeted cost, completion within allocated time and disaster victims' satisfactions with the final product.

CHAPTER 7. KNOWLEDGE COMMUNICATION IN POST-DISASTER RECONSTRUCTION PROJECTS

7.1. Introduction

This chapter focuses on knowledge communication implementation in post-disaster reconstruction (PDR) projects. Section 7.2 describes knowledge management in a post-disaster context followed by section 7.3 which focuses on knowledge communication methods in PDR projects. The barriers to knowledge communication on PDR projects will be discussed in section 7.4 and section 7.5 and 7.6 present the role of knowledge communication in PDR projects and its importance. Inferences and implications of the findings from this research will be presented in section 7.7, and this chapter concludes in section 7.8 which consists of a summary of the chapter.

7.2. Knowledge management in a disaster management context

There are few publications about knowledge management in a post-disaster reconstruction context. One of the publications is by Thanurjan & Seneviratne (2009), who investigated several knowledge management (KM) parameters in post-disaster housing reconstruction in Sri Lanka following the 2004 Indian Ocean tsunami. They employed a questionnaire survey, sent to 56 donors and consultation organisations, and also interviewed 12 donors and consultation organisations. Their findings are lists of KM parameters: knowledge sources, KM technologies, KM techniques, benefits and challenges to KM in post-disaster housing reconstruction. However, there are no weightings or percentages in the lists so it is difficult to draw meaningful conclusions from their results as to the relative significance of the factors identified, and whether and why, in post-disaster housing in Sri Lanka there is a lack of effective information and knowledge dissemination.

In general the scope of disaster management practice, Haight et. al., (2006) suggests a lack of effective information and knowledge dissemination has lead to insufficient performance of disaster management.

Thanurjan & Seneviratne (2009) conclude that most the organisations have not implemented knowledge management (KM) formally into post-disaster housing reconstruction. However, they point out that there is enough awareness of knowledge management in the industry to implement KM into post-disaster reconstruction to improve performance.

Perhaps the main research findings of Thanurjan & Seneviratne are the challenges to KM in post-housing reconstruction in Sri Lanka. They listed the challenges as follows:

- Lack of compiling and synthesizing the accumulated data, information and knowledge, storing and organisation.
- Lack of systematic collection of standardised data.
- Lack of documentation of knowledge and application of lessons learned and best practices for decision-making.
- No validation mechanism.
- Lack of measures to value the performance of knowledge assets.
- Unstructured KM approach.
- Overload of information in the form of reporting.
- Changing people's behaviour.
- What knowledge should be managed?
- Organisational culture.

Gharaati (2010) highlights several issues regarding knowledge transfer in post-disaster reconstruction. He notes, that despite the fact that post disaster reconstruction is considered a success by authorities at the end of the programme, the reconstruction often fails to provide sustainable safe-construction methods. He also argues that the real impact of the reconstruction is only known in the long term, and actual success or failure of reconstruction projects depends on intangible aspects such as awareness, preparedness, acceptance or rejection of preventive measures, and sustainability.

Gharati also highlights characteristics of post-disaster environments and its relationship with basic requirements for knowledge transfer (Table 7-1).

Table 7-1 A summary of post-disaster dynamics and the prerequisites of knowledge transfer (Gharaati 2010)

Characteristics of post-disaster environment in developing countries	**Knowledge transfer prerequisites**
Extremely chaotic/Human dynamics	Suitable context, absorptive capacity, close relationship
Push for quick results	Long-term process, person to person experience
Trauma added to an old social context	New social context for new knowledge

It is apparent from Table 7-1 that absorptive capacity (the ability and willingness of key players to understand, assimilate and have the requisite skill sets to address contextual issues) is important in knowledge transfer and communication. Similarly, knowledge exchanges in social contexts and the tacit knowledge between and among people are also vital.

7.2.1. Knowledge communication in post disaster reconstruction

Eppler (2007) defines knowledge communication as "*(deliberate) activity of interactively conveying and co-constructing insights, assessments, experiences, or skills through verbal and non-verbal means*". Furthermore, he points out that knowledge communication is about the successful transfer of know-how, know-why, know-what, and know-who through face-to-face (co-located) or media-based (virtual) interaction.

Knowledge sharing is a form of communication (Hooff and Ridder, 2004). These authors argue that knowledge transfer involves either actively communicating to others what one knows or actively consulting others in order to learn what they know. Similarly, Liyanage et al. (2009) also suggest that knowledge transfer is an act of communication. They consider knowledge transfer to be the conveyance of knowledge from one place, person or ownership to another. Successful knowledge transfer means that the transfer of knowledge results in the successful creation and application of knowledge in an organisation. In their research, Liyanage et al. (2009) analysed theories and models of knowledge transfer and they concluded that all theories and models were developed from the basic idea of communication and collaboration between the sender and receiver. This idea was originally introduced and popularised by Shannon and Weaver in 1949, in their theory 'Mathematical Approach to Communication and Information'. The work of Shannon and Weaver is most widely known in communication research (Emmitt and Gorse, 2003).

Based on the source-receiver model, Liyanage et al. (2009) introduced a model for process knowledge transfer that, theoretically, involves six steps: awareness, acquisition, transformation, association, application and externalisation or feedback. They also suggest four factors as prerequisites of the knowledge transfer process:

- Identifying the most suitable source of knowledge;
- Willingness of the sources to share their knowledge;
- Willingness of the receiver to acquire the knowledge; and
- The receiver's absorptive capacity.

A series of publications from Eppler (Eppler, 2006, Lurati and Eppler, 2006, Eppler, 2007) investigated problems in knowledge communication. Eppler has investigated knowledge communication problems between experts and decision makers, which are basically the problems of source and receiver in Shanon and Weaver's communication models. According to Eppler, the first type of problem is expert-caused difficulties which lead to the others. For example, managers have difficulties in grasping the insights of the experts. Experts fail to convert their insight into an understandable form for non-experts. Secondly, Eppler explains that some of the problems in knowledge communication come from managers, the non-experts. Since managers are unwilling to discuss in detail the problems they may have, the experts have difficulties in offering solutions to the problems. Furthermore, the various other problems are caused by the mutual behaviour of experts and non experts and the interaction between them (Eppler, 2007).

With regards to communication, one of the influencing factors in knowledge communication is the tools and medium used in communication. KM tools can be differentiated into 'KM techniques' and 'KM technologies' or information technology (IT) and non-IT tools (Al-Ghassani et al., 2005). In the context of reconstruction, Thanurjan and Seneviratne (2009) have identified those tools in housing reconstruction in Sri Lanka. The ten (10) most used techniques and technologies are presented Table 7-2.

Table 7-2 KM techniques and technologies in housing reconstruction (Thanurjan and Seneviratne, 2009)

KM Techniques	KM Technologies
Project reviews	E-mail system
Task teams	Costing and cost management system
Face-to-face communications	Document management system
Formal meetings	The central project file
Brainstorming	Intranet
Site liaison initiative	Knowledge bases
Quality circle	On-line project management
Recruitment	Data and text mining
Seminars	Skills Yellow Page
Training	Groupware

In comparing the table with previous research by Egbu and Botterill (2002), surprisingly, the telephone and documents and reports are not among the main tools identified in Thanurjan and Seneviratne's findings. The most frequently used techniques and technologies in construction organisations are: the telephone, internet/intranet/e-mail and documents and reports (Egbu and Botterill, 2002).

It suggests that there are differences in the nature, extent and type of challenges between normal construction and post-disaster reconstruction. Catastrophic disasters bring enormous challenges to the reconstruction process, while, as suggested by Rotimi et al. (2006), routine construction will fit well into small scale disasters. The scale of disasters is different from one disaster to another, thus the general disaster scaling by Eshghi and Larson (2008), which uses a scale of 1 for emergency situations up to scale 6 for catastrophes, may be appropriate in determining the scale of the disaster.

The nature of post-disaster reconstruction is probably different to common construction, which is likely to affect the use and effectiveness of the tools used in KM in different contexts. Perhaps this may partly explain why, in

Thanurjan & Seneviratne's study on tools and techniques for KM, the use of the telephone was not prominent when compared to Egbu & Botterill's study. The notion of context is important in the role that knowledge communication plays, as well as the approaches to maximising the role; and includes types of construction products and processes and also people in construction; and the use of different mixes of tacit and explicit knowledge (Robinson et.al., 2005).

7.3. Knowledge communication methods in PDR projects

The questionnaire survey and the interviews of this research aimed to identify knowledge communication methods which are being used in PDR projects. A list of knowledge communication methods has been developed by identifying the methods most cited methods in publications and these were used as a question in the questionnaire survey. The respondents were asked, using the Likert scale of 1 to 5, about the frequency of use and effectiveness of knowledge communication methods.

This section, 7.3, presents the results of knowledge communication methods from the questionnaire survey and from the interviews.

7.3.1. Results from the questionnaire survey

Regarding the knowledge communication methods, respondent's perceptions of frequency of use of the methods in the reconstruction stages are depicted in Table 7-3 below.

Table 7-3 Frequency of use of knowledge communication methods

Methods	Stage of reconstruction					
	Planning		Design		Construction	
	Mean	Rank	Mean	Rank	Mean	Rank
Reports	4.14	1	4.14	1	4.43	1
Face-to-face interactions	3.89	2	3.73	4	4.09	2
Telephone	3.78	4	3.73	3	4.02	3
Project review	3.59	5	3.57	5	3.98	4
Meetings	3.86	3	3.78	2	3.98	5
Document management system	3.51	7	3.55	6	3.76	6

Methods	Stage of reconstruction					
	Planning		Design		Construction	
	Mean	Rank	Mean	Rank	Mean	Rank
Mentoring	3.36	10	3.29	10	3.64	7
Emails	3.48	8	3.45	7	3.53	8
Brainstorming	3.56	6	3.43	8	3.45	9
Trainings	3.12	12	3.09	12	3.42	10
Recruitment	3.03	13	3.03	13	3.41	11
Internet	3.36	9	3.36	9	3.33	12
Community of practice (CoP)	3.25	11	3.15	11	3.15	13
Knowledge base	2.98	14	2.97	14	3.00	14
Groupware	2.80	16	2.75	16	2.94	15
Intranet	2.76	17	2.78	15	2.84	16
Apprenticeship	2.45	20	2.50	20	2.80	17
Taxonomy	2.60	19	2.62	19	2.64	18
Electronic discussion forum	2.73	18	2.68	17	2.64	19
Seminars	2.88	15	2.66	18	2.58	20

The score: 1 (Never), 2 (Rarely), 3 (Sometimes), 4 (Very frequently), 5 (Always)

An inspection of the table above shows that the five most frequently used communication methods are report, face-to-face interaction, telephone, project review, and meeting. Down at the bottom of the table the five least frequently used methods at the construction stage are intranet, apprenticeship, taxonomy, electronic discussion forum, and seminars. By comparing average the mean scores in each stage of the reconstruction it seems that there are differences in frequency of use between the methods. In order to get a better understanding, Table 7-3 above, is converted into a column diagram as displayed in Figure 7-1 below.

It can be seen in the Figure 7-1 'brainstorming' and 'seminars' are more frequently used at planning and design stage than at the construction stage. At the planning and design stage brainstorming is useful to generate ideas to identify approaches and strategies for the reconstruction.

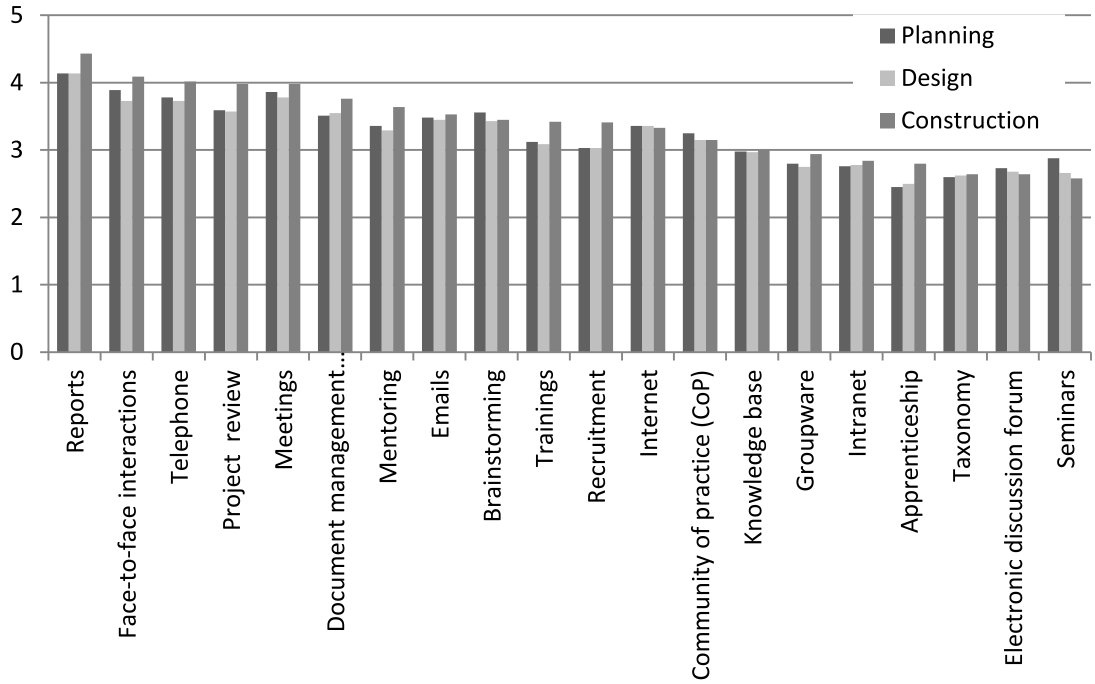

Figure 7-1 Frequency of use of knowledge communication methods in PDR projects

In order to get a better understanding, responses from the questionnaire survey are converted into a disaggregate level based on type of organisation. Table 7-4, Table 7-5, and Table 7-6 present the frequency of use of knowledge communication methods in planning, design, and construction stage of reconstruction projects.

Table 7-4 shows the majority agreement by the respondents on the frequency of use of KC methods. But, differences in the frequency of use of the methods can also be noticed. For example, report, in general, is ranked 1st as the most frequently used KC method. Reports are rank 1st by respondents from contractors, governments, and consultants. But the respondents from NGOs ranked report in 3rd place and ranked 'face-to-face interactions' as the most frequently used tool.

Table 7-4 shows the difference in frequency of the use 'internet' and 'community of practice'. The internet is perceived to be moderately used by respondents from contractors, NGOs, and consultants. They rank internet at 8th, 9th, and 10th respectively, with a mean score of 3.40 to 3.60. In contrast, respondents from government organisations ranked internet at 14th with a mean score of 3.00 which indicates a low level of use of internet by government at planning stage of reconstruction. Community of practice (COP) was ranked higher by respondents from NGOs compared to other respondents. The respondents from NGOs rank it at 4th with a mean score of 3.78.

Similar observation on the use of internet by government can be found at the design stage of reconstruction, as presented in Table 7-5. It is also noticeable from the table the significant use of mentoring by government entities. Governments ranked it at 3rd with a mean score 3.65 while others, for example NGOs, ranked it at 14th with a mean score of 3.00.

The frequency of use of knowledge communication methods at the construction stage is presented in Table 7-6. The table shows significant use of recruitment by respondents from consultants as a method for knowledge communication. The respondents rated it at in 5th place with a mean score of 3.85, while the other respondents have given it a lower ranking and mean score. Training was also ranked higher by respondents from NGOs, in 7th place, compared to the ranking by other respondents. For respondents from contractors brainstorming is used more frequently and they ranked it at 6th with a mean score of 3.72, while NGOs, governments, and consultants have a mean score of 3.25, 3.24, and 3.50 respectively.

Table 7-4 Frequency of use of KC methods at the planning stage of PDRP

KC methods	Mean Score					Rank				
	ALL (N=143)	CTR (N=47)	NGO (N=36)	GOV (N=34)	CSL (N=26)	ALL	CTR	NGO	GOV	CSL
Reports	4.14	4.23	4.03	4.15	4.12	1	1	3	1	1
Face-to-face interactions	3.89	3.51	4.25	3.91	4.04	2	4	1	2	2
Meetings	3.86	3.83	4.17	3.53	3.92	3	3	2	7	4
Telephone	3.78	3.91	3.67	3.62	3.88	4	2	7	4	5
Project review	3.59	3.49	3.28	3.79	3.96	5	5	10	3	3
Brainstorming	3.56	3.28	3.78	3.59	3.73	6	9	5	5	8
Document management system	3.51	3.40	3.47	3.47	3.81	7	7	8	8	7
Emails	3.48	3.43	3.75	3.21	3.58	8	6	6	10	10
Mentoring	3.36	3.17	3.03	3.59	3.85	9	10	12	6	6
Internet	3.36	3.40	3.44	3.00	3.65	10	8	9	14	9
Community of practice (CoP)	3.25	2.87	3.78	3.26	3.19	11	12	4	9	12
Trainings	3.12	3.00	3.25	3.12	3.15	12	11	11	11	13
Recruitment	3.03	2.85	3.00	3.03	3.38	13	14	13	13	11
Knowledge base	2.98	2.85	2.94	3.06	3.15	14	15	14	12	14
Seminars	2.88	2.77	2.89	2.85	3.12	15	18	15	16	15
Groupware	2.80	2.72	2.58	2.97	3.00	16	19	18	15	16
Intranet	2.76	2.85	2.83	2.47	2.88	17	13	16	19	17
Electronic discussion forum	2.73	2.85	2.61	2.59	2.88	18	16	17	18	18
Taxonomy	2.60	2.79	2.22	2.74	2.62	19	17	20	17	20
Apprenticeship	2.45	2.28	2.58	2.35	2.73	20	20	19	20	19

The scale: 1 (Never), 2 (Rarely), 3 (Sometimes), 4 (Very frequently), 5 (Always)
ALL = Overall, CTR = Contractors, NGO = NGOs, GOV = Governments, CSL = Consultants

Table 7-5 Frequency of use of KC methods at the design stage of PDRP

KC methods	Mean Score					Rank				
	ALL (N=143)	CTR (N=47)	NGO (N=36)	GOV (N=34)	CSL (N=26)	ALL	CTR	NGO	GOV	CSL
Reports	4.14	4.15	4.08	4.24	4.08	1	1	1	1	1
Meetings	3.78	3.68	4.06	3.50	3.96	2	3	3	7	3
Telephone	3.73	3.83	3.61	3.59	3.88	3	2	7	5	4
Face-to-face interactions	3.73	3.47	4.06	3.65	3.85	4	4	2	4	5
Project review	3.57	3.40	3.31	3.76	3.96	5	6	10	2	2
Document management system	3.55	3.45	3.67	3.53	3.62	6	5	5	6	7
Emails	3.45	3.32	3.75	3.24	3.58	7	8	4	9	8
Brainstorming	3.43	3.28	3.64	3.41	3.46	8	9	6	8	9
Internet	3.36	3.40	3.44	3.00	3.62	9	7	9	15	6
Mentoring	3.29	3.15	3.00	3.65	3.46	10	10	14	3	10
Community of practice (CoP)	3.15	2.89	3.50	3.21	3.08	11	12	8	10	13
Trainings	3.09	2.96	3.25	3.06	3.15	12	11	11	12	12
Recruitment	3.03	2.77	3.19	3.09	3.19	13	16	12	11	11
Knowledge base	2.97	2.83	3.08	3.06	2.92	14	14	13	13	15
Intranet	2.78	2.87	2.72	2.53	3.00	15	13	16	19	14
Groupware	2.75	2.57	2.61	3.00	2.92	16	18	18	14	16
Electronic discussion forum	2.68	2.66	2.61	2.71	2.77	17	17	17	18	17
Seminars	2.66	2.51	2.72	2.74	2.73	18	19	15	17	18
Taxonomy	2.62	2.79	2.36	2.74	2.54	19	15	20	16	20
Apprenticeship	2.50	2.32	2.61	2.50	2.69	20	20	19	20	19

The scale: 1 (Never), 2 (Rarely), 3 (Sometimes), 4 (Very frequently), 5 (Always)

ALL = Overall, CTR = Contractors, NGO = NGOs, GOV = Governments, CSL = Consultants

Table 7-6 Frequency of use of KC methods at the construction stage of PDRP

KC methods	Mean Score					Rank				
	ALL (N=143)	CTR (N=47)	NGO (N=36)	GOV (N=34)	CSL (N=26)	ALL	CTR	NGO	GOV	CSL
Reports	4.43	4.49	4.25	4.56	4.42	1	1	1	1	1
Face-to-face interactions	4.09	4.17	4.14	4.21	3.73	2	3	2	3	8
Telephone	4.02	4.19	3.89	4.00	3.92	3	2	5	4	4
Project review	3.98	4.02	3.42	4.29	4.27	4	4	9	2	2
Meetings	3.98	3.96	3.97	3.91	4.12	5	5	3	5	3
Document management system	3.76	3.68	3.97	3.62	3.77	6	7	4	7	7
Mentoring	3.64	3.43	3.53	3.91	3.85	7	8	8	6	6
Emails	3.53	3.34	3.81	3.38	3.69	8	11	6	8	9
Brainstorming	3.45	3.72	3.25	3.24	3.50	9	6	12	11	12
Trainings	3.42	3.38	3.58	3.21	3.54	10	9	7	12	10
Recruitment	3.41	3.21	3.39	3.35	3.85	11	12	10	9	5
Internet	3.33	3.36	3.36	3.09	3.54	12	10	11	14	11
Community of practice (CoP)	3.15	2.98	3.14	3.26	3.35	13	13	13	10	14
Knowledge base	3.00	2.87	3.03	3.12	3.04	14	14	14	13	16
Groupware	2.94	2.87	2.75	2.91	3.38	15	15	17	15	13
Intranet	2.84	2.87	2.81	2.65	3.08	16	16	16	19	15
Apprenticeship	2.80	2.72	3.00	2.53	3.04	17	19	15	20	17
Taxonomy	2.64	2.79	2.42	2.74	2.58	18	17	19	17	20
Electronic discussion forum	2.64	2.74	2.39	2.74	2.69	19	18	20	16	19
Seminars	2.58	2.49	2.44	2.68	2.81	20	20	18	18	18

The scale: 1 (Never), 2 (Rarely), 3 (Sometimes), 4 (Very frequently), 5 (Always)

ALL = Overall, CTR = Contractors, NGO = NGOs, GOV = Governments, CSL = Consultants

In terms of effectiveness, respondents to the questionnaire survey view the level of effectiveness of the knowledge communication methods as described in Table 7-7 below.

Table 7-7 Effectiveness of knowledge communication method in PDR projects

Methods	**Stage of reconstruction projects**					
	Planning		**Design**		**Construction**	
	Mean	**Rank**	**Mean**	**Rank**	**Mean**	**Rank**
Reports	3.98	2	4.13	1	4.30	1
Face-to-face interactions	4.02	1	3.97	2	4.18	2
Project review	3.84	3	3.90	3	4.17	3
Meetings	3.81	4	3.80	4	3.87	4
Telephone	3.67	5	3.66	5	3.84	5
Mentoring	3.41	9	3.44	9	3.80	6
Document management system	3.59	7	3.59	6	3.77	7
Trainings	3.35	12	3.41	11	3.55	8
Brainstorming	3.65	6	3.58	7	3.50	9
Emails	3.46	8	3.47	8	3.46	10
Internet	3.40	10	3.43	10	3.38	11
Recruitment	3.06	15	3.11	14	3.37	12
Community of practice (CoP)	3.38	11	3.31	13	3.30	13
Knowledge base	3.27	13	3.31	12	3.22	14
Apprenticeship	2.85	20	2.88	19	3.21	15
Groupware	3.13	14	3.08	15	3.19	16
Intranet	2.94	18	2.95	18	2.96	17
Electronic discussion forum	3.02	16	2.97	17	2.96	18
Seminars	3.01	17	3.04	16	2.92	19
Taxonomy	2.85	19	2.85	20	2.89	20

The scale: 1 (Not effective at all), 2 (Less effective), 3 (Fairly effective), 4 (Effective), 5 (Very effective)

Table 7-3 and Table 7-7 show that reports and face-to-face interaction are two of the most frequently used and most effective methods of knowledge communication in PDR projects. The telephone, project reviews and meetings were also ranked highly by respondents as frequently used and effective methods.

Jigyasu (2002) in his research explored traditional knowledge and capacity in disaster risk reduction in rural areas in India and Nepal. He noted that knowledge is mostly communicated through face-to-face interaction, as described in following quotation.

> *"Traditional communities have a distinct way of communicating the knowledge, which is very different from the present system of education. As expected in a social order with few mechanisms for diffusing knowledge via the written word and none for achieving oral communication on a massive scale, instruction for most of such societies is gained through direct, face-to-face contacts. Children learn from family members at home, by observation in the streets and markets, and in their place of work. Those fortunate enough to gain a foothold as apprentices to shopkeepers or artisans receive specialised, albeit informal, training in a specific occupation. And everywhere storytellers, street singers, and actors diffuse some knowledge through oral or visual means". (Jigyasu, 2002b)*

The questionnaire survey in this research also explores the effectiveness of knowledge communication methods. The respondents were asked to rate the effectiveness by using a five scale system, from 1 for 'not effective at all' to 5 for 'very effective'. The responses were collated by stages of the project: planning, design, and construction stages of the PDR projects. The results are presented in Table 7-8, Table 7-9, and Table 7-10. From those tables it can be observed that the five most effective knowledge communication methods are similar in each stage, the methods are 'reports', 'face-to-face interaction', 'project review', 'meetings', and 'telephone'.

Table 7-8 Effectiveness of KC methods at the planning stage of PDRP

KC methods	Mean Score					Rank				
	ALL (N=143)	CTR (N=47)	NGO (N=36)	GOV (N=34)	CSL (N=26)	ALL	CTR	NGO	GOV	CSL
Face-to-face interactions	4.02	3.72	4.58	3.76	4.12	1	6	1	3	2
Reports	3.98	4.19	3.67	3.85	4.19	2	1	7	2	1
Project review	3.84	3.83	3.72	3.88	3.96	3	3	5	1	4
Meetings	3.81	3.85	4.00	3.35	4.08	4	2	3	9	3
Telephone	3.67	3.81	3.78	3.32	3.73	5	4	4	10	6
Brainstorming	3.65	3.40	4.03	3.38	3.92	6	9	2	8	5
Document management system	3.59	3.72	3.42	3.53	3.69	7	5	9	5	7
Emails	3.46	3.49	3.64	3.38	3.27	8	8	8	7	15
Mentoring	3.41	3.40	3.14	3.65	3.46	9	10	13	4	10
Internet	3.40	3.60	3.33	3.12	3.50	10	7	10	13	9
Community of practice (CoP)	3.38	3.19	3.67	3.26	3.50	11	15	6	12	8
Trainings	3.35	3.23	3.33	3.44	3.46	12	13	11	6	11
Knowledge base	3.27	3.21	3.17	3.32	3.42	13	14	12	11	12
Groupware	3.13	3.26	2.94	3.00	3.31	14	11	16	16	14
Recruitment	3.06	2.94	3.03	3.09	3.31	15	19	14	14	13
Electronic discussion forum	3.02	3.23	2.75	2.91	3.15	16	12	18	18	17
Seminars	3.01	3.06	2.92	2.94	3.15	17	16	17	17	16
Intranet	2.94	3.04	3.03	2.62	3.04	18	17	15	20	19
Taxonomy	2.85	3.04	2.42	2.85	3.08	19	18	20	19	18
Apprenticeship	2.85	2.79	2.64	3.09	2.92	20	20	19	15	20

The scale: 1 (Not effective at all), 2 (Less effective), 3 (Fairly effective), 4 (Effective), 5 (Very effective)
ALL = Overall, CTR = Contractors, NGO = NGOs, GOV = Governments, CSL = Consultants

Table 7-9 Effectiveness of KC methods at the design stage of PDRP

KC methods	Mean Score					Rank				
	ALL (N=143)	CTR (N=47)	NGO (N=36)	GOV (N=34)	CSL (N=26)	ALL	CTR	NGO	GOV	CSL
Reports	4.13	4.32	3.89	4.12	4.12	1	1	2	1	1
Face-to-face interactions	3.97	3.79	4.44	3.68	4.00	2	4	1	4	4
Project review	3.90	3.81	3.86	3.94	4.08	3	3	4	2	3
Meetings	3.80	3.89	3.86	3.38	4.08	4	2	5	8	2
Telephone	3.66	3.77	3.89	3.26	3.69	5	5	3	11	5
Document management system	3.59	3.66	3.50	3.56	3.65	6	6	10	5	6
Brainstorming	3.58	3.40	3.83	3.53	3.62	7	9	6	6	7
Emails	3.47	3.45	3.64	3.38	3.38	8	8	7	9	11
Mentoring	3.44	3.32	3.28	3.76	3.46	9	10	13	3	10
Internet	3.43	3.57	3.50	3.09	3.54	10	7	9	13	8
Trainings	3.41	3.30	3.42	3.50	3.50	11	11	11	7	9
Knowledge base	3.31	3.30	3.33	3.29	3.31	12	12	12	10	12
Community of practice (CoP)	3.31	3.13	3.64	3.21	3.31	13	16	8	12	13
Recruitment	3.11	3.02	3.14	3.09	3.27	14	18	14	14	15
Groupware	3.08	3.21	2.94	2.91	3.27	15	14	17	16	14
Seminars	3.04	3.15	2.97	2.82	3.23	16	15	16	19	16
Electronic discussion forum	2.97	3.23	2.69	2.85	3.04	17	13	19	18	18
Intranet	2.95	3.09	3.08	2.59	3.00	18	17	15	20	19
Apprenticeship	2.88	2.77	2.83	3.00	3.00	19	20	18	15	20
Taxonomy	2.85	3.02	2.42	2.88	3.08	20	19	20	17	17

The scale: 1 (Not effective at all), 2 (Less effective), 3 (Fairly effective), 4 (Effective), 5 (Very effective)

ALL = Overall, CTR = Contractors, NGO = NGOs, GOV = Governments, CSL = Consultants

Table 7-10 Effectiveness of KC methods at the construction stage of PDRP

KC methods	Mean Score					Rank				
	ALL (N=143)	CTR (N=47)	NGO (N=36)	GOV (N=34)	CSL (N=26)	ALL	CTR	NGO	GOV	CSL
Reports	4.30	4.49	4.06	4.24	4.38	1	1	2	1	1
Face-to-face interactions	4.18	4.00	4.58	3.94	4.27	2	3	1	4	3
Project review	4.17	4.26	3.89	4.24	4.35	3	2	3	2	2
Meetings	3.87	3.85	3.81	3.74	4.15	4	5	5	6	4
Telephone	3.84	4.00	3.89	3.68	3.69	5	4	4	7	7
Mentoring	3.80	3.55	3.69	4.12	3.96	6	9	6	3	5
Document management system	3.77	3.83	3.64	3.82	3.77	7	6	9	5	6
Trainings	3.55	3.53	3.69	3.41	3.58	8	10	7	8	8
Brainstorming	3.50	3.66	3.56	3.29	3.38	9	7	10	10	10
Emails	3.46	3.49	3.64	3.35	3.31	10	11	8	9	14
Internet	3.38	3.62	3.36	3.09	3.38	11	8	13	15	9
Recruitment	3.37	3.40	3.44	3.26	3.35	12	12	12	11	11
Community of practice (CoP)	3.30	3.28	3.53	3.12	3.27	13	15	11	14	16
Knowledge base	3.22	3.32	3.06	3.24	3.27	14	13	16	13	15
Apprenticeship	3.21	3.09	3.28	3.24	3.31	15	19	14	12	12
Groupware	3.19	3.32	3.14	2.97	3.31	16	14	15	16	13
Intranet	2.96	3.09	2.92	2.82	2.96	17	18	17	18	18
Electronic discussion forum	2.96	3.23	2.72	2.82	2.96	18	16	19	20	19
Seminars	2.92	3.04	2.92	2.82	2.85	19	20	18	19	20
Taxonomy	2.89	3.15	2.36	2.94	3.08	20	17	20	17	17

The scale: 1 (Not effective at all), 2 (Less effective), 3 (Fairly effective), 4 (Effective), 5 (Very effective)
ALL = Overall, CTR = Contractors, NGO = NGOs, GOV = Governments, CSL = Consultants

Table 7-8, Table 7-9, and Table 7-10 also show the respondents from government consider 'mentoring' to be one of the most effective knowledge communication methods. For example at the design stage they ranked 'mentoring' in 3rd place with a mean value of 3.76, whereas the mean value for contractors, NGOs, and consultants are 3.32, 3.28, and 3.46 respectively.

Rankings in those three tables suggest there are some differences in the perception of effectiveness of knowledge communication methods among the respondents. Therefore, to find out if there is any statistical difference, a series of Kruskal-Wallis tests were conducted and the results are presented in following Table 7-11.

Table 7-11 Kruskal-Wallis test for KC methods effectiveness

KC Methods	Planning			Design			Construction		
	Chi-Square	df	Asymp. Sig.	Chi-Square	df	Asymp. Sig.	Chi-Square	df	Asymp. Sig.
Face-to-face interactions	18.88	3	0.000*	12.83	3	0.005*	10.40	3	0.015*
Training	1.307	3	0.727	1.786	3	0.618	0.743	3	0.863
Brainstorming	10.47	3	0.015*	4.174	3	0.243	2.180	3	0.536
Community of practice (CoP)	4.026	3	0.259	4.817	3	0.186	1.912	3	0.591
Apprenticeships	2.534	3	0.469	1.079	3	0.782	0.910	3	0.823
Recruitment	1.722	3	0.632	0.861	3	0.835	1.032	3	0.794
Project review	0.606	3	0.895	1.597	3	0.660	2.875	3	0.411
Mentoring	4.065	3	0.255	4.797	3	0.187	7.650	3	0.054
Seminars	0.523	3	0.914	2.042	3	0.564	0.702	3	0.873
Meetings	9.18	3	0.027*	8.949	3	0.030*	3.645	3	0.302
Intranet	2.88	3	0.411	4.228	3	0.238	0.826	3	0.843
Telephone	5.375	3	0.146	7.843	3	0.049*	2.815	3	0.421
Internet	3.274	3	0.351	4.233	3	0.237	3.378	3	0.337
Groupware	2.185	3	0.535	2.544	3	0.467	1.812	3	0.612
Knowledge base	0.844	3	0.839	0.078	3	0.994	1.007	3	0.800
Taxonomy	7.22	3	0.065	7.410	3	0.060	10.20	3	0.017*
Emails	1.569	3	0.667	1.504	3	0.681	1.843	3	0.606
Document management system	1.71	3	0.635	0.291	3	0.962	0.615	3	0.893
Electronic discussion forum	2.964	3	0.397	3.962	3	0.266	3.548	3	0.315
Reports	4.232	3	0.237	4.575	3	0.206	3.631	3	0.304

*significant at $p<0.005$

Table 7-11 above shows there are positive results for effectiveness in 'face-to-face interactions the in planning stage, design stage, and construction stage. To find out what the differences are a series of Mann-Whitney tests were conducted and the results are presented in Table 7-12 below.

Table 7-12 Mann-Whitney test for effectiveness of face-to-face interaction

Planning stage			
	NGO	GOV	CSL
CTR	0.000*	0.562	0.105
NGO		0.002*	0.031
GOV			0.375
Design stage			
	NGO	GOV	CSL
CTR	0.001*	0.932	0.322
NGO		0.005*	0.047
GOV			0.392
Construction stage			
	NGO	GOV	CSL
CTR	0.002*	0.996	0.185
NGO		0.014	0.253
GOV			0.271

*significant

The results of the Mann-Whitney tests, shown in the table above, indicate that respondents from NGOs have a different view of the effectiveness of 'face-to-face interaction'. By comparing the mean scores between the respondents in Table 7-8, Table 7-9, and Table 7-10 shows that the NGO's mean scores are higher that other respondents at each stage of reconstruction. In fact, 'face-to-face interaction' is perceived, by the NGO respondents, to be the most effective method for communicating knowledge. For example; in the construction stage of PDR projects (see Table 7.10, page 233), NGOs have a mean score verging on 'very effective' (4.58), while contractors have a mean score of 4.00 for the effectiveness of 'face-to-face interaction'.

The Kruskal-Wallis test in Table 7-12 also shows positive results for the different views of the effectiveness of 'meetings' at the planning and design stage. A series of Mann-Whitney tests was conducted to find out what the differences are and Table 7-13 below presents the results.

Table 7-13 Mann-Whitney test for the effectiveness of meetings

Planning stage			
	NGO	GOV	CSL
CTR	0.606	0.039	0.333
NGO		0.010	0.555
GOV			0.012
Design stage			
	NGO	GOV	CSL
CTR	0.804	0.022	0.543
NGO		0.032	0.398
GOV			0.006*

*significant at p<0.005

The results of the Mann-Whitney tests indicate that there are statistical differences in the perception of the effectiveness of 'meetings' for knowledge communication by the respondent from government organisations. The mean scores for the government respondents is shown in Table 7-8 and Table 7-9 show to be the lowest mean score. This implies that, in comparison with other stakeholders, the government respondents perceived meetings to be an ineffective method for knowledge communication the planning and design stage.

The Kruskal-Wallis test in Table 7-11 also indicates a statistical difference in the effectiveness of 'telephone interaction' at the design stage. The result of the Mann-Whitney test, shown in the table below, confirms that NGO and government respondents have a different perception of 'telephone interaction' at the design stage. As can also be seen from the mean score in Table 7-8, the government respondents ranked the effectiveness of 'telephone interaction' in 11th place with a mean score of 3.26. However, the NGO respondents ranked it in 3rd place with a mean score 3.89. This result implies the NGOs considered 'telephone interaction' to be more effective than as perceived by the government respondents.

Table 7-14 Mann-Whitney test of the effectiveness of telephone interaction at the design stage

Design stage			
	NGO	GOV	CSL
CTR	0.344	0.041	0.773
NGO		0.009*	0.275
GOV			0.125

*significant at p<0.005

The Kruskal-Wallis test in Table 7-14 also reveals that there are positive statistical differences in the effectiveness of 'brainstorming' at the planning stage and 'taxonomy' at the construction stage. Table 7.8 indicates NGOs have reached the highest mean score (4.03) and ranked 'brainstorming' in 2nd place. Table 7.10 shows that overall 'taxonomy' was ranked in last place, but contractors awarded the highest mean score (3.15) and ranked it in 17th place.

7.3.2. Results from the interview

In the semi-structured interviews, respondents were asked about the most effective knowledge communication method in PDRP (refer to question number 7 in Appendix D. The interview questions, page 355). From the NVivo software analysis several themes emerged as presented in Table 7-15.

Table 7-15 KC methods from semi-structured interviews

KC Methods	No. of sources	No. of references
Community of Practise	2	3
Email	5	8
Face-to-face interaction	10	16
Letter	1	2
Manuals-Reports	8	10
Meetings	26	54
Seminars	2	2
Skype	1	1
SMS	3	3
Socialisation	1	1
Telephone	9	15
Training	6	6
Website	1	1

From Table 7-15 above it can be seen that the three most effective knowledge communication methods that emerged from the interviews are; meetings, face-to-face interaction, and telephone.

In the interviews the respondents frequently mentioned meetings to be the best method by which to communicate knowledge. 26 of the 33 respondents considered meeting to be the most effective method to communicate knowledge in the PDR project. Meetings are formal contact points between project participants that facilitate discussion about reconstruction works, as stated by one respondent:

> *"Project's owner comes to site once a week then we have our discussions through meetings with the owner regarding the progress of work." (R02-CTR-LR)*

From Table 7-15 it can be seen that 'face-to-face interactions' is also considered to be an effective knowledge communication method by the respondents. Ten interviewees mentioned it and as one of them asserted:

> *"In the construction world every day there is always a problem. We have to discuss in person, face-to-face. Because the design is on paper, when we apply the design in the field, we can see the problems. For that we need face to face communication." (R28-CTR-ES)*

Furthermore, nine of 33 interviewees revealed the telephone to be an effective method for them to communicate knowledge. Although communication by telephone may be faster and easier, the telephone has limitations as stated by a respondent:

> *"...Faster and easier way is by phone. But for a detailed explanation of course face to face in the field." (R02-CTR-LR)*

Manuals and reports are also considered to be effective methods by 8 interviewees as seen in Table 7-15. It is worth mentioning that IT-based communication methods are also stated by interviewees as effective knowledge communication methods. Five interviewees mentioned using email, one interviewee cited websites, and another interview asserted the use of Skype software.

7.3.3. Discussion on knowledge communication methods in PDR projects

After the presentation of frequency of use and effectiveness of knowledge communication methods in the previous section, this section and its subsections will discuss details about knowledge communication methods.

7.3.3.1. Reports

Documentation plays a role in capturing knowledge from projects in the form of internal documentation or standard operating procedures (Disterer, 2002). Furthermore, product documentation, e.g. drawings, will help other team members to understand what technical solutions work in a project (Disterer, 2002).

In the process of externalisation, converting tacit knowledge to explicit knowledge, research by Senaratne & Sexton (2008) shows that the choice of techniques is dependent on the individual and their specific role. They gave examples: Architects tend to use drawings to express their thoughts; quantity surveyors prefer to use language; and contractors prefer to use examples from their previous projects. However, Senaretne & Sexton indicate that the most preferable technique for converting knowledge was visualization by using pictures, diagrams, and sketches.

Reports in a construction project should be made against the plan, have defined criteria, be issued at certain intervals, discussed in meetings and the report format should be simple and easy to use (Antoniadis et al., 2006).

7.3.3.2. Face-to-face interactions

The results from the questionnaire survey and the interviews show that face-to-face interaction is one of the most significant methods for communicating knowledge. This finding is supported by previous research that found face-to-face interaction to be the main method for communicating knowledge (Mascitelli, 2000, Yao et al., 2007).

Being in the same place and having direct communication, face-to-face, is an important aspect of knowledge communication. ICT may eliminate the distance barrier, but as Mascitelli (2000) argues, it is more effective for communicating explicit knowledge than the tacit knowledge. Furthermore, he added that the more layers of insulation between two members the more likely the communicated knowledge is in the form of explicit knowledge, for example in form of a memo, email, or documentation. This suggests that face-to-face communication is better for communicating tacit knowledge. Furthermore, Yao et al. (2007) suggests Asian people prefer a human contact communication system for knowledge sharing.

7.3.3.3. Project review

Project review is an important process that brings people and their knowledge together in order to discuss experiences from the work that have conducted. Project reviews enable the capture of procedures that have worked well or have gone badly wrong in the work processes. The next work will benefit from this project review.

In a broader scope, project reviews may become post-project reviews, where at the end of project cycle the project team captures information and knowledge on what went well and not so well. As a construction project is a temporary organisation, post-project reviews may enable documentation of experiences during the project life cycle, bringing knowledge into company, which will be used on future projects. Egbu and Easton (2004) argue that post-project reviews enable continuous improvement in organisations and it prevents 'reinventing the wheel', reduces mistakes, and increases project team performance and skills.

7.3.3.4. Meetings

Research by Alarcon and Pavez (2006) shows that meetings consume nearly a third to half of a project manager's working time. It indicates the importance of meetings to a construction project. It is not surprising when meetings emerged as the most frequently used and effective method for knowledge communication in this research. Meetings are a very important part of business (Gorse et al., 2006), and Egbu et al. (2001) show meetings to be a formal procedure to encourage knowledge transfer, especially informal meeting.

7.3.3.5. Telephone

The results of the questionnaire survey and the interviews show that the telephone is a significant method for communicating knowledge. This results is in line which research by Dulaimi (2007), in his research about knowledge sharing across cultural boundaries has shown that meetings and the telephone are the main methods of communication in joint venture organisations.

Tutesigensi and Parcell (2007) argue that mobile phones have been increasingly used on construction projects for the last decade. Their research explores the benefits of using a mobile phone on a construction project. One of their findings shows that there is a difference in call time duration between contractors from rail and highway sectors than the infrastructure sector where the former is shorter. Tutesigensi and Parcell indicate that work planning and preparation is the cause of the difference. Proper, and better, planning and preparation may reduce telephone calls because there will be few issues on the execution of work which will need to be discussed via telephone.

Relating to knowledge communication, Longstaff and Johansen (2009) suggest that mobile phones contribute greatly to improving project networking, prompt speedy decision making, and generally improve project communication.

7.4. Barriers to knowledge communication in PDR projects

After discussing knowledge communication methods in the previous section, this section will present and discuss the findings on the barriers to knowledge communication in PDR projects.

7.4.1. Results from the questionnaire survey

The barriers to knowledge communication in post-disaster reconstruction, in terms of frequency of occurrence, are presented in following Table 7-16.

Table 7-16 Frequency of occurrence of knowledge communication barriers

Barriers	N	Overall mean score	Rank
There is not enough time for collecting information or knowledge	143	3.28	1
Too much information that has to be processed quickly	143	3.27	2
Lack of time to share knowledge	143	3.23	3
Cultural difference (e.g. language)	143	3.14	4
Limited ability to grasp the knowledge, lack of prior knowledge	143	3.13	5
Inadequate infrastructure (e.g. ICT) for knowledge communication	143	3.10	6
Assuming the other participant(s) have similar understanding of an issue	143	3.06	7
Values information/knowledge from outside more than inside organisation	143	3.03	8
Poor relationship between participants, so there is inadequate trust	143	2.92	9
Lack of motivation to seek or share knowledge	143	2.92	10
Hierarchical organisational structure inhibiting knowledge communication	143	2.91	11
Refused knowledge from outside because of pride of group/organisation	143	2.87	12
Using inappropriate channel or media in communication	143	2.73	13
Using specialised language, not common language, in communication	143	2.72	14
Refusal to share knowledge because of fear about job security	143	2.58	15

The score: 1 (Never), 2 (Rarely), 3 (Sometimes), 4 (Very frequently), 5 (Always)

Table 7-16 reveals that 'time' is considered to be the main barrier to knowledge communication. 'Not enough time for collecting knowledge' is ranked in first place and 'lack of time to share knowledge' is placed third on the list of barriers to knowledge communication. Furthermore, 'too much information that has to be processed' (ranked at second), and also "'limited ability, lack of prior knowledge' (ranked at fourth) are noted.

7.4.1.1. Knowledge communication barriers and organisation type

To understand the barriers to knowledge communication by different organisations, the data from Table 7-16 is presented in disaggregate level in Table 7-17 and Table 7-18.

Examination of Table 7-17 shows that there are differences in the rank of influence of barriers to effective knowledge communication. 'Lack of prior knowledge' was ranked 1st by contractors, but was ranked 6th by NGOs and consultants. Respondents from NGOs perceived 'not enough time for collecting information or knowledge' (ranked 1$^{st)}$, as the most the barrier that most hindered knowledge communication. For respondents from government, 'valuing knowledge from outside more than inside' was ranked 1st as the most effective barrier to knowledge communication.

Table 7-17 Influence of barriers on effective knowledge communication by type of organisations

Barriers	Mean Score					Rank				
	ALL (N=143)	**CTR (N=47)**	**NGO (N=36)**	**GOV (N=34)**	**CSL (N=26)**	**ALL**	**CTR**	**NGO**	**GOV**	**CSL**
Too much information that has to be processed quickly	3.63	3.64	3.50	3.53	3.92	1	2	3	4	1
Limited ability to grasp the knowledge, lack of prior knowledge	3.62	3.81	3.42	3.68	3.46	2	1	6	2	6
There is not enough time for collecting information or knowledge	3.57	3.30	3.78	3.53	3.81	3	11	1	3	2
Poor relationship between participants, so there is inadequate trust	3.49	3.57	3.56	3.35	3.42	4	5	2	7	7
Inadequate infrastructure (e.g. ICT) for knowledge communication	3.43	3.57	3.03	3.47	3.69	5	3	14	6	3
Refused knowledge from outside because of pride of group/organisation	3.42	3.57	3.36	3.32	3.35	6	4	8	10	9
Lack of motivation to seek or share knowledge	3.38	3.32	3.36	3.35	3.54	7	9	9	8	5
Cultural difference (e.g. language)	3.36	3.43	3.47	3.32	3.15	8	6	5	11	11
Using inappropriate channel or media in communication	3.35	3.43	3.28	3.35	3.31	9	7	11	9	10
Assuming the other participant(s) have similar understanding of an issue	3.34	3.32	3.47	3.47	3.04	10	10	4	5	13
Lack of time to share knowledge	3.32	3.23	3.39	3.29	3.42	11	13	7	12	8
Values information/knowledge from outside more than inside organisation	3.31	3.30	3.11	3.68	3.12	12	12	12	1	12
Hierarchical organisational structure inhibiting knowledge communication	3.27	3.40	3.06	3.12	3.54	13	8	13	13	4
Refusal to share knowledge because of fear about job security	2.89	2.94	2.69	3.09	2.81	14	14	15	14	14
Using specialised language, not common language, in communication	2.88	2.70	3.33	2.88	2.58	15	15	10	15	15

The scale : 1 (Not influential at all), 2 (Less influential), 3 (Fairly influential), 4 (Influential), 5 (Very influential)

ALL = Overall, CTR = Contractors, NGO = NGOs, GOV = Governments, CSL = Consultants

Table 7-18 Occurrence of knowledge communication barriers by organisation type

Barriers	Mean Score					Rank				
	ALL (N=143)	CTR (N=37)	NGO (N=36)	GOV (N=34)	CSL (N=26)	ALL (N=143)	CTR (N=64)	NGO (N=36)	GOV (N=34)	CSL (N=26)
There is not enough time for collecting information or knowledge	3.28	3.02	3.42	3.35	3.46	1	7	1	3	2
Too much information that has to be processed quickly	3.27	3.32	3.06	3.26	3.50	2	1	5	7	1
Lack of time to share knowledge	3.22	3.15	3.19	3.26	3.35	3	5	2	6	4
Cultural difference (e.g. language)	3.14	3.30	3.17	3.12	2.85	4	2	3	8	12
Limited ability to grasp the knowledge, lack of prior knowledge	3.13	3.19	2.69	3.56	3.08	5	4	10	1	8
Inadequate infrastructure (e.g. ICT) for knowledge communication	3.10	3.26	2.53	3.29	3.38	6	3	13	5	3
Assuming the other participant(s) have similar understanding of an issue	3.06	3.02	3.17	3.06	2.96	7	8	4	9	10
Values information/knowledge from outside more than inside organisation	3.02	3.02	2.78	3.38	2.88	8	9	9	2	11
Poor relationship between participants, so there is inadequate trust	2.92	3.11	2.83	2.68	3.04	9	6	7	13	9
Lack of motivation to seek or share knowledge	2.92	2.87	2.53	3.29	3.08	10	13	12	4	7
Hierarchical organisational structure inhibiting knowledge communication	2.91	2.98	2.81	2.74	3.15	11	11	8	12	6
Refused knowledge from outside because of pride of group/organisation	2.87	3.02	2.61	2.74	3.15	12	10	11	11	5
Using inappropriate channel or media in communication	2.73	2.96	2.47	2.65	2.77	13	12	14	14	13
Using specialised language, not common language, in communication	2.72	2.77	2.89	2.65	2.50	14	14	6	15	14
Refusal to share knowledge because of fear about job security	2.58	2.74	2.28	2.82	2.38	15	15	15	10	15

The scale: 1 (Never), 2 (Rarely), 3 (Sometimes), 4 (Very frequently), 5 (Always)

ALL = Overall, CTR = Contractors, NGO = NGOs, GOV = Governments, CSL = Consultants

The differences indicate there is probably a statistical different between respondent groups' views on the occurrence of barriers. To test this theory a Kruskal-Wallis test is carried out and the results are presented in Table 7-19.

Table 7-19 Kruskal-wallis test for occurrence of KC barriers by different organisations

Methods	**Chi-Square**	**df**	**Asymp. Sig.**
There is not enough time for collecting information or knowledge	4.196784	3	0.2410
Refused knowledge from outside because of pride of group/organisation	4.498771	3	0.2124
Too much information that has to be processed quickly	2.958269	3	0.3981
Limited ability to grasp the knowledge, lack of prior knowledge	11.15424	3	0.0109*
Values information/knowledge from outside more than inside organisation	7.277164	3	0.0636
Refusal to share knowledge because of fear about job security	3.871753	3	0.2756
Using specialised language, not common language, in communication	1.803332	3	0.6142
Assuming the other participant(s) have similar understanding of an issue	1.137586	3	0.7680
Poor relationship between participants, so there is inadequate trust	3.265409	3	0.3525
Using inappropriate channel or media in communication	4.078251	3	0.2531
Cultural difference (e.g. language)	2.713211	3	0.4380
Lack of motivation to seek or share knowledge	9.66088	3	0.0217*
Inadequate infrastructure (e.g. ICT) for knowledge communication	13.42298	3	0.0038*
Lack of time to share knowledge	0.906806	3	0.8238

The table above shows that there are some statistically different views among groups of respondent on 'limited ability to grasp the knowledge', 'lack of motivation', and 'inadequate infrastructures'. The Mann-Whitney test was conducted to find out where the differences are and the results of the test are presented in Table 7-20.

Table 7-20 Mann-Whitney test for occurrence of KC barriers by different organisations

'Limited ability…'			
	NGO	GOV	CSL
CTR	.027	.107	.651
NGO		.001*	.222
GOV			.121
'Lack of motivation"			
	NGO	GOV	CSL
CTR	.070	.041	.521
NGO		.005*	.099
GOV			.493
'Inadequate infrastructure'			
	NGO	GOV	CSL
CTR	.001*	.980	.544
NGO		.004*	.007*
GOV			.649

*results are statistically significant at $p<0.05$

The results from the Mann-Whitney test show that the respondents from NGOs have different views. By examining Table 7-18 on 'limited ability…', it reveals that for the NGOs this barrier did not occur as frequently as for respondents from governments. It indicates the NGOs perceived they have adequate basic experience and knowledge.

In order to get a better understanding the results of frequency of occurrence of knowledge communication barriers (Table 7-18) can be combined with the level of influence of the barriers (Table 7-17).

The extent to which the barriers hinder respondents can be calculated by influence x frequency. Because both parameter had a scale from 1 to 5, the new parameter's value (magnitude of barrier) will vary from 1 (minimum 1 x minimum 1) to 25 (maximum 5 x maximum 5). The result is presented in Table 7-21.

Table 7-21 Magnitude of knowledge communication barriers (Frequency x influence)

Knowledge Communication Barriers	Mean Score					Rank				
	ALL (N=143)	CTR (N=37)	NGO (N=36)	GOV (N=34)	CSL (N=26)	ALL (N=143)	CTR (N=64)	NGO (N=36)	GOV (N=34)	CSL (N=26)
Too much information that has to be processed quickly	12.40	12.51	11.22	11.94	14.42	1	2	5	6	1
There is not enough time for collecting information or knowledge	12.30	10.68	13.14	12.53	13.77	2	8	1	3	2
Limited ability to grasp the knowledge, lack of prior knowledge	12.11	12.70	9.69	14.00	11.92	3	1	9	1	7
Inadequate infrastructure (e.g. ICT) for knowledge communication	11.53	12.28	8.56	12.06	13.62	4	3	13	5	3
Cultural difference (e.g. language)	11.36	12.09	11.58	10.97	10.23	5	4	2	9	12
Lack of time to share knowledge	11.36	10.49	11.56	11.71	12.19	6	9	3	7	5
Poor relationship between participants, so there is inadequate trust	11.10	11.81	10.50	10.18	11.85	7	5	6	11	8
Values information/knowledge from outside more than inside organisation	10.76	10.47	9.33	13.06	10.23	8	10	10	2	11
Assuming the other participant(s) have similar understanding of an issue	10.76	10.45	11.39	11.21	9.85	9	12	4	8	13
Lack of motivation to seek or share knowledge	10.60	9.74	9.22	12.06	12.15	10	13	12	4	6
Refused knowledge from outside because of pride of group/organisation	10.55	11.28	9.25	10.18	11.50	11	6	11	12	9
Hierarchical organisational structure inhibiting knowledge communication	10.50	10.98	9.72	9.26	12.35	12	7	8	14	4
Using inappropriate channel or media in communication	9.92	10.47	8.39	10.06	10.85	13	11	14	13	10
Using specialised language, not common language, in communication	8.68	8.34	10.08	8.59	7.46	14	15	7	15	15
Refusal to share knowledge because of fear about job security	8.61	9.06	6.92	10.26	7.96	15	14	15	10	14

ALL = Overall, CTR = Contractors, NGO = NGOs, GOV = Governments, CSL = Consultants

From Table 7-21, it can be seen that the five main barriers to knowledge communication are ‘too much information that has to be processed quickly’, not enough time for collecting knowledge’, ‘limited ability to grasp the knowledge’, inadequate infrastructure’, and ‘cultural difference’.

However, at the disaggregate level, as in Table 7-21, there are some differences in opinion regarding the barriers. For the contractors, the five main barriers are ‘limited ability’, ‘too much information’, ‘inadequate infrastructure’, ‘cultural difference (e.g. language)’ and ‘poor relationship between project participants’. For the NGOs, the five main barriers are ‘lack of time for collecting the knowledge’, ‘cultural difference (e.g. language)’, ‘lack of time to share knowledge’, ‘assuming other participants have similar understanding’, and ‘too much information’.

Examining the above mentioned barriers, it seems that respondents from the government entities have a different five main knowledge communication barriers. Ranked 1st, 2nd, and 5th are the barriers that are also included in five main barriers of the contractors and NGOs. The different barriers in the government’s five main barriers compared to the contractors and NGOs are ‘values knowledge from outside more than inside’ in 2^{nd} place and ‘lack of motivation to seek or to share knowledge’ ranked 4th.

Similar observations can be made on the responses of the respondents from the consultant organisations. Barriers ranked 1^{st}, 2^{nd}, 3^{rd}, and 5^{th} by them are similar barriers to the five main barriers selected by the other groups, but the consultants ranked ‘hierarchical organisational structure’ at 4^{th} in their selected main barriers.

7.4.2. Results from the interview

The barriers to knowledge communication are also explored in the semi-structured interview. The respondents were asked what they considered are the main barriers to communicating knowledge (refer to question 8, in Appendix D. The interview questions, page 355). From the semi-structured interviews the following table presents the findings about barriers in knowledge communication.

Table 7-22 Knowledge communication barriers from the interviews

KC Barriers	No. of sources	No. of references
Assuming the other part has understand	3	4
Coordination	1	2
Cost related	1	1
Different background	16	24
Different culture (e.g. Language)	10	13
Different task of stakeholders	5	8
Do not want to share knowledge	5	6
External is superior	2	5
Formal environment	2	2
late action	2	2
Limited ability	13	21
Limited infrastructure	1	1
Limited time	6	8
No need to share knowledge	3	4
Pride	6	6
Relationship among project participants	6	8

When asked about the barriers to communicating knowledge almost half of respondents from the interviews (16 of the 33 interviewees) stated the different backgrounds of PDRP stakeholders to be a barrier. Differences in educational background is an example where, although reconstruction projects are basically construction projects, the workers involved do not have to have had an engineering or construction education background, as stated by the following respondents:

> *"Many people in Aceh [reconstruction] enter reconstruction work but with no engineering or construction background. For example, because someone is good at English then he is more easily hired by NGOs to do the work. In fact, their educational background was from literacy, where the NGO people at that time had been led to believe they consisted of newly graduated*

> *engineers. It has become an obstacle." (R22-NGO-AS)*
>
> *"The biggest obstacle is in terms of our basic knowledge. Well if we talk to [owner from] the technical department, perhaps the solutions or the experiences we give them then maybe they can 'picture' it, even though they had never such an experience. But if the [owner from] a non-technical department, their basic understanding is not technical, so we share our experience, they have not a clues." (R23-CTR-OO)*

13 of the 33 interviewees mentioned 'limited ability' to be a barrier to knowledge communication. It is related to lack of skills or experience, as stated by the following interviewee:

> *The problem is human resources. There are technical things that they [the government] cannot digest in a short time. We have to do [communication of knowledge] repeatedly. The main obstacle is that their background is not engineering, so after a few times recently they understand.*
>
> *For contractors, mostly the artisans do not understand, because it may be too difficult to find [skilled] workers. (R03-CTR-MD)*

With the influx of workers from other provinces or other countries, culture differences become an obstacle to knowledge communication in post-disaster reconstruction projects. 10 of the 33 interviewees mentioned the difficulties of working with individual from different cultures, as stated by the following respondents:

> *"The first obstacle is in terms of language. I have difficulty in discussions with my American boss. The good news is, because of my background is civil [engineering], if I am stuck with language then I change to the sketch, so I understand better." (R13-NGO-FY)*
>
> *"The main barrier is language, because there are people from the UK, France, Ireland, and Japan." (R05-CSL-IT)*

> *"It's often our culture is not similar to their culture. In ours [Indonesian], if we already know each other well then we're willing to share. But for them, we do not. I learned a lot from it." (R07-GOV-JA)*

The findings shown in Table 7-22 reveal that the stakeholders' position and their poor relationship are also barriers to knowledge communication. Five respondents mentioned the different task of the stakeholders and six respondents considered the poor relationship between the project stakeholders prevents good knowledge communication.

It can also be noticed in Table 7-22 that there is a reluctance to communicate knowledge. 5 interviewees mentioned that others 'do not want to share knowledge' and 3 interviewees stated there was 'no need to share knowledge'. One of the respondents illustrated those barriers in relation to job security:

> *"Another problem is about 'the rice pot' [source of income]. He knows the right thing, but he did not want to convey it. If he had knowledge then he does not want to share. If he protests, he will be fired later. It was one of their concerns." (R13-NGO-FY)*

7.4.3. Discussion on barriers in communicating knowledge

Close inspection of the findings from the questionnaire survey and the interviews show that there are similarities in the barriers to knowledge communication.

Too much information

From the findings of the questionnaire survey it can be seen that 'too much information that has to be processed quickly' is ranked 1st. However, in the interviews, there is very little mentioned about 'too much information'. Too much information, or known as information overload', may lead the decision maker to prefer to rely on intuition or political-based decisions than depend on the information (Nawakda et al., 2008). Too much information can lead to a lack of high value information that may result in difficulty in decision making and less probability of reuse in the future (Tang et al., 2008).

Lack of absorptive capacity

One prominent barrier from the questionnaire survey and the interviews is 'limited ability to grasp the knowledge, lack of prior knowledge', or it could be associated with lack of absorptive capacity. Absorptive capacity is the ability to recognise, assimilate, and apply the new knowledge (Cohen and Levinthal, 1990). Lack of the absorptive capacity is one of the major barriers of internal knowledge transfer where the knowledge recipients might be unable to exploit the new knowledge (Szulanski, 1996). Zahra and George (2002) argue there are four components to absorptive capacity: acquisition, assimilation, transformation, and exploitation. One of components in acquisition is prior knowledge and Minbaeva and Michailova (2004) note that the behaviour of the knowledge sender depends on individual characteristics which include the senders' previous knowledge and experience and willingness to share knowledge.

Time limitation

Time constraints are one of the prominent barriers in knowledge communication in this research. This finding was consistent with the previous studies of (Koskinen et al., 2003, Riege, 2005, Andriessen, 2006, Yao et al., 2007, Sandhu et al., 2011, Carrillo et al., 2013) which also identifies the time factor as a main barrier.

Riege (2005) in his extensive list of knowledge-sharing barriers also identifies 'time limitation' as one of the constraints. According to him, because of the limitation of time to share knowledge, people tend to keep knowledge to themselves, or because considering the time to be a cost factor.

Job security

Job security was one barrier found in this research. Research by Sun and Scott (2005) shows that personal imperative in an organisation becomes a significant barriers in the transfer of knowledge from one person to another person or to team. The interest in the form of economic wellbeing, psychological comfort zone, and social status prevents knowledge being transferred to another person.

Trust

The job security factor may be related to the trust factor between project participants. Research by Renzl (2008) shows the relationship between trust in management and knowledge sharing by providing evidence that knowledge documentation and fear of losing unique knowledge play a mediating role. If provided with the trust, most people are willing to share documents and their knowledge and reduce the fear. In a similar way Wang and Noe (2010) noted that knowledge may be viewed as a commodity where possessing unique knowledge may distinguish one worker from others.

In the context of a construction project, where time is limited, so is the time to share knowledge and to share previous involvement on a project which may develop trust between project team members, as noted by Koskinen et al. (2003): “Shared experiences of project team members, experience from previous jointly implemented projects could improve the possibilities of sharing tacit knowledge”.

Language and culture

The next barrier is cultural difference, for instance different languages. This barrier in supported by previous research by Dulaimi (2007) who conducted research about knowledge sharing across cultural studies. The scope of his research is about joint ventures on construction projects among local and foreign companies and the research clearly shows the incompatibility of cultures may hinder the sharing of knowledge among them. In one of the case studies the foreign contractors used their own language outside formal communication which prevented opportunities to learn or to share in the informal channel of information.

Some behaviour characteristics of Asian people hinder knowledge sharing as highlighted by Yao (2007) (from Ritter and Choi’s (2005) research). Those characteristics are ‘being less open, ‘more passive’, and ‘too polite to criticise others’. These characteristics inhibit acquiring or exploring new knowledge from other persons.

Different background

The other barrier is different backgrounds between the project participants. This view is supported by Koskinen (2003), who argues that "*individual team members may use language and expressions which are specific to their professions and experience and which, therefore, are also situation and worldview related. The result of this is that at the outset of a new project different team members may not understand well all the terms and expressions used in the interaction within the project team*".

A previous sub-section has already mentioned the influx of workers with no engineering background in reconstruction projects. Even though construction workers have an educational background in construction, they also face difficulties in sharing knowledge due to different backgrounds. Few respondents in the interviews mentioned the difficulties of adapting to different measuring systems that are used by foreign engineers. Indonesian engineers use a metric measuring system (example: cm, m, kilometre for length) whereas other foreign engineers use an imperial measuring system (inch, foot, yard, mile). Also few respondents referred to the different construction methods used for certain work between local practices and foreign practices.

Lack of motivation

Project team members are often fully occupied with their jobs and they consider documenting and reporting are not one of them (Kasvi et al., 2003), so there is no motivation to share or seek knowledge. What motivates people to share their knowledge? Research by Javernick-Will (2012) shows there are four components of knowledge sharing motivation: resources, intrinsic motivations, extrinsic incentives, and social motivation. Social motivation was cited the most in his research, thus it indicates that social rewards are as important as monetary rewards (Javernick-Will, 2012).

Prefer outside knowledge than inside knowledge

There is a preference to chose external knowledge due to its scarcity and the perception that external knowledge sources have a higher status value (Menon and Pfeffer, 2003). The preference may also be because people tend to perceive items to be more valuable when they are not easily available or rare (Cialdini, 2001).

Examples of this barrier are captured in one of the interviews with an interviewee who is a project manager from a contractor company. He proposed a structural design for a building to the supervising consultants and the project owner but they difficult in accepting the proposed design. He then invited an expert in earthquake engineering to attend a meeting with the consultant and the project owner. The expert, often dubbed, the 'father of earthquakes' gave his opinion and although that opinion was similar to that previously suggested by the contractor, the consultant and the project owner easily accepted it. This demonstrates the scarcity value as indicated by Cialdini (2001).

Research by Stenberg et al. (2001) supports a growing body of knowledge that practical intelligence can be, and often is, distinct from academic intelligence.

7.5. Role of knowledge communication

In sub-section 7.3 and sub-section 7.4 knowledge communication methods and barriers in post-disaster reconstruction projects have been discussed. This section, 7.5, will explore the level of contribution knowledge communication has on effective management of PDR projects. Sub-section 7.5.1, presents the findings from the questionnaire survey The responses from the interviews about the role of knowledge communication will be presented in sub-section 7.5.2. Discussion from both findings is presented in sub-section 7.5.3.

7.5.1. Results from the questionnaire survey

Respondents to the questionnaire survey were asked about the level of contribution of knowledge communication in PDR project management. As in the other questions, a five-rating Likert scale was used to capture respondents' opinions where 1 meant 'no contribution at all' and 5 meant 'a very high contribution'. The findings are presented in Table 7-23.

The table shows that knowledge communication contributes a great deal to project management by improving the quality of work, spreading best practice among project participants, and reducing costly mistakes and rework.

Table 7-23 Level of contribution which knowledge communication plays in effective project management of post-disaster reconstruction projects

Contribution	Mean Score					Rank				
	ALL (N=143)	CTR (N=37)	NGO (N=36)	GOV (N=34)	CSL (N=26)	ALL (N=143)	CTR (N=64)	NGO (N=36)	GOV (N=34)	CSL (N=26)
To improve quality of work	4.33	4.47	4.39	3.97	4.46	1	1	1	2	1
To spread best practice among project participants	4.21	4.28	4.28	3.97	4.31	2	2	2	3	4
To reduce costly mistakes and re-work	4.11	4.21	4.06	3.88	4.31	3	3	5	5	5
To transfer information and knowledge for problem solving	4.08	4.06	4.00	3.97	4.35	4	7	7	4	3
To improve performance and productivity by sharing knowledge on product, process and people	4.07	4.21	4.08	3.76	4.19	5	4	3	7	6
To build networks and prevent interaction deterioration	4.03	4.06	3.81	3.97	4.38	6	8	10	1	2
To improve decision making by exchanging lessons learned and experience gained among participants in the projects	4.01	4.11	4.08	3.74	4.12	7	6	4	8	7
To distribute knowledge among project teams for realising design	4.01	4.11	3.97	3.82	4.12	8	5	8	6	9
To collaborate and share knowledge and expertise to improve understanding among project participants	3.91	3.89	4.00	3.71	4.08	9	10	6	10	10
To improve project responsiveness	3.86	3.87	3.81	3.71	4.12	10	11	9	11	8
To disseminate values and cultures of the project	3.78	3.91	3.58	3.71	3.92	11	9	12	9	12
To identify and fulfil knowledge requirement/gap in the project	3.71	3.70	3.81	3.38	4.04	12	12	11	12	11

The scale: 1 (No contribution at all), 2 (Low level contribution), 3 (Little contribution), 4 (Some contribution), 5 (A very high contribution)

ALL = Overall, CTR = Contractors, NGO = NGOs, GOV = Governments, CSL = Consultants

Close examination of Table 7-23 indicates there are different views on role of knowledge communication in PDR projects among the respondents' groups. For example, overall 'to transfer information and knowledge for problem solving' was ranked at 4th, but the respondents from contractors and NGOs ranked it at 7th. Another example, 'to build networks' was ranked in 1st and 2nd place by the respondents from governments and consultants respectively. However, the respondents from contractors and NGOs ranked it much lower, at 8th and 10th respectively. Therefore, to find out if there is any statistical difference, a Kruskal-Wallis test was conducted and the result is presented in Table 7-24.

Table 7-24 Kruskal-Wallis test for level of contribution of KC in PDRP

Contribution	Chi-Square	df	Asymp. Sig.
To collaborate and share knowledge and expertise to improve understanding among project participants	3.779759	3	0.286
To identify and fulfil knowledge requirement/gap in the project	9.154502	3	0.027*
To distribute knowledge among project teams for realising design	2.623785	3	0.453
To spread best practice among project participants	2.213418	3	0.529
To improve decision making by exchanging lessons learned and experience gained among participants in the projects	3.023074	3	0.388
To build networks and prevent interaction deterioration	8.828017	3	0.032*
To improve project responsiveness	2.613203	3	0.455
To improve performance and productivity by sharing knowledge on product, process and people	6.409136	3	0.093
To disseminate values and cultures of the project	2.780254	3	0.427
To reduce costly mistakes and re-work	4.653749	3	0.199
To transfer information and knowledge for problem solving	4.297599	3	0.231
To improve quality of work	7.155874	3	0.067

*significant

Table 7-24 above shows there are two positive results, i.e. there are differences in viewpoints on 'to identify and fulfil knowledge' and 'to build networks'. To find out what the difference is a series of Mann-Whitney tests were conducted and the results are presented in Table 7-21 below.

Table 7-25 Mann-Whitney test for level of contribution of KC in PDRP

'To identify and fulfil knowledge requirement/gap'			
	NGO	GOV	CSL
CTR	0.504	0.112	0.071
NGO		0.053	0.330
GOV			0.004*
'To build networks and prevent interaction deterioration'			
	NGO	GOV	CSL
CTR	0.136	0.677	0.105
NGO		0.228	0.004*
GOV			0.036

*results are statistically significant at $p<0.05$

By comparing the results from Table 7-25 above with the mean value score in Table 7-23, it indicates that the respondents from the consultants group have rated 'to identify and fulfil knowledge gap' statistically higher than the government group, and also rated 'to build networks' higher than the NGOs respondents.

7.5.2. Results from the interview

In the interviews the respondents were asked about the role knowledge communication played in effective management of post disaster reconstruction projects (refer to Appendix D. The interview questions, page 355). After analysing the interview transcripts using NVivo software, several themes emerged and are presented in Table 7-26.

Table 7-26 Knowledge communication role from the interview

Role	No. of sources	No. of reference
Reach Agreement	6	7
Get new knowledge	5	5
Improve decisions	1	1
Improve skills	4	4
Improve understanding	11	17
Raise motivation	1	1
Reduce rework	2	2
Solve problems	10	12
Work faster	9	9

Six of 33 respondents viewed knowledge communication as a form of sharing knowledge that may help to reach an agreement on how to conduct the work, as mentioned by the following respondent:

> *"On each execution of the work we don't go directly into the site, of course there are all sorts of pre-construction meetings. So in the meetings we would share experiences or discuss in terms of design, so that when we go to the site we already have an agreement on how to carry out the work. So these are the kinds of thing that we need to discuss in every meeting, the exchange of experiences." (R06-GOV-AA)*

Knowledge communication also gives construction workers the opportunity to get new knowledge from other people; for example information about methods of working on the project. 5 respondents mentioned this as being a role of knowledge communication and one of them stated:

> *"To add insight, maybe there are new things that are found on the site, to share the information with others who do not know yet, it's knowledge that has arisen. Sometimes in the (structural) calculations we must put steel bars in a certain number, but it is hard to put the bar in position maybe (because) there are too many bars in the design, so that*

> *implementation becomes difficult, especially in the joint between the beam and column. If the implementation it's difficult to execute it should be addressed. The bar may be replaced from small size to a larger size. Smaller sized bars will make a larger number of steel bars; implementation may become difficult. Maybe then the quality of the concrete itself, because there may be a plan to strengthen the column, the cost in the plate is designed differently using different concrete quality, but its implementation is difficult if the quality of the concrete plate is different to the columns. In theory it can be efficient, but it is difficult to implementation." (R30-CSL-IF)*

Four interviewees stated the role of knowledge communication played in improving skills. Experiences differ among construction workers and knowledge communication may spread the experience so that the less experienced workers may improve their skills. One of the respondents stated that:

> *"I think in general we have to admit that one's experience is different from others and at any time knowledge certainly has added value. Construction in previous years compared with the construction of the current year may be a way of handling its technical implementation, ways of operation are different. It's increasingly advanced. So, this is not necessarily my experience, although I was representing the government, is better. So with the shared experiences we can now, at that meeting, conclude that it (work method) is simpler, that it gives better result." (R06-GOV-AA)*

As can be seen in Table 7-26, 11 of 33 interviewees viewed knowledge communication as helping to improve understanding, as asserted by following respondent:

> *"Benefits, maybe we can prevent misunderstandings. After that we do not spend time on mistakes. If there happens to be miss communication or disagreement the works are definitely delayed. I think that if we cannot communicate, or transfer knowledge to the*

> *contractor to prevent it, it will created misunderstanding. So we spend time sorting it out. So we can concentrate so that the work can be completed as planned." (R04-NGO-FF)*

If the project participants are of the same understanding, the implementation of work may be faster. 'Work faster' is mentioned by 9 of the 33 interviewees. One of the interviewees stated:

> *"If we often hold discussions then the understanding will be the same, the method will be the same, the reference will be the same, so it would work faster." (R27-CTR-IZ)*

One of respondents from the contractors group explained the knowledge management system used in his company, where they document all the work methods that they have used. New projects can refer to this work methods bank, and according to the respondent, that will prevent rework on future projects. In the interviews, 2 respondents stated 'reduce rework' to be a role played by knowledge communication. The respondent stated:

> *"We in our company have a slogan that we always avoid rework. Because rework will lead to additional cost and rework could also affect profit. Our company is now run ISO, we have to prepare a work method before work commences. These methods, especially methods that in other projects do not yet exist, we gather at the company level. All methods that have been collected are returned to the project, so we've got in project references to the work procedures or work instructions." (R28-CTR-ES)*

One of the most frequent themes that emerged from the interviews is knowledge communication is for problem solving. 10 of the 33 interviewees mentioned that knowledge communication helped to 'solve problems', as stated by respondent R17:

> *"Every project is unique, there is no similar project. Often problems occur in the field, it will always be there, so the communication of knowledge is required for finding the solution." (R05-CSL-TI)*

> *"Before we start work, we first discuss what we will do. What and how the work method for it. It has to be in one of perception first. Then we discuss what the risks of the work are." (R17-CTR-BS)*

7.5.3. Discussion on role of knowledge communication

Table 7-23 (page 257) shows the results from the questionnaire survey on the level of contribution of knowledge communication in PDP projects. Five significant roles of knowledge communication from the table are 'to improve quality of work', 'to spread best practice', 'to reduce rework, 'to transfer information for problem solving', and 'to improve performance and productivity'.

Improving the quality of work is one aspect where knowledge communication can make a large contribution, as can be seen from the results from the questionnaire survey in Table 7-23 (page 257). As indicated by a previous study, one of reasons organisations employ knowledge management is for quality improvement (Malik and Malik, 2008). Research by Chuang (2013) also shows that workers' intention to share and manage knowledge is potentially most important for total quality management operations and performance in an organisation.

By communicating knowledge, individuals and groups can utilise new knowledge to introduce creative ideas to solve problems (Chen et al., 2010). Similar finding in an empirical work by Egbu et al., (2003b) shows that a majority of triggers for knowledge sharing are associated with problem solving, for instance in dealing with complex projects.

Findings from the questionnaire and the interviews show that knowledge communication also enables the spread of best practice among project participants. Best practice is needed to improve work implementations or operations (McCampbell et al., 1999).

The findings from the interviews show that there are many references to 'improve understanding' being a positive result of knowledge communication in projects. People may become more effective if they understand the importance of the process in which they are involved (Johannessen et al., 1999).

However, Dove (1999) warns that knowledge has no value until it is implemented. By implementing knowledge obtained from another a worker may develop his own context of the knowledge as he learns during the progress of the work. Comparing what he learns with his own experience may result in new knowledge and innovation emerges with the application of the knowledge (Dove, 1999).

7.6. Importance of knowledge communication and its exploitation in PDR projects

One of the questions in the interview seeks the opinion of the respondent about the importance of knowledge communication in PDR projects (refer to question 10, Appendix D. The interview questions, page 355). The interviewees were asked to rate the importance from 'not important at all' to very important', or, they were asked to rate from 1 to 10, where 1 is 'not important at all' and 10 is 'very important'.

About three quarters of the respondents (23 of 33 respondents) stated that knowledge communication is 'very important' or rated the importance on the scale between 8 and 10, as mentioned by following respondents:

> *"For me, I thought it was in figure 8. Because this way, the contractor has got his own experience, consultants also have experience. Owner is the party who has the job, they choose the most appropriate. I think it is good that we share experiences on the project." (R08-CSL-DM)*

> *"I think it's very important. Because there are things in the field [project] that are not met by theory [from formal education]." (R20-CTR-YZ)*

The above responses show that most of the respondents have realised the importance of knowledge communication to the project.

However, 8 of 33 respondents considered that knowledge communication is not as important as the opinion of others. One respondent stated that knowledge communication is fairly important:

> *"I think it's fairly important for this reconstruction project in which we use the local [human] resources that lack quality. But suppose in a normal project that the contractor has balanced resources [good quality], we are even less bothered. We really only serve as controllers. but if it is not balanced, we function more like coaches." (R14-CTR-LR).*

Another respondent, a consultant, views sharing knowledge in the project as an obligation. He related the knowledge sharing process with the payment of his service; consultants in Indonesia are usually only paid at the end of the term after conducting a seminar to discuss their work.

> *"I gave a score of 6. That is, it is not a must to share experiences. Only because of compulsion then we share the experience." (R31-CSL-AL).*

The above responses show that the interviewees are aware of the importance of knowledge sharing which has a role as discussed in sub section 7.5.3 (page 263).

Despite being aware of the importance of knowledge communication it is worth finding out how to exploit and make full and best use of knowledge communication. Several authors (O'Dell and Grayson, 1998, Riege, 2005, Kutsch and Hall, 2010) give a warning that the biggest barrier to knowledge sharing is 'ignorance at both ends' where sources and recipients of knowledge are not too concerned with who possesses the knowledge or who requires knowledge. There are various methods for communicating knowledge, as presented in section 7.3 (page 222), which are the most frequently used methods related to a formal approach, for examples meetings and reports. It seems that technology based methods are not fully exploited in PDR projects.

Perhaps it also caused by the barriers to knowledge communication in PDR projects which are mainly lack of trust and different interests among the project participants. Barriers to knowledge communication have been discussed in section 7.4 (page 241). One of the respondents stated that the difficulty of sharing knowledge about technical aspects of the work:

> *"For ongoing projects I think we can not share the experience. We can't share experience of technical issues. But we can on sharing information on suppliers, where the cheap and accessible materials are.*
>
> *The technical issues tend to be debatable. Everyone has their own way. For example, I want to go to Bali, there are options to go, by using bus, plane, or train. I may choose the bus, because it's cheap and I can have good sleep on it. But if I use the plane, in two hours I will arrive there.*
>
> *Well, a contractor in the calculation of the work has many factors to consider, such as speed, cost, and quality. But if the consultant gives advice, they only say two things: the speed, and the quality. They do not consider the cost. Whilst to most of the contractors, the cost is of key consideration. So sharing your experiences of the technical issues tends to be debatable." (R26-CTR-EO)*

Another respondent from the contractors had an experience that illustrates the opinion of respondent R26-CTR-EO. He builds houses during the reconstruction and the specification requires the use of smooth faced plywood for concrete formwork in order to have a good, smooth finish for the wall. The plywood was expensive and difficult to find. However, based on his experience he can get the same result by using cheap multiplex board covered by plastic sheets as concrete formwork. But this idea was declined by his project consultants.

7.7. Knowledge communication impact on PDR activities

Table 7-27 shows the level of impact that knowledge communication has on PDR project activities. Overall, the table reveals that knowledge communication has most impact on 'ensuring good quality workmanship', followed by 'understanding funding system and timescale' and 'incorporating disaster risk reduction strategies into the design'.

In the previous sections, it has been shown that knowledge communication contributes greatly to improving the quality of the work. It is understandable that it also has a great impact on ensuring quality workmanship activities. However, closer examination of Table 7-27 shows that respondents from NGOs ranked 'ensuring good quality of workmanship' in twelfth position. From the respondents' viewpoint knowledge communication has the biggest impact on the following three activities: 'identifying the beneficiaries', 'determine the most appropriate assistance' and 'understanding the impact and context of the disaster'.

The government respondents thought that knowledge communication had the highest level of impact on the following activities: 'determining the quality of reconstruction agreed by the stakeholder', 'selection of appropriate site' and 'ensuring good quality workmanship'.

Similar findings can be seen in the responses made by the consultants. Table 7-27, suggests that consultants perceive knowledge communication can have an impact on design-related activities, for example 'incorporating disaster risk reduction into design' was ranked 2nd, 'minimising the environmental impact of reconstruction' was ranked 3rd and 'determining appropriate types of construction' was ranked 4th.

All the above rankings suggest that organisations perceive differences in the level of impact knowledge communication has on PDR activities. A Kruskal-Wallis test was conducted to statistically find the differences as presented in Table 7-28 and post-hoc Mann-Whitney test in Table 7-29.

Table 7-27 Level of impact that knowledge communication has on post-disaster reconstruction activities

Activities	Mean Score					Rank				
	ALL	CTR	NGO	GOV	CSL	ALL	CTR	NGO	GOV	CSL
Ensuring good quality workmanship	4.40	4.60	3.97	4.44	4.58	1	1	12	3	1
Understanding funding system and timescale	4.31	4.45	4.22	4.29	4.23	2	2	4	11	14
Incorporating disaster risk reduction strategies into design	4.30	4.32	4.11	4.35	4.46	3	4	6	7	2
Determining quality of reconstruction that was agreed by stakeholders	4.29	4.30	4.00	4.53	4.35	4	8	10	1	9
Recognising natural hazards which pose future risks	4.27	4.38	4.08	4.24	4.38	5	3	7	12	5
Selection of appropriate sites for reconstruction	4.27	4.26	4.06	4.44	4.35	6	10	8	2	7
Determining the most appropriate assistance	4.27	4.17	4.44	4.32	4.12	7	11	2	9	16
Determining appropriate types of construction	4.24	4.32	3.94	4.35	4.38	8	7	13	6	4
Understanding the impact and context of disaster	4.24	4.28	4.25	4.18	4.23	9	9	3	16	13
Construction management	4.24	4.32	3.92	4.38	4.35	10	5	15	5	8
Resolving issues of land tenure	4.22	4.15	4.14	4.44	4.19	11	13	5	4	15
Maintaining the availability of good quality material	4.22	4.32	3.86	4.35	4.38	12	6	18	8	6
Identifying the beneficiaries	4.19	4.09	4.53	4.06	4.08	13	16	1	19	17
Design structural and architectural features of buildings	4.14	4.17	3.89	4.29	4.23	14	12	17	10	11
Physical planning, integrating houses with services and public buildings	4.11	4.11	3.97	4.18	4.23	15	15	11	15	12
Minimising the environmental impact of reconstruction	4.10	4.13	3.72	4.24	4.42	16	14	19	13	3
Determining the method of implementation	4.04	3.94	3.94	4.12	4.27	17	18	14	18	10
Understanding government structure and regulations	4.01	3.98	4.03	4.12	3.92	18	17	9	17	19
Establishing partnerships with other stakeholders	3.99	3.87	3.92	4.21	4.04	19	19	16	14	18

The Scale: 1 (No impact at all), 2 (Low impact), 3 (Little impact), 4 (Some impact), 5 (A very high impact)
ALL = Overall, CTR = Contractors, NGO = NGOs, GOV = Governments, CSL = Consultants

Table 7-28 Kruskal-Wallis test of level of impact KC has on PDR activities, by type of organisation

Activities	Chi-Square	df	Asymp. Sig.
Understanding the impact and context of disaster	0.6635	3	0.8818
Understanding government structure and regulations	2.4022	3	0.4932
Understanding funding system and timescale	1.2351	3	0.7446
Identifying the beneficiaries	9.8985	3	0.0194*
Determining the most appropriate assistance	2.8881	3	0.4092
Establishing partnerships with other stakeholders	4.4288	3	0.2187
Recognising natural hazards which pose future risks	3.7818	3	0.2860
Selection of appropriate sites for reconstruction	6.1688	3	0.1037
Resolving issues of land tenure	6.0505	3	0.1092
Physical planning, integrating houses with services and public buildings	1.4158	3	0.7018
Determining appropriate types of construction	8.6690	3	0.0340*
Determining quality of reconstruction that was agreed by stakeholders	8.1643	3	0.0427*
Minimising the environmental impact of reconstruction	15.2394	3	0.0016*
Incorporating disaster risk reduction strategies into design	3.6647	3	0.3000
Design structural and architectural features of buildings	5.8440	3	0.1194
Determining the method of implementation	3.5645	3	0.3125
Construction management	5.7360	3	0.1252
Maintaining the availability of good quality material	8.5438	3	0.0360*
Ensuring good quality workmanship	12.5750	3	0.0060*

*results are statistically significant at p<0.05

Table 7-29 Post-hoc Mann-Whitney test of level of impact KC has on PDR activities, by type of organisation

Identifying beneficiaries			
	NGO	GOV	CSL
CTR	.002*	.464	.897
NGO		.075	.016
GOV			.656
Determining of appropriate types of construction			
	NGO	GOV	CSL
CTR	.021	.730	.783
NGO		.011	.030

GOV			.967
Determining quality of reconstruction that agreed by stakeholders			
	NGO	GOV	CSL
CTR	.119	.149	.641
NGO		.005*	.086
GOV			.471
Minimising the environmental impact of reconstruction			
	NGO	GOV	CSL
CTR	.046	.135	.025
NGO		.005*	.001*
GOV			.471
Maintaining the availability of good quality material			
	NGO	GOV	CSL
CTR	.026	.570	.577
NGO		.018	.018
GOV			.960
Ensuring good quality workmanship			
	NGO	GOV	CSL
CTR	.001*	.496	.902
NGO		.028	.006*
GOV			.504
*Significant at <0.05			

From Table 7-29, it can be seen that, generally, NGOs have a different viewpoint on the impact KC has on PDR activities. For example, '*identifying beneficiaries*' is statistically different between contractors and NGOs with a Mann-Whitney test score of 0.002. Referring to Table 7-27 '*identifying beneficiaries*', the contractors have given it a mean value of 4.09 whilst NGOs have 4.53. The contractors ranked 'identifying beneficiaries' in 16th place whilst NGOs ranked it in 1st place.

Similar perceptions prevail in '*determining appropriate type of construction'* where the Mann-Whitney test shows that NGOs have different view from the other respondents. From Table 7-27 the contractors, governments and consultants have arrived at mean values of 4.32, 4.35, 4.38 respectively, but NGOs have the lowest mean value score of 3.94.

7.8. Inferences and implications from the results

7.8.1. Inferences of knowledge communication in PDR projects

From the results of questionnaire survey and the interviews there are several inference that can be drawn:

- The five most frequently used knowledge communication methods at the construction stage of PDR projects are reports, face-to-face interaction, telephone, project review and meetings.
- For effectiveness, the five most effective knowledge communication methods are reports, face-to-face interaction, project review, meetings, and telephone.
- IT-based knowledge communication methods are rarely used, except for telephone and email. Email is mainly used by the NGOs.
- The five main barriers to communicating knowledge are 'too much information to process quickly', 'there is not enough time for collecting knowledge', 'limited ability to grasp knowledge', 'inadequate infrastructure for knowledge communication', and 'cultural difference'.
- Five significant roles for knowledge communication that emerged from the survey are 'to improve quality of work', 'to spread best practice', 'to reduce rework, 'to transfer information for problem solving', and 'to improve performance and productivity'.
- Although most of respondent understand the importance of knowledge communication the implementation for its use among project participants is limited to formal contact points, such as monthly meetings. The different positions of the participants and lack of trust among them are preventing them from exploiting the benefits of knowledge communication.
- Five significant knowledge communication impacts are seen in following task on PDR projects: 'ensuring good quality workmanship', 'understanding funding system and timescale', 'incorporating disaster risk reduction strategies into design', 'determining quality of reconstruction that was agreed by stakeholders', and 'recognising natural hazards which pose future risks'.

7.8.2. Implication of knowledge communication in PDR projects

- By observing the inferences in section 7.8.1, it may conclude that the quality of reconstruction is the main theme. In other words, knowledge communication plays an important role in enhancing the quality of the reconstruction.
- By examining the results of barriers to knowledge communication and the importance of knowledge communication it suggests that formal monthly meetings and face-to-face interaction are important knowledge communication methods.

7.9. Summary

This chapter focussed on knowledge communication in post-disaster reconstruction and documented methods for communicating knowledge and identified the barriers to knowledge communication.

The findings from the questionnaire survey show that reports, face-to-face interactions, the telephone, project reviews and meetings are the five most frequently used methods of knowledge communication used in post-disaster reconstruction projects.

However, there are also key barriers to knowledge communication. ‘Not enough time for collecting information or knowledge’, ‘too much information’, ‘lack of time to share knowledge’, ‘cultural differences’ and ‘lack of prior knowledge’ are the five most frequent barriers.

This research also reveals that knowledge communication has a significant contribution to make to PDR project management in improving the quality of work, spreading best practices among project participants and reducing costly mistakes and reworks.

CHAPTER 8. THE MODEL DEVELOPMENT

8.1. Introduction

The aim of this research study is to develop a model for improved awareness and understanding of the role of knowledge communication in post-disaster reconstruction. As previously described in chapter one, there is still little research being undertaken in the knowledge management of post-disaster reconstruction domain, especially in the Indonesia context. It also implies that there are two main domains, knowledge management and project management in post-disaster context, which are the topics in this research. Because these topics are still in the early stages of development in Indonesia there is a need for a model which captures and presents the main issues in the two domains (knowledge management and project management) and shows the connections between these two domains.

This research offers a model, called the KERAN model, to address the need. The model is based on data analysis described in previous chapters. It is assembled from the findings of the main activities in PDR projects (section 7.7, page 266), challenges in PDR project (section 5.6, page165), critical success factors (section 6.3, page 193), role of knowledge communication (section 7.5, page 256), knowledge communication methods (section 7.3, page 222), and project success criteria (section 6.4, page 206).

The model helps to increase understanding about project management in a post-disaster context, knowledge communication and knowledge management, and how knowledge communication contributes to effective project management. The model integrates knowledge across the two domains and provides a holistic view on project management of post-disaster reconstruction.

This chapter is structured by sub-sections to show development of the model and its validation. Sub-section 8.2 introduces definitions of a model and stages in developing a model. Sub-section 8.3 presents the development of the KERAN model, a model for knowledge communication in PDR projects. Sub-section 8.4

presents feedback from validation respondents, and the chapter concludes in sub-section 8.5 with a summary of the chapter.

8.2. Stages of model development

8.2.1. Definition of a model

A model may be interpreted as a representation of an actual object, process or system, or a presentation of a reality which must capture the reality as closely as is practicable (Fellows and Liu, 2003). A model also explains certain aspects of the real world which are relevant to the research, highlights relationships between the aspects and "enables the formulation of empirically testable propositions regarding the relationships" (Hamza, 2002).

According to Earp and Ennet (1991), the term 'model' has different uses and meanings. A model may refer to a conceptual framework for organising and integrating information; a diagram of a system (i.e. mathematical and statistical model); or a conceptual structure successfully developed in one field and applied to another field. A model may also refer to the visual representation of theory (Earp and Ennet, 1991). A graphical model also helps individuals to understand a process and how various factors and interactions affect the outcome of the process (Waller and Polonsky, 1998).

A model is a conceptual model when representing a conceptual framework presented in the form of a diagram that offers causal linkage among a set of concepts in a particular issue (Earp and Ennet, 1991).

Fellows and Liu (2003) suggest four classifications of models:

- Iconic: graphical representation of certain aspects of a real system.
- Replication: displays significant physical similarity to reality, for example: a doll.
- Analogue: employs one set of properties to represent another set of properties which the system processes.
- Symbolic: requires logical or mathematical operation.

8.2.2. Development of a model

There are two activities in the development of a conceptual model: (1) identification of the phenomena to be modelled, and (2) converting the phenomena into grammatical constructs. Grammar refers to techniques in diagramming, for example; activity cycle diagrams, flow charts, and graphical representations (Van der Zee and Van der Vorst, 2007). To understand the phenomena, Earp and Ennet (1991) suggest starting by focussing on the end point of interest, outcome or target of intervention, the dependent variable. Model development then begins with the selection of potential connections and proceeds by grouping the initial relationships among the concepts.

Fellows and Liu (2003) propose fives stages of model development, they are the objective of the model, to analyse reality, to synthesise, and to verify and validate the model.

- Objectives of the model. The purpose of the model should be reflected in the model's objectives. Users of the model should be indentified in order to obtain different perspectives and to suggest the source of data, forms and outputs.
- Analysis. This stage consists of organised, analytic procedures to determine the operation of the reality, noting location and permeability of the system to be modelled.
- Synthesise. In this stage the variables and their relationship are identified, often in the form of a diagram of the reality.
- Verification. Verification of a model involves determining whether the structure of the model is correct; by comparing outputs resulting from the model with given input.
- Validation. In validation, the model's output resulting from known inputs is compared to realisations of the reality.

The model development suggested by Fellows and Liu is depicted in Figure 8-1.

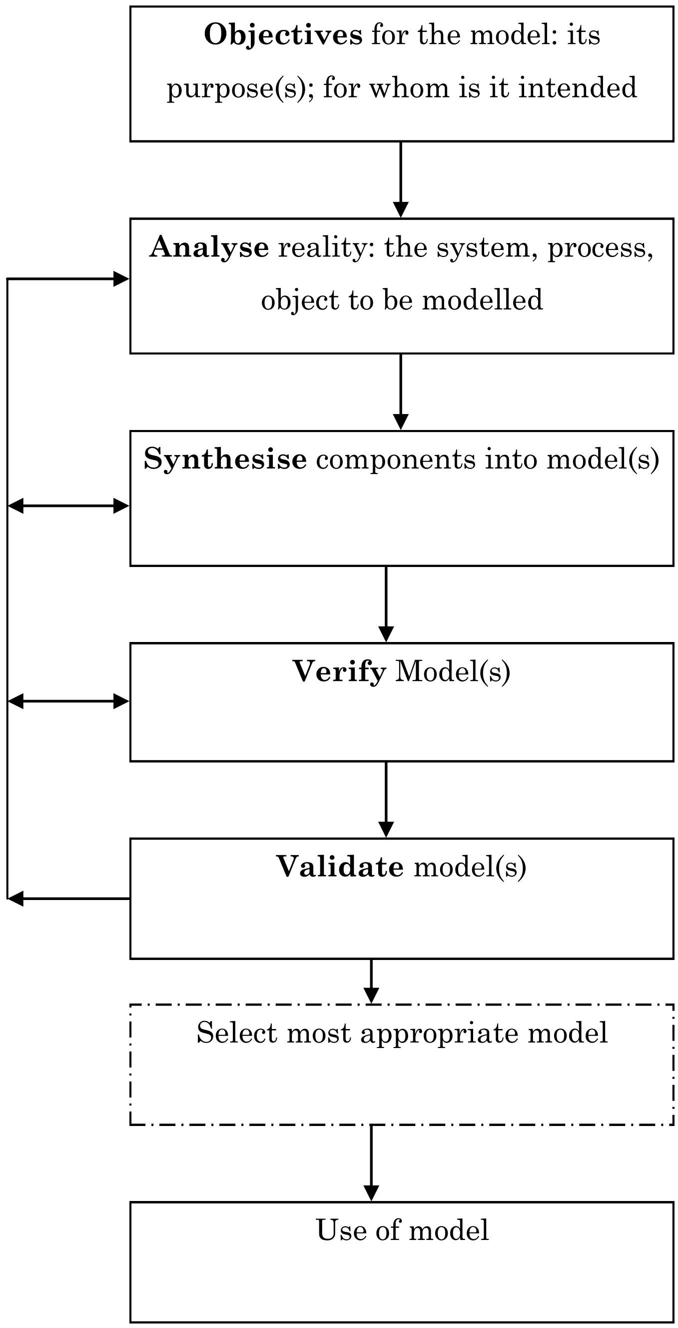

Figure 8-1 The modelling process (Fellows and Liu, 2003)

8.2.3. Typical example of a model

A model helps individuals to understand a certain process in the form of diagrammatic presentation. In communication, the most cited communication model is probably a model provided by Shannon and Weaver (1949); they presented a simple linear communication model in their publication 'The Mathematical Theory of Communication'. The model contains sender, message and receiver in the communication process.

The diagram of their model is depicted in the following figure:

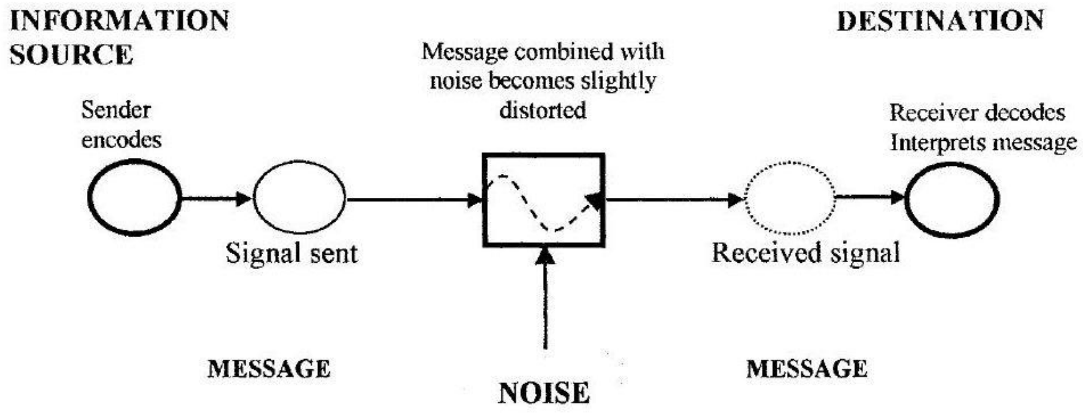

Figure 8-2 Shannon and Weaver's model of communication (source Emmit & Gorse, 2003)

The development of a model may also start from an existing model (Earp and Ennet, 1991). Waller and Polonsky (1998), in their research on business communication models, suggest that most communication models are based on the 'traditional model' of sender-message-receiver, with examination of the models using different aspects of communication or in different contexts. For example, to understand the knowledge communication process Liyanage et al. (2009), consider the process of knowledge sharing as an act of communication and then develop a knowledge transfer model that is based on Shannon and Weaver's communication model (Figure 8-3).

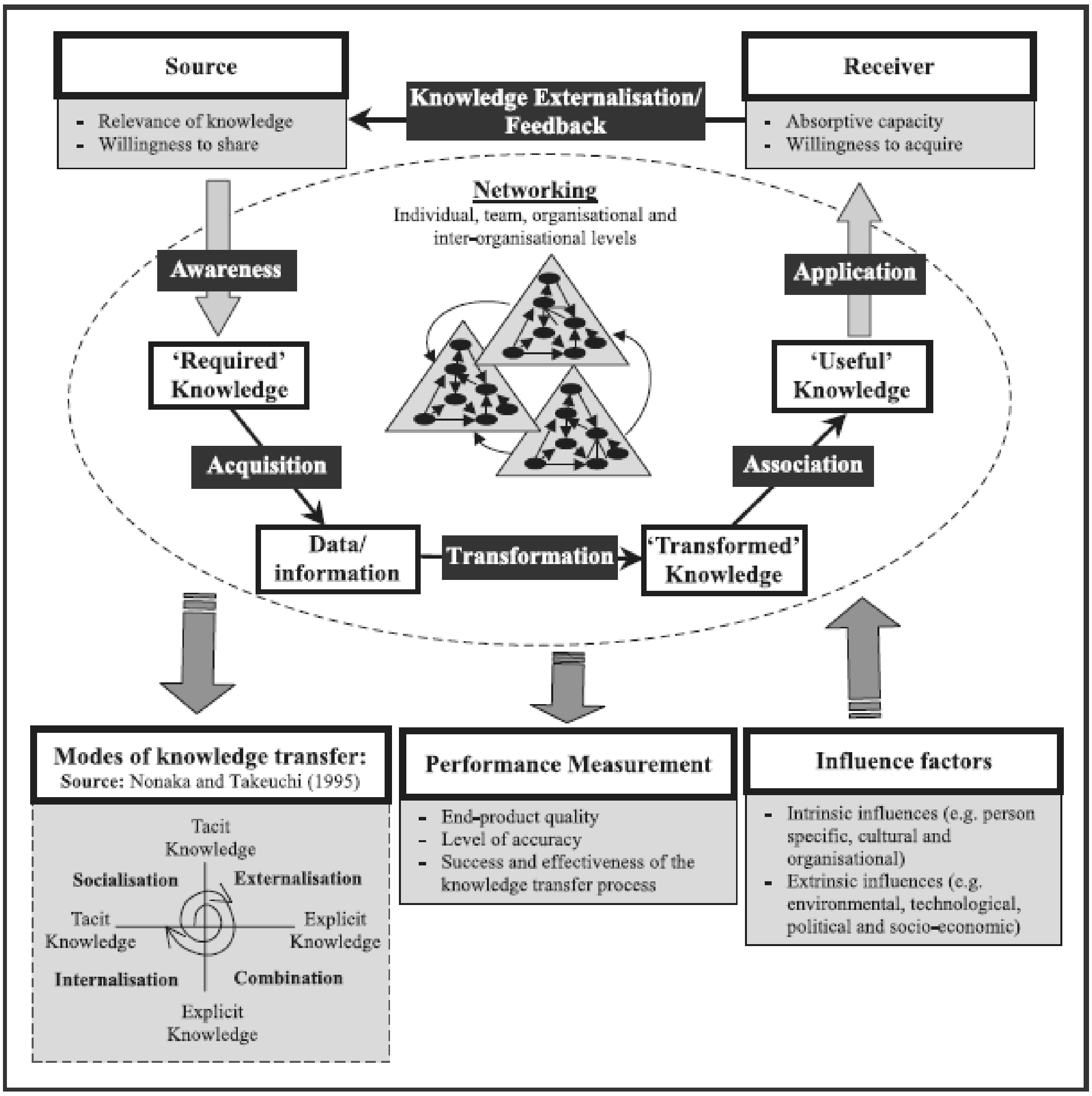

Figure 8-3 Process model of knowledge transfer (Liyanage et al., 2009).

8.3. The KERAN model: Knowledge Communication in Post-Disaster Reconstruction Projects

The aim of the present research is to develop a model showing the role of knowledge communication in effective project management of post-disaster reconstruction projects. The drafts of the model are elicited in Figure 8-4 and Figure 8-5. The model was continually reshaped using informing data from the questionnaire survey and interviews.

8.3.1. First draft of the model

The central view of the model was management of post-disaster reconstruction projects. Project management is defined as the planning, monitoring, and control of all aspects of a project and motivation of all those involved to achieve project specific objectives (Egbu et al., 1999). Effective management is needed to translate the idea of change into tangible deliverables which must match the client expectation, and achieve project success (Cicmil, 1997). There are two concepts in project success: success criteria and success factors. Success criteria are the measures by which success or failure of a project or business will be judged, whereas success factors are those inputs to the management system that lead directly or indirectly to the success of the project or business (Cooke-Davies, 2002).

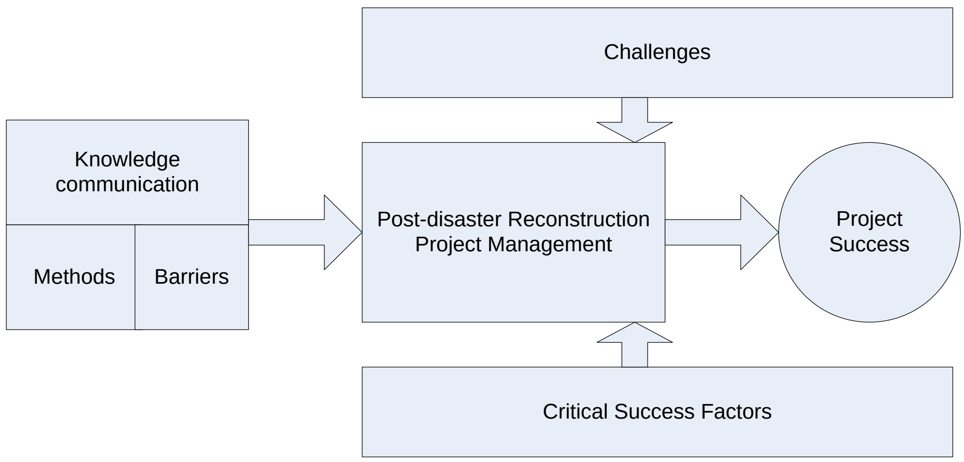

Figure 8-4 First draft of the model

The list of success factors are derived from a review of literature. For this research, the literature review has proposed 20 success factors. These are as follows:

- Effective project planning;
- Effective project monitoring and control;
- Competent project manager;
- Sufficient resources;
- Skilled and sufficient project team;
- Support from top management/parent company;

- Appropriate project coordination;
- Active involvement of stakeholder/community;
- Good communication;
- Good written contract;
- Learning from previous experience;
- Use of technology and IT;
- Adequate funding;
- Adequate consultation;
- Political stability;
- Less negative influence on the physical environment;
- Manageable size and complexity of project;
- Economic stability;
- Less bureaucracy in the reconstruction process;
- Good tendering method.

For success criteria, this research identified criteria from the literature review and proposes eight criteria. The criteria include the 'golden triangle' criteria (i.e. time, cost and quality), satisfaction, minimum conflicts and health and safety. The eight criteria are as follows:

- Completion of reconstruction project within the allocated time period;
- Completion of reconstruction project within the budgeted cost;
- Completion of reconstruction project within specified quality;
- Stakeholders' satisfaction ;
- End user (disaster victims) satisfaction with reconstruction process;
- End user (disaster victims) satisfaction with final product ;
- Minimum disputes and conflicts between stakeholders;
- Meet health and safety standards;

This model includes the challenges associated with post-disaster reconstruction projects which also have been identified from the literature review. The challenges are as follows:

- To have good coordination with other stakeholders/parties;
- Securing adequate resources (material and machinery);
- Securing an adequate labour force;

- Improving the capacity of local government/agency;
- Achieving planned construction quality;
- Having adequate quality inspection of construction work;
- Building construction projects that culturally fit the needs of local people;
- Putting in place an appropriate organisation structure;
- Minimising the negative effects of political instability;
- Finding suitable land/location for the reconstruction project;
- Following regulations related to the reconstruction;
- Securing finance for the reconstruction project;
- Improving information and communication processes;
- Dealing with rising costs of materials and labour;
- Starting the construction project on time/immediately;
- Establishing property rights;
- Avoiding corruption in the reconstruction process;
- Having clear accountability in the reconstruction process;
- Having clear transparency in processes in the reconstruction project;
- Working with limited or poor conditions, facilities and infrastructure at project location;
- Working with poor or restricted access to location.

The other part of the model is about knowledge communication. This model will describe the methods and barriers to communicating knowledge in post-disaster projects. Knowledge communication methods are tools and techniques which have been used to convey knowledge.

8.3.2. Second draft of the model

As mentioned in the previous section, the model evolves during its development, as it will be informed by the findings from the questionnaire survey and interviews.

The findings from the questionnaire survey were presented in chapter four, chapter five and chapter six. These findings informed the model and the second draft of the model is presented in Figure 8-5.

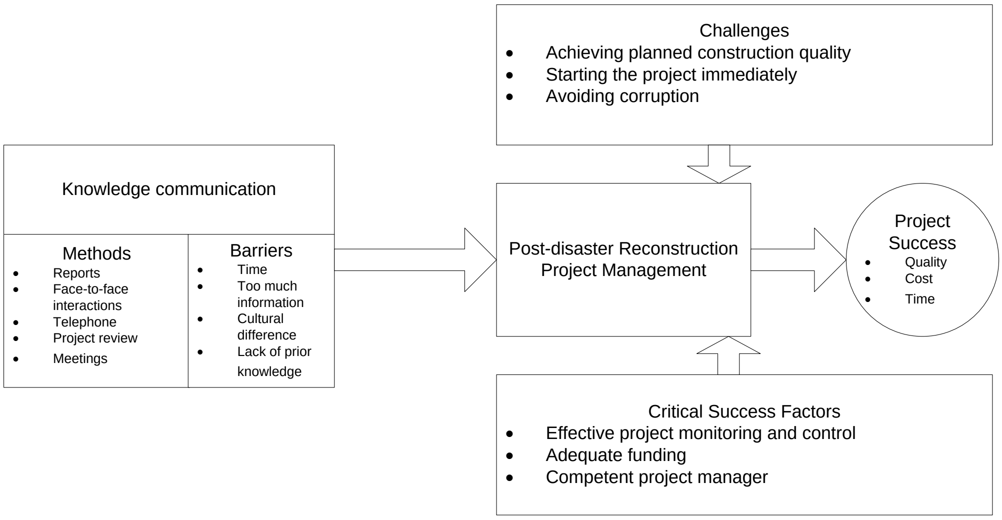

Figure 8-5 Second draft of the model

8.3.3. Third draft of the model

The most common models in research are analogue and symbolic models, whilst in the construction industry iconic and replication models are usual (Fellows and Liu, 2003). Figure 8-6 represents an analogical model for the roles of knowledge communication in effective project management in post-disaster reconstruction, which is a converted version of the model in Figure 8-5. The model is an analogical model which visualises the post-disaster reconstruction process as a 'tap and pipe' system.

The water in the model is an analogical form for works in post-disaster reconstruction which throughout some processes (i.e. construction stage: planning, design, and construction) are delivered through a tube which is a visualisation of project management. Project management is defined as the planning, monitoring, and control of all aspects of a project and motivation of all those involved in it to achieve project specific objectives (Egbu et al., 1999).

The flow of the water represents progress of the works and will be influenced by occurrence of CSFs and challenges. Success factors are factors that contribute to achieving the success of the project (Cooke-Davies, 2002) and challenges are barriers; difficulties that are faced during the project that inhibit the achievement of project success. So, the CSFs and challenges act as the valve which determines how much (volume) and how long (time) the work took.

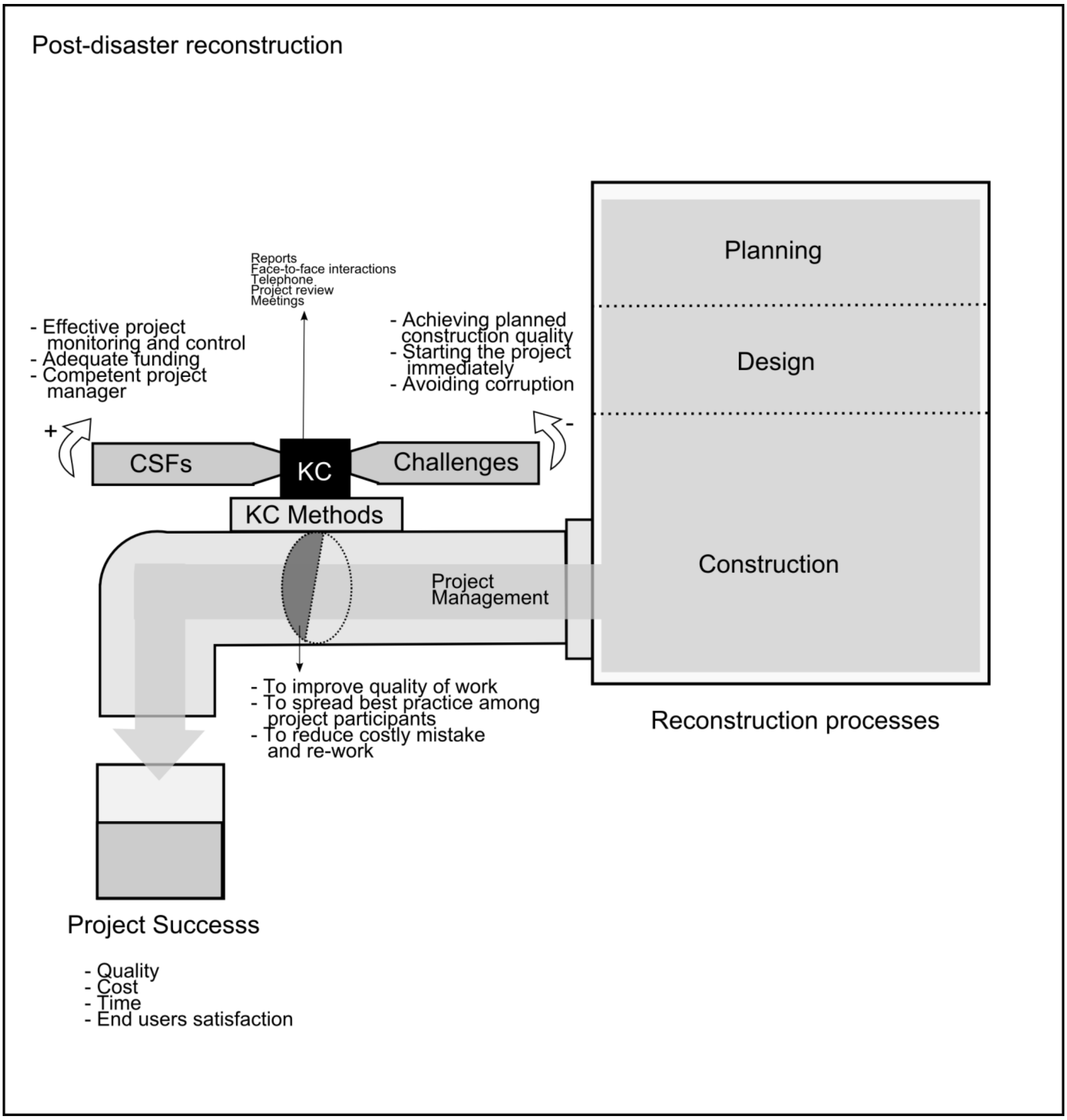

Figure 8-6 Third draft of the model

The tap model has a valve in the tube, controlling the work (flow); it is analogical for the role knowledge communication has on improving the quality of the work, spreading best practices, and reducing costly mistakes.

8.4. Model validation

Yuan (2012), in the context of system dynamics, proposes four tests to validate a model:

- Boundary test : to find out if all the essential variables are included in the model
- Structure verification: whether the model structure is consistent with relevant descriptive knowledge of the system being modelled.
- Dimension consistency: the model must be dimensionally valid.
- Extreme condition: whether the model exhibits proper behaviour when subjected to extreme conditions.

According to Hvala et al. (2005), the quality of a model can be determined by several features: model purposiveness (usefulness), model falseness, and model plausibility. Models are created to solve a certain problem and model usefulness signifies whether the model satisfies its purpose. Model plausibility refers to whether the model refers to conceptual validity, often related to expert judgment of whether the model is good. The third feature, model falseness, is most commonly used to validate a model, by directly comparing the input-output data of the model and from the real system.

Ahmad (2010), in his KM model development, proposes feedback from the respondents to verify the model's usability and usefulness. The model usability includes specification issues relating to the ability of the model, for example: ease of use, systemisation, comprehensiveness, reliability, appropriateness, applicability and sufficiency. The model's usefulness includes assessment of the benefits that the model can offer users.

As mentioned earlier, the final model was validated by obtaining feedback from the industry using a questionnaire survey. This method is the common method for validating tools or methods and which is supported by several authors (Al-Ghassani, 2003, Olomolaiye, 2007, Ahmad, 2010). Validation of the model included several aspects, presented in a questionnaire format as described in the validation form presented in appendix D (page 355).

The questions for model validation were formatted in Microsoft Word software, and provided check-boxes for respondents' responses. The questionnaire was sent as an email attachment to the respondents.

Ten (10) potential respondents, who work as project managers, were identified from the questionnaire survey feedback. The validation questionnaire was then sent to their email and seven (7) responses were received from project managers. A summary of the responses is presented in the following Table 8-1.

Table 8-1 Summary of model validation responses

No	Criteria	Scale					Mean score
		1	2	3	4	5	
1	Correct identification of critical success factors (CSFs)	0	0	0	4	3	4.4
2	Correct identification of success criteria	0	0	0	3	4	4.6
3	Correct identification of main challenges in PDR projects	0	0	0	5	2	4.3
4	Correct identification of the role of knowledge communication	0	0	0	4	3	4.4
5	Correct identification of knowledge communication methods	0	0	0	4	3	4.4
6	Easy to understand	0	0	1	2	4	4.4
7	Easy to use	0	0	2	4	1	3.9
8	Provides systematic view of post-disaster reconstruction projects	0	0	1	4	2	4.1
9	Help in raising awareness of knowledge communication	0	0	0	5	2	4.3
10	Helps in understanding the role knowledge communication plays in PDR projects	0	0	1	2	4	4.4

There are ten questions in the model validation questionnaire where each of the questions uses 1 to 5 Likert-like scales to capture respondents' opinions. For example, question number 1, 'correct identification of critical success factors' has options for the answer as: 1 for 'very poor identification' to 5 for 'very good identification' of the critical success factors. The higher the number on the scale, the better indication is felt.

From the above table, it can be seen that most of the respondents' answer, have an average value bigger than 4, which indicates very good reception from the respondents about the model. But, one question has an average score below 4, which is question number 7 (easy to use) with the average score of 3.9.

Question number one is about 'correct identification of CSF's'. The validation respondents were asked to rate the correctness on the scale from 1 for 'very poor identification' to 5 for 'very good identification'. From the table, it can be seen that all of the respondents rated it at 4 (good identification) or 5 (very good identification). It suggests the model has the correct CSFs in PDR projects.

The second question in the validation is to find out the correctness of the identification of the success criteria. The scale used for rating is from 1 for very poor identification to 5 for very good identification. The average value of ratings from respondents is 4.6 where 3 respondents rated it at 4 (good identification) and 4 respondents rated it at 5 (very good identification). That suggests this model has an adequate correctness in the success criteria within the model.

The third and fourth questions ask about the correctness of identification of challenges and the role of knowledge communication in PDR projects. Both questions have a mean score of 4.3 and 4.4 which indicate this model is quite robust in capturing challenges and the role of knowledge communication. Similar observations were made on question number five, where the response has a mean score of 4.4 which indicates a good level of correctness in identification methods of knowledge communication.

The next question, question number 6, asks about the ease of the model to be understood. The question has a mean score of 4.4 which means it is fairly easy to understand. However, the ease of the model to use, as in question number seven, has a lower mean score (3.9) compared with other questions. Five respondents considered the model easy or very easy to use, and two respondents perceive the model fairly easy to understand.

Question number eight asks about whether the model provides a systematic view of post-disaster reconstruction projects. The response from the validation questionnaire shows that the model has a fairly systematic view on post-disaster reconstruction projects.

The last two questions in the model validation are about the extent of the model in raising awareness of knowledge communication (question number 9) and help in understanding the role of knowledge communication in PDR projects (question number 10). The mean score for question number 9 is 4.3

where four (4) respondents rated the model as helpful and two (2) respondents rated it as very helpful. Question number 10 has a mean score of 4.4 where one respondent rated it fairly helpful and six respondents rated it as helpful or very helpful. The high mean scores indicate the model provides understanding about knowledge communication in PDR projects.

There were three comments received in the model validation questionnaire. The comments received were:

> *"To add definition of knowledge communication so as everyone share the same stand of the meaning"*
>
> *"If the role of KC is a power to (but not the effect of) identify challenges and create CSFs, then I think you would be better off to switch places between the role of KC (number 3) and number 2 (CSFs and Challenges)"*
>
> *"Very interesting and simple understanding model."*

8.4.1. Final version of the model

In the previous section, the validation process of the model was discussed and presented. Few comments suggest improvements for the model, in order to have a clear analogical model. Based on the suggestion, the previous model is modified to become the final model as in Figure 8-7.

The name of the model 'KERAN (tap) model' is the Indonesian translation of the word 'tap'. However, KERAN is also an acronym for the steps necessary for implementing knowledge communication; as depicted in Figure 8-7. The word 'tap' may also be considered to be an acronym for 'technology and people', two of the main factors essential for knowledge management, which are also depicted in the model. Thus, the title 'KERAN (tap)' is a good name which not only reflects the physical dimension of the model (i.e. drawing of a tap), but also imitates processes and factors of the model.

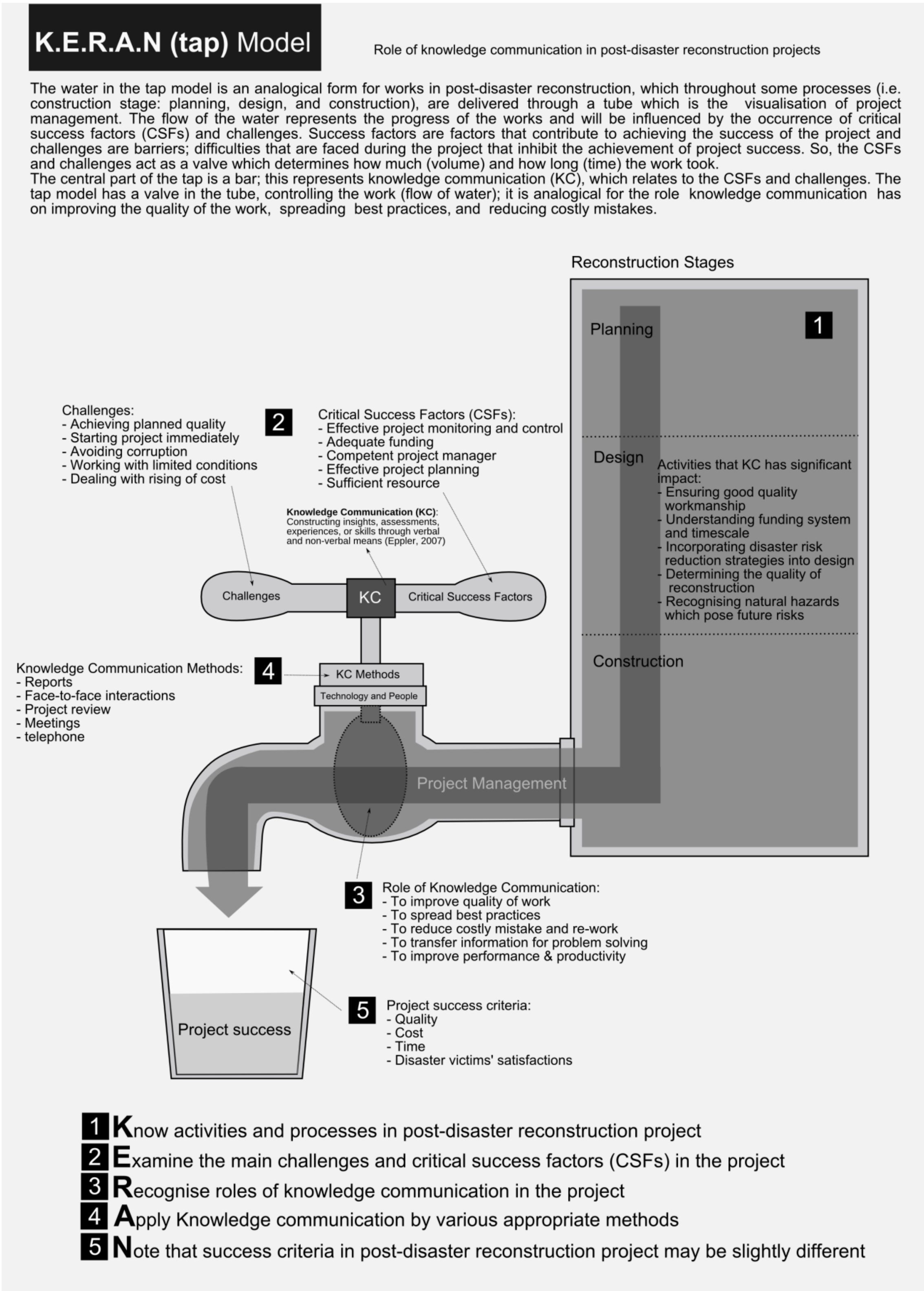

Figure 8-7 Final version of the KERAN (tap) model

The model was designed to fit onto one concise page and consists of the model's name, a description of the model, a definition of knowledge communication, and graphics of the model itself. The description in the model provides an explanation of the water and tap system which represents the processes in post-disaster reconstruction projects. By reading the description of the model and the fact that the tap is a daily, common occurrence, it is expected that users of the model will easily understand the role of knowledge communication. The components of the models are labelled numbers 1 to 5 and these numbers are associated with the name of the model, KERAN. By following the numbers 1 to 5, users will obtain a deeper understanding about the implementation of knowledge communication (KC). The KERAN word is an abbreviation for the following sentences, as depicted in Figure 8-7:

1. **K**now activities and processes in post-disaster reconstruction. As previously mentioned, the water in the model represents works in PDR projects which have three main stages: planning, design, and construction. The works are delivered through project management. The model also provides 5 main activities in PDR projects where knowledge communication has great impact or benefit.
2. **E**xamine the main challenges and critical success factors (CSFs) in the PDR project. The works in PDR projects may be affected by the occurrence of challenges and critical factors. This condition is visualised in the model as the tap which can be turned left or right, to open or shut the water or the works. The KERAN model presents 5 of the most significant challenges and 5 CSFs in PDR projects.
3. **R**ecognise the role of knowledge communication in the project. The role is presented as valve in tap model. Five main roles for knowledge communication are presented in the model: to improve the quality of work, to spread best practices, to reduce mistakes and re-works, to transfer information for problem solving, and to improve performance and productivity.
4. **A**pply knowledge communication to the project. There are various methods for communicating knowledge in post-disaster reconstruction projects; however this model provides 5 of the most effective methods: reports, face-to-face interactions, project reviews, meetings, and telephone calls.

5. **N**ote that the success criteria in diverse PDR projects may be slightly different. At the end of post-disaster reconstruction, the works will be judged a success or not. The project's success in the model is portrayed by the 'half full or half empty glass which indicates the subjectivity of the success criteria. However, the model provides four main criteria for project success. They are time, cost, quality, and disaster victims' satisfaction.

8.5. Summary

This chapter discussed the model development and presented the model of the role of knowledge communication in post-disaster reconstruction projects. The model was named the KERAN (tap) model, and is an analogical model which pictured the works in post-disaster reconstruction projects as water that flows through a pipe (which represents project management) and is controlled by a valve, which represents knowledge communication.

The first draft of the model was developed using information from the literature review and then this was developed further into the second draft model by informing information from the questionnaire survey. Furthermore, data analysis of the questionnaire survey and interviews reshape the draft of the model, and the final model was finalised after the validation process.

After finalising and presenting the model for this research, the next chapter will present the next product of this research: a guidance document on knowledge communication in post-disaster reconstruction projects.

CHAPTER 9. GUIDANCE ON ROLE OF KNOWLEDGE COMMUNICATION IN POST-DISASTER RECONSTRUCTION

9.1. Introduction

One of the objectives of the present research is to develop and validate a set of guidelines for improving the awareness and understanding of project managers involved in post-disaster reconstruction projects. This chapter explores the definitions of guideline documents, development processes of guidelines, and identifies the characteristics of good guidance documents.

9.2. Definition of guidance

Guidance is defined in the Oxford Dictionary of 'English in English Dictionaries & Thesauruses' as "advice or information aimed at resolving a problem or difficulty, especially as given by someone in authority".

Bimrose et al. (2004) imply guidelines are tools for helping the user to understand the needs, the goal and objectives, the barriers and how to overcome them and guidance to produce an action plan.

A process guide is a reference document for an intended process, providing guidance to facilitate participants through the process. Process guides contain, at least, process definitions, and may be extended by services for browsing and searching the definitions, storing process information, and providing expert guidance (Kellner et al., 1998).

Guidance can also be interpreted as documents to explain government regulations to the public (Austin Community College, 2011). Most guidance documents aim to help implementation of a rule. Donowa (2006) briefly describes how guidance documents help medical device manufacturers to integrate ISO 14971 into their quality systems. ISO 14971 is concerned with the application of risk management of medical devices, but manufacturers encountered some problems in implementing it, and also, the ISO does not integrate into quality-management systems. The guidance document assists manufacturers by providing concise and proven guidance in implementation of ISO 14971.

9.2.1. Characteristics of good guidance documents

There is an assumption that most people do not read regulations or that regulations are too difficult for them to read. The purpose of a guidance document is to explain and interpret the rule of a program to the public, a short guide to regulation or activity, so the document should be accurate and easy to understand (Austin Community College, 2011).

In order to have a document that is 'easy to understand', the guidelines should be written in plain language. The guidance document should also be accurate which means the guidelines should cover all conditions. If the guidance document is an explanation of a rule, there should be no additions and no ambiguity in the guidance document (Austin Community College, 2011).

The guidance document also acts as a shortened version of the regulations, so it usually consists of a few pages with the contents organised by subject headings. Guidance commonly uses the following format (Austin Community College, 2011):

- Title.

  The title should explain what the guidance document is about. It is important to include the date in the title since regulations often change and this gives the reader the current edition of the guidance document.

- Introduction.

  The purpose of the introduction is to familiarise the reader with the subject of the guidance document. Also, it usually has a disclaimer that explains that the guidance document is not a rule and therefore is not legally binding.

- Definition of terms and acronyms.
- A series of headings

A similar format is echoed by Intosai (2009), that suggests 4 sections in a guidance document. The first section is the introduction section which consists of acknowledgements and foreword, table of contents, summary tables and figures, executive summary and introduction. The second section is the background section which gives relevant information about the topic. The main section comprises the third section which is based on understanding the problems and their solution. The last section is the appendices that consist of references, glossary and acronyms, and abbreviations.

The BIS (Department for Business Innovation & Skills) defines eight golden rules for good guidance (BIS, 2009). It should be:

- Based on a good understanding by users.
- Designed with input from users and their representative bodies.
- Organised around the user's way of working.
- Easy for intended user to understand.
- Designed to provide users with confidence in how to comply with the law.
- Issued in good time.
- Easy to access.
- Reviewed and improved.

9.2.2. Example of a guidance document

The Health & Safety Executive (HSE) produced a document entitled 'A Guide to Measuring Health & Safety Performance' (HSE, 2001). The central topic in this document is the measurement of health & safety performance and HSE gives an explanation about the measurement by deploying questions of 'why', 'what', 'when', 'who', and 'how'. The structure of the guidance document is as in the following headings:

- Introduction. This section explains how the guidance will help, what is not covered in the guidance, and explains why the guidance is necessary.
- Why measure performance?
- What to measure;
- When to measure;
- Who should measure performance;

- How to measure performance;
- Reference;
- Further information and feedback.

In knowledge management, Bornemann et al. (2003) produced an illustrative guide to knowledge management. Illustrations that accompanied texts in every page of the 43 page guidance document help its readers to understand the concepts in knowledge management. In contrast, Egbu et al. (2004) produced a concise (ten pages) guidance document for contractors and consultants on the first steps in introduction to knowledge management.

9.3. The guidance document development

Developing guidance is based on evaluation of current practice, then identifying critical problem areas, analysing detailed operations, identifying best practice and implementing corrective solutions in a continuous improvement programme (Reiner, 2005).

The BIS (2009), in their guidance document, explain how to plan and design guidance documents which follow some rules that they called the 'eight golden rules of guidance'. They propose the following steps when designing guidance documents:

- The first step is identifying and engaging with stakeholders. Input from stakeholders on the design of guidance will help to ensure the guidance will work in practice. The stakeholders are individuals, organisations or companies who have an interest in, or will be affected by, the issues in the guidance. In this step it is important to identify and have a good understanding of those who will use the guidelines. This will help to design guidelines in an appropriate format and language and the guideline will have a good chance of reaching the target audience. Users' involvement in designing guidelines also helps to raise the effectiveness of the guidelines, because it meets the needs of the end user (BIS, 2009).
- The format and language of the guidance should be considered. The easier the guidance is to understand the more likely it will be followed correctly. The language used should be as easy to understand as

possible. Using acronyms and jargon which are not familiar to the end users should be avoided.

- The guidance should be in compact format, so the users can understand it in as short a time as possible. If the guidance is not already short and straightforward, a quick-start guide should be made available.
- In order to get better understanding, communication forms other than text can be used. Other technique which can be used are graphics, flowcharts, videos, question and answer section, and interactive tools.
- The guidance should contain a summary level backup providing more detail or technical information. A summary version allows the user to quickly view the content of the guidelines and assess the relevance of the guidance to them.
- It is also beneficial to include a case study in the guidelines, so the users can see how the guidelines will help them.

9.3.1. Contents of the guidance

The characteristics of a guidance document and its development have been discussed in the previous section. Safour (2011), in developing her guidance document, observed that most of the guidance was presented in question form or in bullet points with tables or diagrams.

After exploring the characteristics and examples of guidance documents, the guidance for knowledge communication in post-disaster reconstruction projects will be developed into a concise, brief document which can be easily read and understood by project managers.

The guidelines for the role of knowledge communication in post-disaster reconstruction projects will be divided into three main topics, and sub-divided into several subjects which cover the following issues:

- Introduction;
- Meaning of issues;
- Knowledge Communication Implementation;
- Other important issues.

After discussing the contents of the guidance document, the next section will present the considerations for formatting of the guidance document.

Format of the guidance document

The aim of the guidance document is to raise awareness by the project managers, so format of the document needs to be considered, in order to easily reach its reader. The final guidance document format is in electronic file in portable document format (pdf) which is standard format for the electronic exchange of documents (Adobe System Inc., 2006). The pdf file is easily distributed through email or put on a website, and also easy to print.

After completing the development of the content of the documents, the content of the document is formatted in Microsoft Publisher software to provide a professional layout. The pdf file is produced into two versions, one for distributing in email and websites and the other version is a booklet version which is ready to print and form a booklet.

9.4. Validation of the guidance

In order to refine the guidance document, a validation process follows development of the guidance. Considering the format of the guidance document in pdf (portable document format) file and validation method in previous research (Takim, 2005, Suresh, 2006, Safour, 2011), a questionnaire was chosen as a validation method.

The validation questionnaires were sent to project managers to provide their views and comments on the content, structure, user-friendliness and relevance and usefulness of the guidance document. The questionnaire for the guideline validation is presented in appendix G (page 376).

The guidance validation questionnaire asked the respondents for their opinion of the content, structure, user-friendliness, relevance, and usefulness of the guidance document, using a five scale (1 to 5). Number 1 indicates 'very poor' and at the other end of the scale, number 5, indicates 'very good'. The questionnaire was formatted in Microsoft Word software and provided check-boxes for the respondents' response. The questionnaire was sent out by email attachment to the respondents.

To obtain guidance validation the questionnaire was sent to 6 project managers. The responses from the project managers are presented in following table.

Table 9-1 Summary of guidance document validation

No	Criteria	Scale					Mean score
		1	2	3	4	5	
1	The content of the guidance is comprehensive	0	0	0	4	2	4.3
2	The structure of the guidance document is logical and easy to follow	0	0	1	3	2	4.2
3	The guidance document is relevant and useful	0	0	1	2	3	4.3
4	The guidance is in a user-friendly format and easy to use	0	1	1	0	4	4.2
5	Benefits of the guidance	0	0	2	2	2	4.0

The table above shows that all the mean scores are above 4, which indicates that the guidance document is relatively well planned. The guidance document is perceived to be good in the areas of comprehensiveness, good structure, good relevance, good format, and has high benefit.

However, the table also indicates a contradiction in the respondents' perception of question number 4. Although the question has a mean score of 4.2, which indicates a 'good' user-friendly format, one respondent rated it at 2 (poor) and another respondent rated it at 3 (fair). Comments received from the respondents suggest that the format should be more user-friendly and easier to use as a guidance document, as stated in the following comments:

> *"All activities and procedure should be easily available in "one page", for example, diagram and flowchart."*

> *"The guidance has a less user friendly format because the users must read all the pages, in detailed in order, to understand it. This guidance is also not attractive enough for people to be interested enough to read it. Perhaps, if the author adds some pictures it will be more interesting."*

The comments from the respondents were taken on board and the guidance document was improved. A one page summary in a flowchart format was provided; pictures and/or illustrations were added; bullets points and numbering in the document were also reformatted, thus, the guidance document is more easy to use and more attractive than previous one.

The final guidance is presented in appendix F, page 361.

9.5. Summary

This chapter presented the process of the development of the guidance documents and also presented the contents of the guidance document. The guidance document is developed from the model of the role of knowledge communication in post-disaster reconstruction and findings from the questionnaire survey and interviews. The final guidance document has covered the main topics that need to be understood on knowledge communication and post-disaster reconstruction projects. The guidance document also covers considerations, methods and barriers in communicating knowledge in a post-disaster reconstruction project.

CHAPTER 10. CONCLUSIONS AND RECOMMENDATIONS

10.1. Introduction

This chapter presents the overall conclusion and reflections towards the whole process of this research. It summarises the key findings and main conclusions of the study. The lessons learnt in conducting the research are highlighted and it offers recommendations for future research.

10.2. The research process

The overall research process can be divided into three distinct stages: literature review; data collection and analysis; and the development and validation of the model and the guidance document.

The literature review was the initial stage of this research where reviews of publications about three topics (knowledge management, project management, and disaster management) were conducted. The literature review helped to detect the research problems and to identify potential factors which related to research problems which in turn later served as a basis for questions for the questionnaire survey and the interviews.

The main data collection and analysis adopted a mix-method approach where a questionnaire survey was conducted concurrently with semi-structured interviews. Overall 143 questionnaires from 777 sent questionnaires were considered usable for the data analysis and these constituted a 21.7% response rate. Since it was of almost no financial benefits for the respondent to the questionnaire survey, the questionnaire survey in this research reflects the importance of having a good network in order to get higher questionnaire response rates. Follow-up actions after questionnaire distribution also helped to increase the response rate.

For the semi-structured interviews, 33 interviews have been conducted with participants from key PDR project stakeholders. This present research shows that using the Skype software for telephone interviews has some potential benefits compared to face-to-face interviews.

Data analysis is one of the biggest challenges in this research. Responses from respondents in returned questionnaires were carefully coded and input into SPSS software and then analysed by appropriate statistical methods. For the semi-structured interviews the transcription process of the interviews was a time-consuming process. It took three to five hours of transcription for a one hour interview, however the transcripts were uploaded into NVivo software, the software is very useful tool to store and categorise the interview data, as it assists in capturing meanings from the interview transcripts.

Implementing a mix-method, combining two methods, also implies combining two efforts. Hence, mix-method research is more time consuming than adopting a single method in research. The available time frame should be one of main considerations in choosing mixed or single method in research.

After the data analysis, the development of the model is a challenge. The challenge is how to produce a model and guidelines which are easy to understand and give benefits to its users. This present research suggests the KERAN (tap) model and sketch-plus-text form of guidance document, in order to raise the awareness as the aim of this research.

Findings across the research process are presented in the next section.

10.3. Conclusions of the research

As described in the aim and objectives section of this study (refer to page 7), this research aims 'to develop a conceptual model and a set of guidelines for improved awareness and understanding of the role of knowledge communication in effective PDR projects'. In order to achieve the aim, seven objectives are provided and executed which have been reported within previous chapters.

Examinations of findings across the objectives show that construction quality is the main theme in post-disaster reconstruction. This confirms the importance in post-disaster reconstruction project of quality of the product and that it will affect the capacity of the disaster-affected community towards the next disaster.

The main findings of the present research are in the following sub-sections, divided by research objectives.

10.3.1. Objective 1: Key roles and challenges faced by different stakeholders

When compared to stakeholders of construction projects in normal conditions, this research shows that NGOs/donors and disaster victims become important stakeholders in post-disaster reconstruction projects. The NGOs tend to promote community-based reconstruction which promotes involvement of the disaster victims in the reconstruction process.

There are some challenges in Post-disaster reconstruction projects, the most challenging according to this research are:

- To achieve planned construction quality. Achieving planned quality is becoming difficult in post-disaster reconstruction due to limited availability of materials and skilled workers, and insufficient supervision of work in the project.
- To start the construction project immediately. There is pressure from affected communities (disaster victims) to start the reconstruction project immediately so they can return to normal routine and conditions.
- To avoid corruption in the projects. A combination of pressure to start the project immediately, available funds from donors, and characteristics of Indonesian construction industry create opportunities for corruption in reconstruction projects.
- Working within limited conditions and facilities. Depending on the scale of the disaster, in the aftermath of the disaster most of public infrastructures and facilities have usually been damaged in the disaster.
- Dealing with rising of cost of materials and labour. As resources for reconstruction (building materials and human resources) usually become rare, there inevitably will be a rise in costs.

10.3.2. Objective 2: Nature of PDR projects impact on the effective management

The nature of projects after a disaster is arguably different with construction projects in normal conditions. It seems that there are more pressures on the management of a project in post-disaster reconstruction. There are some characteristics of the post-disaster reconstruction projects, e.g. complexity of the reconstruction project, chaotic conditions after the disasters, public pressure on the project, limited availability of resources, and unstable economic conditions. These natures of the project have a significant impact on the management of the projects. This research shows the nature of the post-disaster situation has a very high impact on controlling projects.

10.3.3. Objective 3: Critical success factors of PDR projects

This research has identified the five most critical factors of project success in post-disaster reconstruction projects:

- Effective project monitoring and control;
- Adequate funding;
- Competent project management;
- Effective project planning;
- Sufficient resources.

This survey also identifies the project success criteria for post-disaster reconstruction projects. The findings show the quality of construction is the most important criteria. However, this research also confirms that the satisfaction of the disaster victims is one of important success criteria in post-disaster reconstruction projects.

Furthermore, this research also shows that NGOs have a different view on project success criteria, the 'golden triangle' criteria (cost, time, and quality) are not as important as perceived by other stakeholders in post-disaster reconstruction projects.

10.3.4. Objective 4: Knowledge communication practices and techniques

This research investigated the methods and the barriers in knowledge communication in PDR projects. There are various methods that can be used in communicating knowledge and according to this research the five most frequently used methods are as follows:

- Meetings;
- Face-to-face interactions;
- Telephone;
- Reports;
- Project review.

However, findings of this research also show some particular methods are more frequently used by certain respondents and the methods are rated into the five-most frequently used by the respondents. Community of Practices (CoP) is more frequently used by the NGOs; mentoring is more frequently used by Governments; and recruitment is more frequently used by the consultants.

In terms of effectiveness, this research shows the five most effective knowledge communication methods are:

- Reports;
- Face-to-face interactions;
- Project review;
- Meetings;
- Telephone.

Findings on the frequency of use and the effectiveness of various knowledge communication methods indicate the reduced utilisation of IT-based methods.

This research also identified barriers in knowledge communication and the five significant barriers are:

- Too much information that has to be processed quickly;
- There is not enough time for collecting information or knowledge;
- Limited ability to grasp the knowledge, lack of prior knowledge;

- Inadequate infrastructure (e.g. ICT) for knowledge communication;
- Cultural difference (e.g. language).

10.3.5. Objective 5: Role of knowledge communication

This research investigated the role of knowledge communication in PDR projects and the results of the research show that knowledge communication has a significant role:

- To improve quality of work;
- To spread best practice among project participants;
- To reduce costly mistakes and re-works;
- To transfer information and knowledge for problem solving;
- To improve performance and productivity by sharing knowledge on product, process and people;

Although most of the respondents knew the importance of knowledge communication, the implementation for its use among project participants is limited to formal contact points, such as monthly meetings. The different positions of the participants and lack of trust among them prevent them from exploiting the benefits of knowledge communication.

Five significant knowledge communication impacts are seen when following activities of PDR projects: 'ensuring good quality workmanship', 'understanding funding system and timescale', 'incorporating disaster risk reduction strategies into design', 'determining the quality of reconstruction that was agreed by stakeholders', and 'recognising natural hazards which pose future risks'.

10.3.6. Objective 6: Development of the conceptual model

The research has synthesised relevant literature and examined findings from the questionnaire surveys and the interviews. It provided the foundation for the development of the model of the role of knowledge communication in post-disaster reconstruction projects.

The development of the model is presented in Chapter 8 and the model is named KERAN (tap) model. The model provides analogical representation of post-disaster reconstruction projects and provides critical success factors

(CSFs) and challenges, project success criteria, and knowledge communication methods and its roles in post-disaster reconstruction projects. The model should provide the project managers with the understanding about the role of knowledge management in post-disaster reconstruction projects.

10.3.7. Objective 7: Development of guidance document

In line with the development of the model, a guidance document is also developed to improve awareness and understanding of the project managers on knowledge communication in PDR projects. The guideline document consists of sections which cover topics on characteristics of PDR projects, and considerations, methods and barriers in knowledge communication.

10.4. Limitations of the study

Although the study has achieved some useful results, it also has some limitations. One major limitation is the difficulty in tracing organisations (specifically for contractor and consultant) that have experience in post-disaster reconstruction projects. This is due to few available databases. This study combined information from several sources to develop the respondent's database.

Another challenge in this study was the low level of response rate. This is because of the limited available database and reluctance of potential respondents to participate. Thus, this study was based on a relatively small sample.

The aim of this research (refer to section 1.3, page 7) is "to develop a conceptual model and a set of guidance documents for improved awareness and understanding of the role of knowledge communication". However, this research does not include a measurement of the level of awareness of project managers in post-disaster reconstruction regarding the role of knowledge communication. The researcher understands the importance of the level of awareness at the initial stage and the impact the model and the guidance has on project managers throughout the project. However, due to time constraints the measurement was not conducted. Knowledge management is a relatively new topic and more exploration is required regarding this topic in post-disaster reconstruction in general and in the context of Indonesia specifically (see Table 1-2, page 5). Therefore, it may be assumed that the level of awareness of knowledge communication in the Indonesian construction industry is poor. However, in the validation of the model and guidance document (refer to Table 8-1, page 285 and Table 9-1, page 297) there are questions that refer to the benefits of the model to the users awareness.

10.5. Recommendations

The outputs from this research are the KERAN model and the guidance document. Both of the products are recommended for use by project managers. It will help project managers to understand the process of post-disaster reconstruction and to understand knowledge communication in the reconstruction process. Governments, NGOs, and academia can also benefit from the model and the guidance document, as they are actively involved in the reconstruction process and the research output will help them to be aware of the role played by knowledge communication in PDR projects.

10.5.1. Recommendations for project managers

- This research shows that a competent project manager is one of the most important aspects for project success and also the research shows the nature of PDR mostly affects control of the project. This implies the project managers should have better knowledge and skills to face the challenges in PDR projects. Involving them in continuous professional development is recommended.
- Projects meetings in this research were found to have important positions as formal contact points between project participants and an effective method to exchange knowledge, thus the project managers should take the benefits of this method. The meetings should be planned and implemented effectively.
- Face-to-face interaction is also one of the important methods to communicate knowledge. It is suggested that project managers have to

improve their communication and social skills in order to get an effective face-to-face interaction.

- NGOs are becoming more important stakeholders in PDR projects which have more emphasis on satisfaction of the disaster victims. It implies that the project manager should have more consultation with the disaster victims or beneficiaries.
- The present research shows the important role of knowledge communication in enhancing the project performance. Thus it will be beneficial if project managers promote knowledge communication in the projects, by improving trust and providing opportunities to exchange the knowledge.

10.5.2. Recommendation for the government

- One of the findings of this research shows that effective project planning is one critical success factor in the post-disaster reconstruction project, which also echoes previous research that having a 'pre-disaster plan' increases the speed of reconstruction. It is recommended that the government should prepare and should have that plan as preparedness for the next disaster.
- After the disaster, resources for the reconstruction become limited and the prices usually increase. The government should provide logistics frameworks to overcome this problem. Alternatively, the government should set proper owner estimate costs in government funded projects in post-disaster reconstruction to accommodate the rising costs.

10.5.3. Recommendation for NGOs

- Working with the disaster affected community as reconstruction projects may take longer time to finish the project with the provided construction skills of the community. NGOs should allocate a more flexible timeframe in project planning, subjected to donors' budget timeframe.
- As NGOs bring new knowledge into disaster-affected community and regards to findings on knowledge barriers in this research, it is recommended that the NGOs hire local staff rather than foreign staff.

- In order to promote community-based reconstruction, NGOs should also give more attention to knowledge transfer about seismic-safe building design and house construction methods to the community. This would ensure that constructed houses had adequate quality.

10.5.4. Recommendation for academics

- Post-disaster reconstruction is a relatively new context in the Indonesian construction industry. Academia may play an important role in disaster management by working closely with the construction industry to understand the effect of disasters to construction.
- One of the findings in this research shows that there is a lack of field-related experience from fresh graduate workers. It is suggested that the students in construction education should have more involvement in construction work, for example by field work or apprenticeship.
- The research found that one of the challenges in post-disaster reconstruction is the inadequate level of skills and knowledge of the construction workers. It suggests that academics should play a role as a training provider for the construction workers with collaboration with related governmental departments.

10.6. Future research

After reflection on the journey of this research and the findings, it is recommended that the following topics are important to explore in future research:

- This research suggests satisfaction of disaster victims is also an important project success criterion beside the 'golden triangle' criteria, thus there is a need for a specific research construction quality of PDR projects. The research could cover the trade-off and interplay between cost, time, quality, and disaster-victims' satisfaction. A standard document for specifications of works may be a product of this research.
- The present research shows the low level of workmanship of construction workers which may be caused by low level education. On the other hand there is knowledge communication which may improve processes in

construction. It is necessary to conduct further research on knowledge communication on Indonesia construction workers to find out the effective methods in communicating knowledge from 'the knower' to the need (construction worker).

- There is still little research on knowledge management in the Indonesian construction industry. Future studies could explore the attributes to implementation of formal or non-formal approaches of knowledge management.

The research also highlights that corruption is one of the challenges in post-disaster reconstruction projects. Until now very little research has been conducted which explores corruption in construction projects in Indonesia. Research on how to reduce corruption is needed in order to reduce construction costs and get better construction quality.

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Appendix A. Research ethical approval

Academic Audit and Governance Committee

Research Ethics Panel
(REP)

THE UNIVERSITY OF SALFORD

MEMORANDUM

To	Benny Hidayat
cc:	Prof Charles Egbu, Prof Mike Kagioglou
From	Jayne Hunter, Contracts Administrator
Date	29th September 2011

Subject:	**Approval of your Project by REP**
Project Title:	**The Role of Knowledge Communication in Effective Project Management of Post-disaster Reconstruction Projects in Indonesia**
REP Reference:	**REP11/136**

Following your responses to the Panel's queries, based on the information you provided, I can confirm that they have no objections on ethical grounds to your project.

If there are any changes to the project and/or its methodology, please inform the Panel as soon as possible.

Regards,

Jayne Hunter
Contracts Administrator

For enquiries please contact
Jayne Hunter
Contracts Administrator
Contracts Office
Enterprise Division
Faraday House
Telephone: 0161 295 3530 Facsimile: 0161 295 5494
E-mail: j.hunter@salford.ac.uk

Appendix B. Invitation emails and research information sheet

Benny Hidayat

From: Benny Hidayat (Salford University) [b.hidayat@edu.salford.ac.uk]
Sent: 07 July 2011 15:14
To: [redacted]
Subject: Invitation to become potential respondent in post-disaster reconstruction research
Attachments: research information sheet.pdf

Importance: High

Dear Mr. [redacted]

My name is Benny Hidayat, and I am a PhD student at the University of Salford, Manchester, UK. My research is on research on knowledge communication in post-disaster reconstruction projects in Indonesia. This email is an introduction to my research.

Your email address was obtained from RAND (Recovery Aceh Nias Database, http://rand.brr.go.id) and I believe your organisation had involved in the post-tsunami reconstruction.

My research objectives are to focus on investigating challenges, critical success factors in the reconstruction and also exploring current practice of knowledge communication in the reconstruction, from a project management of construction facility perspective. The aim of the research is to develop a conceptual model and a set of guidance for improved awareness and understanding of the role of knowledge communication in the reconstruction. This research hopefully will contribute to more effective post-disaster reconstruction in Indonesia.

However this research needs your support as a potential respondent in my survey. I will distribute questionnaire (via postal/online method) and conduct interview in November 2011. I believe your experience in reconstruction is valuable and will contribute in this research. Also if you have another email contacts (from NGO, government agency, contractor) that involved in post-disaster reconstruction in Indonesia, please share with me.

Please be assured that both your identity and your organisation you work will remain strictly confidential. Thank you very much.

Yours faithfully,

Benny Hidayat

Benny Hidayat
Room 344, Maxwell Building
School of Build Environment, The University of Salford
The Crescent, Salford
Greater Manchester M5 4WT
United Kingdom
email: b.hidayat@edu.salford.ac.uk

1

RESEARCH INFORMATION SHEET

You are being invited as a participant in this research. Before you decide to participate or not, please read following information to help your decision. This information sheet contains brief information about the research. If you have question about this research please contact the researcher at provided address below. Thank you for reading this.

About the research

Title:

The Role of Knowledge Communication in Effective Management of Post-disaster Reconstruction Project in Indonesia

Student/researcher: Benny Hidayat

Email address: B.Hidayat@edu.salford.ac.uk

School: School of Built Environment (SoBE)

The University of Salford

Supervisor: Prof. Charles Egbu

Course of Study: Doctoral (PhD)

Funding: This research as mandatory task as PhD student and the researcher (the student) is funded by scholarship from Ministry of Education, Government of Republic of Indonesia.

Purpose of the Study

Purpose of the study is to develop a conceptual model and a set of guidance for improved awareness and understanding of the role of knowledge communication in the effective project management of post disaster reconstruction projects

The main research objectives focus on indentifying challenges and critical success factors in the reconstruction projects and explore employment of knowledge communication practices in the reconstruction projects.

Why was I selected as the participant?

You have been selected as one of participants in this research because your organisation has been involved in post-disaster reconstruction project in Indonesia.

Do I have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and will be asked to sign a consent form. Furthermore, if you decide to be involved now but at later stage thinking of to withdraw without giving a reason you are allowed to do so. If you refuse to take part at all, it will not affect your job or any circumstance.

What will happen to me if I want to take part?

I will send questionnaire (postal/online/email attachment as participant preference) or/and conduct semi structured interview that focus on knowledge communication in effective management of post-disaster reconstruction project. Filling the questionnaire will take approximately 30 minutes and the interview will be varying among 30 to 60 minutes.

Will my details information in this research keep confidential?

All information collected from questionnaires and interviews will be kept strictly confidential. You will identified by a 'research code' (e.g. PQ01) and false name. Any information about your detail will be removed from reports and publications. This research follows Salford University Research Ethics Guidance.

What the option do I have?

- Participate or not.
- During interview you can ask me to stop at any time and resume later (or not) as you wish.
- You can refuse to answer any question in interview or questionnaire.
- You can ask me not to publish any information you have given in report and publication.

Thank you for taking part in my research project.

THE UNIVERSITY OF SALFORD

Information sheet. Version : ENG-A1

LEMBARAN INFORMASI RISET

Anda diundang untuk berpatisipasi dalam riset ini. Sebelum anda memutuskan untuk ikut berpatisipasi atau tidak dalam riset ini, mohon dibaca terlebih dahulu informasi berikut. Jika ada pertanyaan tentang riset ini anda bisa bertanya ke peneliti dengan alamat tertera di bawah

Tentang Riset

Judul :

The Role of Knowledge Communication in Effective Management of Post-disaster Reconstruction Project in Indonesia

Mahasiswa/peneliti: Benny Hidayat
Alamat Email: B.Hidayat@edu.salford.ac.uk
School of Built Environment (SoBE)
The University of Salford
Pembimbing: Prof. Charles Egbu
Jenis program: Doctoral (PhD)
Sumber dana: Riset ini merupakan bagian terpenting dari program PhD dimana peneliti/mahasiswa dibiayai dengan beasiswa dari Kementrian Pendidikan Nasional, pemerintah Republik Indonesia.

Tujuan Riset

Tujuan dari riset ini adalah untuk mengembangkan model konseptual dan satu set arahan untuk meningkatkan kepedulian dan pemahaman terhadap peran knowledge communication dalam manajemen proyek yang efektif di rekonstruksi setelah bencana.

Kenapa saya dipilih sebagai responden?

Anda dipilih sebagai responden dalam riset ini karena organisasi/perusahan anda pernah terlibat dalam proyek rekonstruksi setelah bencana.

Apakah saya harus ikut?

Semuanya tergantung pada anda, apakah mau ikut atau tidak. Jika anda memutuskan untuk ikut, anda diminta untuk menyimpan lembara ini dan menandatangani form persetujuan.

Apabila anda memutuskan untuk ikut berpatisipasi sebagai responden dalam riset ini, setiap saat anda mundur ikut berpatisipasi. Apabila anda memutuskan tidak ikur serta, hal tersebut tidak akan berpengaruh terhadap apa pun.

Jika saya ikut survey ini, apa selanjutnya?

Saya akan melakukan semi-structured interview dan atau kuesioner yang focus pada knowledge communication dalam efektif management di proyek rekonstruksi setelah bencana. Pengisian kuesioner kira-kira membutuhkan waktu 30 menit dan interview kira-kira antara 30 – 60 menit. Anda bias berhenti kapan pun.

Apakah informasi yang saya berikan dalam riset ini bersifat rahasia?

Semua informasi yang dikumpulkan dari kuesioner dan interview akan dijaga kerahasisaannya. Anda akan diidentifikasi dengan sebuah kode (contoh PQ01) dan atau nama fiktif. Semua informasi tentang detail anda akan dihilangkan dari laporan dan publikasi.

Apa saja pilihan yang saya punya?

- Berpatisipasi atau tidak.
- Selama interview anda bisa berhenti kapan saja, bisa dilanjutkan nanti atau tidak sama sekali.
- Anda bisa menolak menjawab pertanyaan manapun di interview atau kuesioner.
- Anda bisa meminta saya untuk tidak memuat sembarang informasi yang telah dberi di laporan dan publikasi.

Terima kasih sudah berpatisipasi dalam riset saya ini.

Information sheet. Version : INA-A1

Appendix C. The questionnaire

QUESTIONNAIRE

REF

N	G	D	x	x

University of Salford MANCHESTER

SURVEY ON THE ROLE OF KNOWLEDGE COMMUNICATION IN EFFECTIVE PROJECT MANAGEMENT OF POST- DISASTER RECONSTRUCTION PROJECTS IN INDONESIA

POSTAL RETURN ADDRESS:
BENNY HIDAYAT
JURUSAN TEKNIK SIPIL,
FAKULTAS TEKNIK
UNIVERSITAS ANDALAS,
KAMPUS UNAND LIMAU MANIS
PADANG, SUMATRA BARAT

Email: B.Hidayat@edu.salford.ac.uk

Overview of the survey

This survey is part of on an on-going PhD research study at the University of Salford. The aim of the research is to develop a conceptual model and a set of guidance for improved awareness and understanding of the role of knowledge communication in effective project management of post disaster reconstruction projects.

Questionnaire instructions

- **There are no right or wrong answers** to questions in this survey. Select the most appropriate answer by clicking a box (☒) for each question **based on your view and experience in post-disaster reconstruction projects**.
- There may be questions which appear irrelevant or impertinent. However, **it is necessary in this study that all questions are answered**, as the questionnaire is designed to achieve particular research objectives.
- If there are questions which you are unwilling or unable to answer, skip them and continue with the remaining questions.
- **Please remember that your identity and that of your organisation will remain strictly confidential.**

SECTION A. GENERAL INFORMATION

Select the most appropriate answer by clicking one box (☒) for each question based on your view and experience

1. What is your sex?
   ☐ Male ☐ Female
2. Please indicate (by clicking ☒) your education background:
   ☐ High school ☐ Diploma ☐ Undergraduate
   ☐ Post graduate ☐ Other, please specify.....................
3. Which category best represents your organisation? Please click (☒) one box only.
   ☐ Contractor ☐ NGO/Donors
   ☐ Government ☐ Consultant
   ☐ Other, please specify.....................
4. What major role do you currently play in post disaster reconstruction project? Please click (☒) one box only.
   ☐ Project manager ☐ Construction manager
   ☐ Consultant ☐ Engineer/designer
   ☐ Project Owner/Client ☐ Other, please specify......................
5. How long have you worked in a project management role in general?
   ☐ Less than 1 year ☐ 1-5 years
   ☐ 6-10 years ☐ 11-15 years
   ☐ 16-20 years ☐ More than 20 years
6. How long have you been involved in managing post-disaster reconstruction projects?
   ☐ None ☐ Less than 1 year ☐ 1-5 years ☐ 6-10 years
   ☐ 11-15 years ☐ 16-20 years ☐ More than 20 years
7. Which of the following post disaster reconstruction projects have you been involved with? Please click (☒) one box only.
   ☐ None ☐ Aceh & Nias reconstruction
   ☐ Yogyakarta reconstruction ☐ Padang (west-Sumatra) reconstruction
   ☐ Other, please specify ....

1/10

SECTION B. CHALLENGES IN POST DISASTER RECONSTRUCTION

The purpose of this section is to explore the level of challenge faced during the **construction stage** of post-disaster reconstruction projects. Please select the most appropriate answer by clicking one box (☒) for each question based on your view and experience.

8. Based on your experience of the last 10 years of post-disaster reconstruction, what would you say is the **most challenging type of construction** your organisation has been involved in? Please click (☒) only one.

- ☐ Housing
- ☐ Office
- ☐ Commercial building (e.g. shopping centre, bank)
- ☐ Dockyard (e.g. seaport)
- ☐ Road & Bridge
- ☐ School
- ☐ Religious building (e.g. Mosque, church)
- ☐ Other, please specify ....

9. Using your experience of post-disaster reconstruction, please indicate (by clicking ☒) **the level of challenge** which the variables below pose during the construction stage of post-disaster reconstruction projects:

Meaning of scale of challenges:
1 (Not challenging at all), 2 (Less challenging), 3 (Fairly challenging), 4 (Challenging), 5 (Very challenging)

No	Variables	Level of Challenging: Not 1	Challenging → 2	3	4	Very 5
1	To have **good coordination** with other stakeholders/parties	1☐	2☐	3☐	4☐	5☐
2	Securing **adequate resources** (material and machinery)	1☐	2☐	3☐	4☐	5☐
3	Securing an **adequate labour force**	1☐	2☐	3☐	4☐	5☐
4	Improving the **capacity of local government/agency**	1☐	2☐	3☐	4☐	5☐
5	Achieving planned **construction quality**	1☐	2☐	3☐	4☐	5☐
6	Having **adequate quality inspection** of construction work	1☐	2☐	3☐	4☐	5☐
7	Building construction projects that **culturally fit the needs of local people**	1☐	2☐	3☐	4☐	5☐
8	Putting in place an **appropriate organisation structure**	1☐	2☐	3☐	4☐	5☐
9	Minimising the negative effects of **political instability**	1☐	2☐	3☐	4☐	5☐
10	Finding **suitable land/location** for the reconstruction project	1☐	2☐	3☐	4☐	5☐
11	Following **regulations** related to the reconstruction	1☐	2☐	3☐	4☐	5☐
12	Securing **finance** for the reconstruction project	1☐	2☐	3☐	4☐	5☐
13	Improving **information and communication** processes	1☐	2☐	3☐	4☐	5☐
14	Dealing **with rising costs** of materials and labour	1☐	2☐	3☐	4☐	5☐
15	**Starting the construction project timely/immediately**	1☐	2☐	3☐	4☐	5☐
16	Establishing **property rights**	1☐	2☐	3☐	4☐	5☐
17	Avoiding **corruption** in the reconstruction process	1☐	2☐	3☐	4☐	5☐
18	Having **clear accountability** in the reconstruction process	1☐	2☐	3☐	4☐	5☐
19	Having **clear transparency** in processes in the reconstruction project	1☐	2☐	3☐	4☐	5☐
20	Working with **limited** or **poor conditions, facilities and infrastructure at project location.**	1☐	2☐	3☐	4☐	5☐
21	Working with **poor or restricted access** to location	1☐	2☐	3☐	4☐	5☐

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10. Please indicate the **degree of involvement** of key stakeholders in different stages of post-disaster reconstruction project. Please indicate by clicking (☒) one box only.

Meaning of scale of involvement:
1 (No involvement), 2 (Little involvement), 3 (Average involvement), 4 (Moderate involvement), 5 (Full involvement)

No	Stakeholders	Planning stage					Design stage					Construction stage				
		No → Involve → Full					No → Involve → Full					No → Involve → Full				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1	Contractor	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
2	Client	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
3	Consultant	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
4	Disaster victim	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐

11. Please indicate the **degree of effectiveness** of key stakeholders' involvement in different stages of post-disaster reconstruction project. Please indicate by clicking (☒) one box only.

Meaning of scale of effectiveness:
1 (Not effective at all), 2 (Less effective), 3 (Fairly effective), 4 (Effective), 5 (Very effective)

No	Stakeholders	Planning stage					Design stage					Construction stage				
		Not → Effective → Very					Not → Effective → Very					Not → Effective → Very				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1	Contractor	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
2	Client	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
3	Consultant	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
4	Disaster victim	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐

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SECTION C. PROJECT SUCCESS CRITERIA & CRITICAL SUCCESS FACTORS

Select the most appropriate answer by clicking the box (☒) for each question based on your view and experience.

12. The following table lists the criteria for measuring the success of a reconstruction project. Based on your opinion, please indicate by clicking (☒) the **level of importance** of the following criteria as a measurement of success of post-disaster reconstruction projects:

Meaning of scale of importance:
1 (Not important at all), 2 (Less important), 3 (Fairly important), 4 (Important), 5 (Very important)

	Success Criteria	Level of Importance				
		Not		Important →		Very
		1	2	3	4	5
1	Completion of reconstruction project within the allocated time period	1☐	2☐	3☐	4☐	5☐
2	Completion of reconstruction project within the budgeted cost	1☐	2☐	3☐	4☐	5☐
3	Completion of reconstruction project within specified quality	1☐	2☐	3☐	4☐	5☐
4	Stakeholders satisfaction	1☐	2☐	3☐	4☐	5☐
5	End user (disaster victims) satisfaction with reconstruction process	1☐	2☐	3☐	4☐	5☐
6	End user (disaster victims) satisfaction with final product	1☐	2☐	3☐	4☐	5☐
7	Minimum disputes and conflicts between stakeholders	1☐	2☐	3☐	4☐	5☐

13. The success of post-disaster reconstruction projects might be influenced by occurrence of the conditions or factors, stipulated in the following table. Please indicate by clicking (☒) the **Criticality** of the factors for successful post-disaster reconstruction projects.

Meaning of scale of importance:
1 (Not critical at all), 2 (Less critical), 3 (Fairly critical), 4 (Critical), 5 (Very critical)

	Critical Success Factors	Level of Criticality				
		Not		Critical →		Very
		1	2	3	4	5
1	Effective project planning	1☐	2☐	3☐	4☐	5☐
2	Effective project monitoring and control	1☐	2☐	3☐	4☐	5☐
3	Competent project manager	1☐	2☐	3☐	4☐	5☐
4	Sufficient resources	1☐	2☐	3☐	4☐	5☐
5	Skilled and sufficient project team	1☐	2☐	3☐	4☐	5☐
6	Support from top management/parent company	1☐	2☐	3☐	4☐	5☐
7	Appropriate project coordination	1☐	2☐	3☐	4☐	5☐
8	Active involvement of stakeholder/community	1☐	2☐	3☐	4☐	5☐
9	Good communication	1☐	2☐	3☐	4☐	5☐
10	Good written contract	1☐	2☐	3☐	4☐	5☐
11	Learning from previous experience	1☐	2☐	3☐	4☐	5☐
12	Use of technology and IT	1☐	2☐	3☐	4☐	5☐
13	Adequate funding	1☐	2☐	3☐	4☐	5☐
14	Adequate consultation and coordination	1☐	2☐	3☐	4☐	5☐
15	Political stability	1☐	2☐	3☐	4☐	5☐
16	Less the negative influence of the physical environment	1☐	2☐	3☐	4☐	5☐
17	Manageable size and complexity of project	1☐	2☐	3☐	4☐	5☐
18	Economic stability	1☐	2☐	3☐	4☐	5☐
19	Less bureaucracy in the reconstruction process	1☐	2☐	3☐	4☐	5☐
20	Good tendering method	1☐	2☐	3☐	4☐	5☐

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14. Please indicate by clicking (☒) the **degree of impact** the nature of post-disaster reconstruction has on effective management of post-disaster reconstruction projects:

    14A: The **degree of impact** the variables have on **planning** in post-disaster reconstruction projects
    14B: The **degree of impact** the variables have on **organising resources** in post-disaster reconstruction projects
    14C: The **degree of impact** the variables have on **directing people** in post-disaster reconstruction projects
    14D: The **degree of impact** the variables have on **controlling the project** in post-disaster reconstruction projects

    Meaning of scale of impact:
    1 (No impact at all), 2 (Low impact), 3 (Little impact), 4 (Some impact), 5 (A very high impact)

No	Variable	14A. Level of impact on planning					14B. Level of impact on organising resources					14C. Level of impact on directing people					14D. Level of impact on controlling the project				
		Impact No → Very large					Impact No → Very large					Impact No → Very large					Impact No → Very large				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1	Complexity in terms of number of parties involved	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
2	Chaotic conditions	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
3	Public pressure to finish quickly	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
4	Limited availability of relevant infrastructural support (e.g. water, electricity, telephone, road)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
5	Unstable economic conditions	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐

SECTION D. KNOWLEDGE COMMUNICATION

Construction activity is based on knowledge (insight, assessments, experiences, or skills) of stakeholders, built upon the interaction between them. This section identifies knowledge communication practices in post-disaster reconstruction project. **Knowledge communication is defined as *activity of interactively conveying and co-constructing insights, assessments, experiences, or skills through verbal and non-verbal means.***

15. By drawing on your experience, please indicate (by clicking the box☒) the **frequency of use** of different knowledge communication methods used by stakeholders in different stages of post-disaster reconstruction projects.
    Meaning of scale of frequency:
    1 (Never), 2 (Rarely), 3 (Sometimes), 4 (Very frequently), 5 (Always)

No	Knowledge Communication Methods	Planning stage					Design stage					Construction stage				
		Frequency of use					Frequency of use					Frequency of use				
		Never → Always					Never → Always					Never → Always				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1	Face-to-face interactions	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
2	Trainings	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
3	Brainstorming	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
4	Community of practice (CoP) (a group of people who share an interest)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
5	Apprenticeship	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
6	Recruitment	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
7	Project review/Lesson learned	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
8	Mentoring	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
9	Seminars	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
10	Meetings	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
11	Intranet (private network)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
12	Telephone	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
13	Internet	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
14	Groupware (program that help people work together collectively while located remotely from each other)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
15	Knowledge base (Repositories that store knowledge about a topic in a concise and organized manner, e.g. in books, website)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
16	Taxonomy (collection of terms in organisation)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
17	Emails	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
18	Document management system	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
19	Electronic discussion forum	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
20	Reports	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐

16. By drawing on your experience, please indicate (by clicking the box☒) the **level of effectiveness** of different knowledge communication methods between stakeholders in different stages of post-disaster reconstruction projects.
Meaning of scale of effectiveness:
1 (Not effective at all), 2 (Less effective), 3 (Fairly effective), 4 (Effective), 5 (Very effective)

No	Knowledge Communication Methods	Planning stage					Design stage					Construction stage				
		Effective					Effective					Effective				
		Not	→			Very	Not	→			Very	Not	→			Very
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1	Face-to-face interactions	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
2	Trainings	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
3	Brainstorming	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
4	Community of practice (CoP) (a group of people who share an interest)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
5	Apprenticeship	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
6	Recruitment	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
7	Project review/Lesson learned	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
8	Mentoring	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
9	Seminars	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
10	Meetings	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
11	Intranet (private network)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
12	Telephone	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
13	Internet	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
14	Groupware (program that help people work together collectively while located remotely from each other)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
15	Knowledge base (Repositories that store knowledge about a topic in a concise and organized manner, e.g. in books, website)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
16	Taxonomy (collection of terms in organisation)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
17	Emails	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
18	Document management system	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
19	Electronic discussion forum	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
20	Reports	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐

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17. The barriers to knowledge communication are listed below.

In section 17 A: Please indicate by clicking the box (☒) the **level of influence of the barriers to effective knowledge communication.**
Meaning of scale of influence: 1 (Not influential at all), 2 (Less influential), 3 (Fairly influential), 4 (Influential), 5 (Very influential)

In section 17 B: Please indicate by clicking the box (☒) the **frequency of occurrence** of the **knowledge communication barriers** in post-disaster reconstruction.
Meaning of scale of frequency: 1 (Never), 2 (Rarely), 3 (Sometimes), 4 (Very frequently), 5 (Always)

	Barriers	Section 17 A Influential (No → Very)					Section 17 B Frequency (Never → Always)				
		1	2	3	4	5	1	2	3	4	5
1	There is not enough time for collecting information or knowledge	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
2	Refused knowledge from outside because of pride of group/organisation	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
3	Too much information that has to be processed quickly	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
4	Limited ability to grasp the knowledge, lack of prior knowledge	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
5	Valued information/knowledge from outside more than inside organisation	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
6	Refusal to share knowledge because of fear about job security	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
7	Using specialised language, not common language, in communication	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
8	Assuming the other participant(s) have similar understanding of an issue	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
9	Poor relationship between participants, so there is inadequate trust	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
10	Using inappropriate channel or media in communication	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
11	Cultural difference (e.g. language)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
12	Lack of motivation to seek or share knowledge	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
13	Inadequate infrastructure (e.g. ICT) for knowledge communication	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
14	Lack of time to share knowledge	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
15	Hierarchical organisational structure inhibiting knowledge communication	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐

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18. In your view, and based on your experiences, please indicate the **level of contribution** which knowledge communication plays **in effective project management of post-disaster reconstruction projects.** Please indicate by clicking (☒) one box only.

Meaning of scale of contribution:
1 (No contribution at all), 2 (Low level contribution), 3 (Little contribution), 4 (Some contribution), 5 (A very high contribution)

	Knowledge Communication Role	Level of Contribution				
		No	Contribution →			Very high
		1	2	3	4	5
1	**To collaborate and share knowledge** and expertise to improve understanding among project participants	1☐	2☐	3☐	4☐	5☐
2	To **identify** and **fulfil knowledge requirement/gap** in the project	1☐	2☐	3☐	4☐	5☐
3	To **distribute knowledge among project teams** for realising design	1☐	2☐	3☐	4☐	5☐
4	To **spread best practice** among project participants	1☐	2☐	3☐	4☐	5☐
5	**To improve decision making** by exchanging lessons learned and experience gained among participants in the projects	1☐	2☐	3☐	4☐	5☐
6	To **build networks** and prevent interaction deterioration	1☐	2☐	3☐	4☐	5☐
7	To improve **project responsiveness**	1☐	2☐	3☐	4☐	5☐
8	To improve **performance and productivity** by sharing knowledge on product, process and people	1☐	2☐	3☐	4☐	5☐
9	To **disseminate values and cultures** of the project	1☐	2☐	3☐	4☐	5☐
10	To **reduce costly mistake and re-work**	1☐	2☐	3☐	4☐	5☐
11	To transfer information and knowledge for **problem solving**	1☐	2☐	3☐	4☐	5☐
12	To **improve quality** of work	1☐	2☐	3☐	4☐	5☐

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19. In your view, and based on your experiences, please **indicate the level of impact** that **knowledge communication** (conveying and co-constructing insights, assessments, experiences, or skills through verbal and non-verbal means) has on post-disaster reconstruction activities. Please indicate by a clicking (☒) one box only.
Meaning of scale of impact:
1 (No impact at all), 2 (Low impact), 3 (Little impact), 4 (Some impact), 5 (A very high impact)

	Post-disaster project activity	Level of Impact				
		No	impact →			Very High
		1	2	3	4	5
1	Understanding the impact and context of disaster	1☐	2☐	3☐	4☐	5☐
2	Understanding government structure and regulations	1☐	2☐	3☐	4☐	5☐
3	Understanding funding system and timescale	1☐	2☐	3☐	4☐	5☐
4	Identifying the beneficiaries	1☐	2☐	3☐	4☐	5☐
5	Determining the most appropriate assistance	1☐	2☐	3☐	4☐	5☐
6	Establishing partnership with other stakeholders	1☐	2☐	3☐	4☐	5☐
7	Recognizing natural hazards which pose future risks	1☐	2☐	3☐	4☐	5☐
8	Selection of appropriate sites for reconstruction	1☐	2☐	3☐	4☐	5☐
9	Resolving issues of land tenure	1☐	2☐	3☐	4☐	5☐
10	Physical planning, integrating houses with services and public buildings	1☐	2☐	3☐	4☐	5☐
11	Determining of appropriate types of construction	1☐	2☐	3☐	4☐	5☐
12	Determining quality of reconstruction that agreed by stakeholders	1☐	2☐	3☐	4☐	5☐
13	Minimising the environmental impact of reconstruction	1☐	2☐	3☐	4☐	5☐
14	Incorporating disaster risk reduction strategies into design	1☐	2☐	3☐	4☐	5☐
15	Design structural and architectural features of building	1☐	2☐	3☐	4☐	5☐
16	Determining the method of implementation (e.g. self build, contractor based)	1☐	2☐	3☐	4☐	5☐
17	Construction management	1☐	2☐	3☐	4☐	5☐
18	Maintaining the availability of good quality material	1☐	2☐	3☐	4☐	5☐
19	Ensuring good quality workmanship	1☐	2☐	3☐	4☐	5☐

SECTION E. CLOSING

Thank you very much for taking the time to complete this questionnaire. If you have any queries, please contact **Benny Hidayat** by telephone +447540947767 or email b.hidayat@edu.salford.ac.uk.

A. RESULT & FINDINGS
If you want to receive a summary of the result of this survey, please complete the following contact details:

Name : ....

Email : ....

THANK YOU

For your participation in this research

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Appendix D. The interview questions

SEMI STRUCTURED INTERVIEW

Date of interview : ..../..../.....

Time of interview : from .... to.........(......minutes)

Preliminary Details

Name of interviewee : ....

Name of organisation : ....

Job title/position : ....

No of years experience : ....

Introduction to the interview

Firstly, thank you for giving me the opportunity to interview you and for taking time out of your busy schedule to participate in this study.

This interview is part of a PhD study being conducted at the University of Salford, which hopes to explore, in some, detail the role of knowledge communication in post-disaster reconstruction (PDR) projects.

Before we commence, I would like to assure you that this study is part of a PhD programme at the university. There is no commercial benefit attached to this research. It is purely for academic purposes only.

If you agree, I would be like to record this interview, to allow me to go back and listen to it in more detail at the interview analysis stage. Please be assured that this interview will be confidential, your identity and organisation will not be revealed in any research report or publication. Also, please feel free to let me know if there are particular instances where you would want me to temporarily switch of the recorder, perhaps in areas of discussion which you think are sensitive or you feel should be discussed off the record.

Roles and Challenges in post-disaster reconstruction projects

1. Could you please explain to me how your organisation is involved in post-disaster reconstruction and what are your organisation's roles in post-disaster reconstruction projects?

1

2. Given your experience of post-disaster reconstruction project, can you please explain what is the most challenging aspect in the project?

The nature of post-disaster reconstruction projects and their affect on effective project management

3. In your opinion what are the differences of project management in normal condition and project management in after disaster?
4. Considering the complex nature of post-disaster reconstruction projects, could you please explain to what extent the nature of the project affects effective project management, i.e. planning; organising resources, directing people; and project control?

Critical Success Factors (CSFs)

5. In a post-disaster reconstruction project, taking into consideration the different stages, i.e. planning and construction, could you please tell me what critical factors most affect the success of project and why?
6. In your view, what is the most important criterion for success of post-disaster reconstruction project?

Knowledge Communication

7. In your experience, and bearing in mind the different phases of the reconstruction process, what do you consider to be the best way to communicate knowledge such as experience and insight?
8. What are the main barriers in communicating the knowledge?
9. In your experience of post-disaster reconstruction projects, what role does communicating knowledge, such as insight and experience, have on the effective management of post-disaster reconstruction?
10. In your opinion, to what extend is the importance of knowledge communication in post-disaster reconstruction project? You may use scale 1 to 10, where 1 is "not important at all" and 10 is "very important"

2

Closing

Thank you for your informative discussions and thoughts about knowledge communication in post-disaster reconstruction projects. I would also like to thank you for the time you have dedicated to the research.

I want to inform you again that your identity and that of your organisation will not be revealed in any report. If you would like to know the outcome of this research, it would be my pleasure to share with you.

3

Appendix E. Model validation form

Model Validation Feedback Form

Please email to b.hidayat@edu.salford.ac.uk

1. Background

Reconstruction projects following disasters have an important role to play in preparing (mitigation) for future disasters, but this also poses some challenges. Knowledge communication has the potential roles of supporting project management in achieving project success. This background has lead to this current research.

The research has conducted a questionnaire survey with 143 post-disaster reconstruction (PDR) projects stakeholders (contractors, consultants, governments, NGOs) in Indonesia. In line with the survey, 33 interviews have also been conducted with the project stakeholders. Based on the results of survey and interviews the current research proposes a model which is explained further in the Section 2. This document is part of the validation process for the model which requires input from project stakeholders.

2. The model of the role of knowledge communication in post-disaster reconstruction projects

2.1. Description of the model

The processes in post-disaster reconstruction projects may be described in an analogical tap model, as presented in figure 1. The water in the tap model is an analogical form for works in post-disaster reconstruction, which throughout some processes (i.e. construction stage: planning, design, and construction) are delivered through a tube which is the visualisation of project management. The flow of the water represents the progress of the works and will be influenced by the occurrence of critical success factors (CSFs) and challenges. Success factors are factors that contribute to achieving the success of the project and challenges are barriers; difficulties that are faced during the project that inhibit the achievement of project success. So, the CSFs and challenges act as a valve which determines how much (volume) and how long (time) the work took.

The central part of the tap is a bar; this represents knowledge communication (KC), which relates to the CSFs and challenges. Knowledge communication is defined as *"(deliberate) activity of interactively conveying and co-constructing insights, assessments, experiences, or skills through verbal and non-verbal means (Eppler, 2007)"*. Some methods of knowledge communication have a role to play in project management, for example to improve the quality of the work, to spread best practice and to reduce costly mistakes.

2.2. Elements of the model

The model has five key elements:

Critical success factors (CSFs) : This deals with factors which contribute to project success. This study proposes 3 important critical factors.

Project success criteria : This relates to the criteria used to judge the success of the project. This study proposes 4 criteria

Challenges in post-disaster : This concerns the barriers or difficulties in the project.

reconstruction projects	This study identified 3 significant challenges.
Roles of Knowledge communication	: This relates to the roles knowledge communication plays in the management of post-disaster reconstruction projects.
Knowledge communication method	: This deals with methods of knowledge communication which are used in PDR projects.

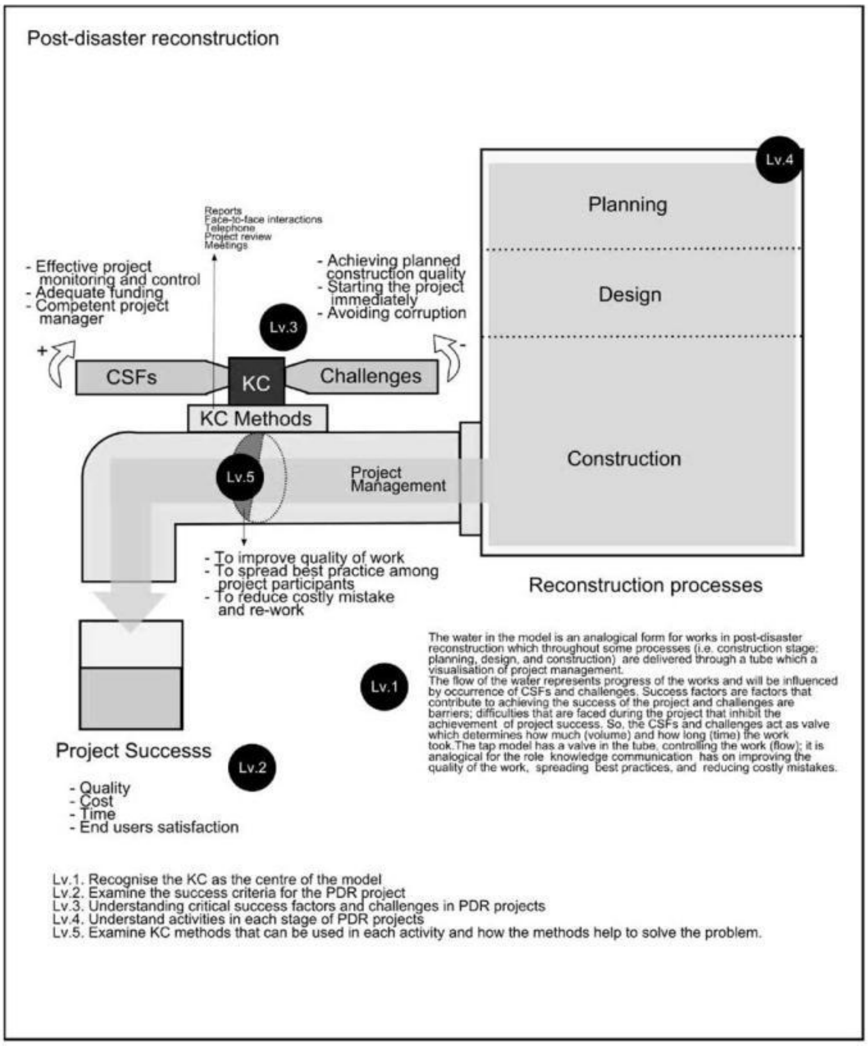


Figure 1. Model of the role knowledge communication plays in post-disaster reconstruction projects

3. Validation questionnaire

As part of validation process, we need your comments on the completeness, ease of use, and usefulness of the model.

Q1. Please provide your views on some aspects of the model.

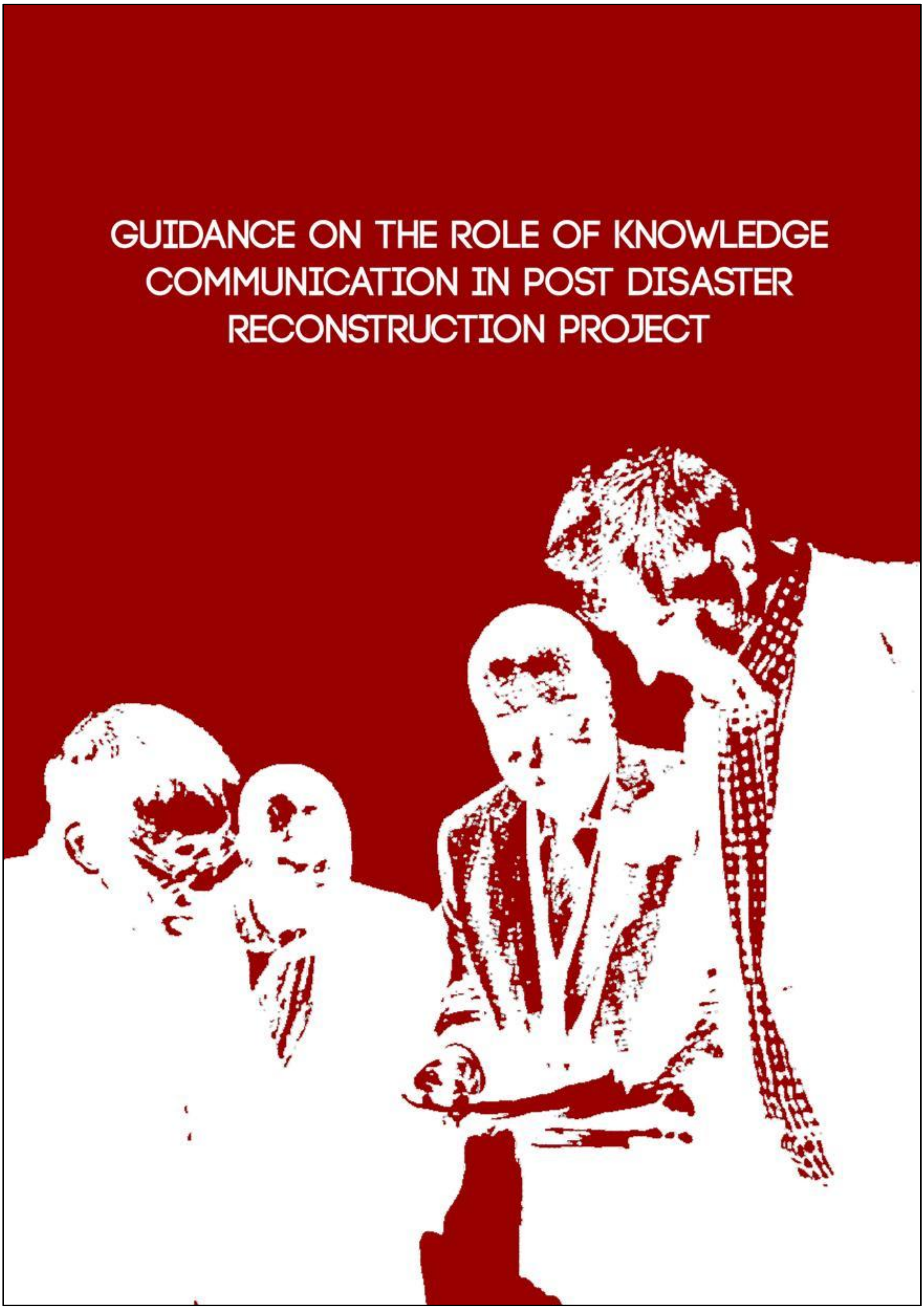
Please indicate your view by clicking the appropriate box (☒), where scale 1 means 'very poor' and 5 means 'very good'.

Feedback aspects	Rating: Very poor → Very good				
	1	2	3	4	5
Correct identification of critical success factors (CSFs)	☐	☐	☐	☐	☐
Correct identification of success criteria	☐	☐	☐	☐	☐
Correct identification of main challenges in PDR projects	☐	☐	☐	☐	☐
Correct identification of the role of knowledge communication	☐	☐	☐	☐	☐
Correct identification of knowledge communication methods	☐	☐	☐	☐	☐
Is the model easy to understand?	☐	☐	☐	☐	☐
Is the model easy to use?	☐	☐	☐	☐	☐
Provides systematic view of post-disaster reconstruction projects	☐	☐	☐	☐	☐
Help in raising awareness of knowledge communication	☐	☐	☐	☐	☐
Helps in understanding the role knowledge communication plays in post-disaster reconstruction projects	☐	☐	☐	☐	☐
Meaning of scale: 1 (very poor), 2 (poor), 3(fair), 4 (good),5 (very good),					

Q.2 Please provide additional comments on the model

--- THANK YOU FOR YOUR PARTICIPATION ---

Appendix F. The guidance document

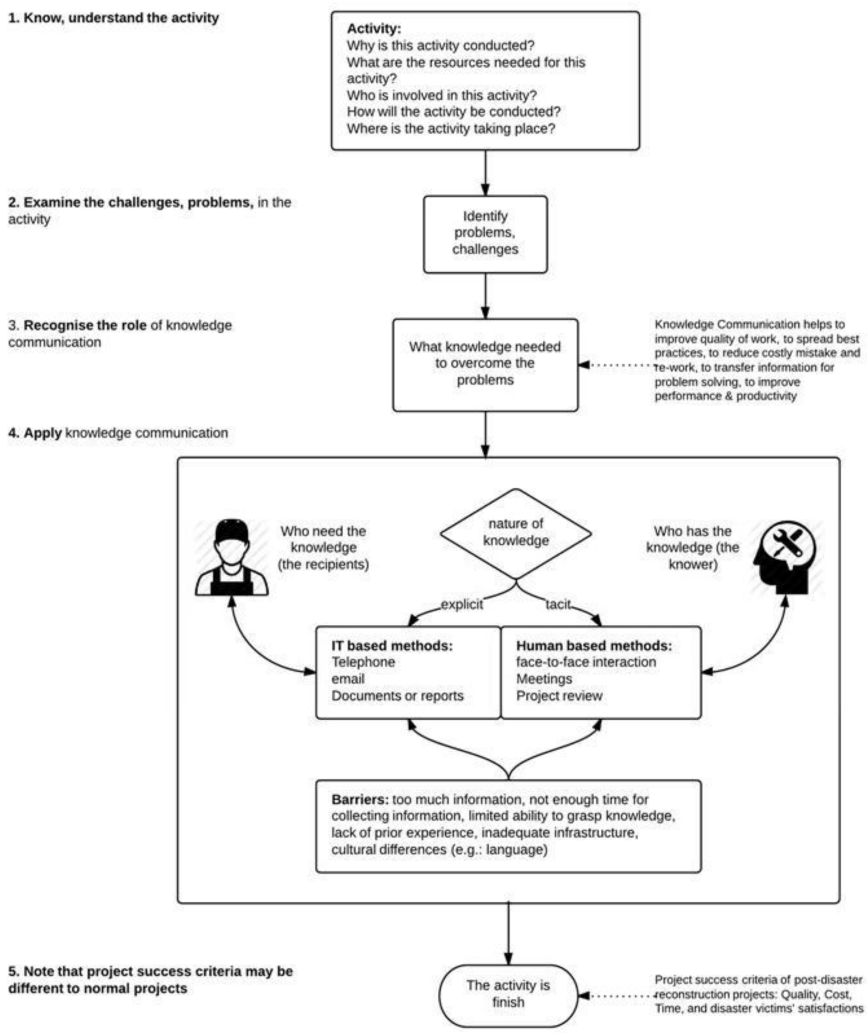


Guidance on the Role of Knowledge Communication in Post-Disaster Reconstruction Project

This guidance document is based on the research which had conducted a questionnaire survey with 143 post-disaster reconstruction (PDR) projects key stakeholders (contractors, consultants, governments, NGOs) in Indonesia. In line with the survey, 33 interviews had also been conducted with the project stakeholders.

Table of contents

Flow chart of knowledge communication implementation in post-disaster reconstruction projects.



Guidance on knowledge communication in post disaster reconstruction projects 3

1. Introduction

Disasters, especially earthquakes, have brought disastrous damage in Indonesia, as can be seen from the 2004 Aceh earthquake and tsunami, 2006 Yogyakarta earthquake, and 2009 West Sumatra earthquake. Reconstruction projects after those disasters faced many and great challenges. Recently, the knowledge management area has become an important aspect of project management where it can give benefits to achieve project success.

One strategic process in knowledge management is knowledge communication which is conveying knowledge among project participants. This guideline was developed in order to raise awareness and to create better understanding by the project managers on the role of knowledge communication in post-disaster reconstruction projects.

2. Meaning of issues

What is a post-disaster reconstruction project?

Post-disaster reconstruction projects are the projects that take place after the disaster, by repairing or building new houses, commercial buildings, and infrastructure. Post-disaster reconstruction plays an important role for preparation and mitigation for the next disaster. Successful post-disaster reconstruction projects may lead to better capacity of communities in the disaster affected area toward the next disaster.

How do post-disaster reconstruction projects differ from normal projects?

Because of the damage from the disaster, post-disaster reconstruction projects are usually hampered by a lack of available resources (construction materials, machinery, and skilled construction workers) and may lead to a rise in project costs.

The present research shows that in addition to 'the golden triangle' of project success (time, cost and quality), satisfaction of disaster victims or beneficiaries is also an important criterion for measuring project success.

What is knowledge and knowledge communication?

Knowledge may be defined as knowing something (know what, know why, know how, know where, know who, and know when) with a considerable degree of familiarity through experience, association, or contact.

Knowledge communication can be simply defined as the exchange of know-how, know-why, and know who.

Why is knowledge communication important in the project?

Tasks or works in construction projects are basically the kinds of collaboration of knowledge from different project participants, from consultants, contractors, or project owners. Thus by communicating the knowledge it will improve project performance to achieve project goals.

3. Implementation of Knowledge Communication

To implement knowledge communication in the projects, the following steps may be followed:

Step 1.

Know and understand the activity

Each activity can be understood by answering the following questions:

- Why is this activity conducted?
- What are the resources (materials, funds, and machinery) needed for this activity?
- Who is involved in this activity?
- How will the activity be conducted?
- Where is the activity taking place?

Step 2.

Examine the challenges

The next step is to assess the challenges or the difficulties that will be faced during implementation of the activity. Please note that the challenges may be different for each project, but it is expected in post-disaster reconstruction projects that there will be rarity of resources, a limited number of skilled workers, limited access to site location, which cause the costs to rise.

These challenges can be identified from answers from the previous questions.

Example:

Why is this activity conducted?

- The aim of the activity is not clear

What are resources (materials, fund, and machinery) needed for this activity?

- Materials are not readily available near the project site.
- Limited number of dumper trucks and excavators available.

Who is involved in this activity?

- Supervision consultant is not available daily on the site

How will the activity be conducted?

- The quality specification is not clearly set.

Where is the activity taking place?

- Limited access to the project site.

Step 3.

Recognise the role of knowledge communication

To address the challenges in step 2, some knowledge may be needed. The knowledge may come from another person or another source, so the knowledge needs to be communicated from the person who owns the knowledge (source) to the person who needs the knowledge (recipient).

Knowledge communication in the post-disaster reconstruction project may be helpful in improving quality of work, improving understanding about the work, getting and distributing new knowledge, and problem solving.

So, after identifying the challenges in step 2, the next step is to identify the knowledge needed to address the challenges.

Example:

The challenge is that the construction materials are not readily available at the construction site. The knowledge needed to address these challenges are:

- Nearest materials suppliers.
- The optimum material price, so the price is still reasonable.
- Transportation of materials to site.

Step 4.

Apply knowledge communication

After the needed knowledge is identified, the next step is to choose the suitable knowledge method to acquire the knowledge. There are a few considerations before choosing the knowledge communication method:

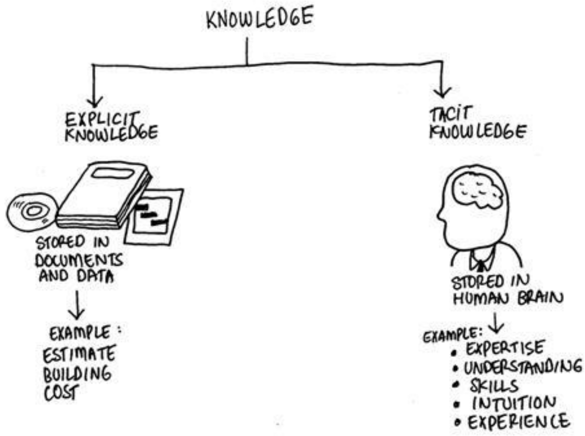
- Who has the knowledge and who needs the knowledge?
- Where does the required knowledge reside (internal or external, repository or person)?
- Is the knowledge mainly tacit or explicit?
- What are the barriers?
- Apply appropriate knowledge communication method.

Who has the knowledge and who are the recipients?

Identify persons or organisations that have the knowledge (the knower) and who needs the knowledge (the recipients). The knowledge may exist internally in organisations or external to organisations. Internal knowledge is relatively easier to acquire than external knowledge.

Where does the knowledge reside?

Knowledge may reside as a document in the repository or reside in a person's head. Knowledge in the form of a document is often called explicit knowledge, this type of knowledge is easy to acquire or transfer. The opposite is tacit knowledge, which is knowledge in a person's head, in the form of experience, insights, or judgement, which is difficult to transfer.



Apply knowledge communication method

To convey the knowledge of the knower to the recipients, some knowledge communication methods can be used. The more tacit the knowledge, the more it requires direct person to person communication.

According to the present research the most effective methods are discussed as follows.

A. Meetings;

A meeting is a gathering of the project participants, and may be formal or informal. Formal meetings (e.g. project monthly meeting) give opportunities to the participants to exchange insights and experience to solve project problems.

In order to have an effective meeting it is suggested that the meeting agenda is set and informed before the meeting, that it starts on time, it has a no blame culture, and shows graphical presentation to help the different educational backgrounds between project participants.

B. Face-to-face interactions;

A direct discussion between someone with another can allow knowledge to be communicated more fluently. In the informal setting (e.g. in canteen) may increase the exchange of knowledge.

C. Telephone;

Phone infrastructures may be limited in the aftermath of the disaster, but the use of telephone may enable and give benefits in the project discussion between two persons with geographical separation.

D. Reports;

Experience and insights may be documented in the report. For example, seismic-safe house designs are mostly available in the form of reports which can be learned.

E. Project review.

Discussion among staff or among project participants about ‘what went well’ and ‘what went wrong’ will produce lessons learned and provide recommendations for problem solving.

Other knowledge communication methods: email, internet, community of practice, training, mentoring. Please beware that ICT-based methods, e.g. emails, may be limited in post-disaster reconstruction.

What are the barriers in communicating the knowledge?

The five most significant barriers in knowledge communication in post-disaster reconstruction projects are:

1. Too much information that has to be processed quickly.

Chaotic conditions after the disasters and many parties involved in the reconstruction may generate multi source information which needs to be processed into knowledge immediately.

2. There is not enough time for collecting information or knowledge.

Limited time in the reconstruction project prevents a person looking for further knowledge. Project meetings are an opportunity to gather all project participants to exchange their knowledge.

3. Limited ability to grasp the knowledge, lack of prior knowledge.

Limited similar experience may make it difficult to capture new knowledge. For example, involvement of workers with education background of non-civil engineering in the project may be difficult for them to understand the construction process. Mentoring or in job training will help them to increase their knowledge.

4. Inadequate infrastructure (e.g. ICT) for knowledge communication.

Communication infrastructures may be damaged by the disaster; hence telephone coverage and access to the internet may be limited.

5. Cultural difference (e.g. language).

Many parties involved in the reconstruction come from different areas, even a different country, which has a different language. It is difficult to express the insights or difficult to ask about something if they have a different language. Using sketches or drawings will help to reduce this barrier.

Step 5.

Note that project success criteria may be different to normal projects

The project success in a normal condition project may be attributed to what is known as 'the golden triangle', e.g. meeting the expected time duration, achieving the planning quality, and delivered within the planned cost.

Meeting the planned quality becomes the most important criterion for the project success, since the quality of the finished reconstruction project will affect the capacity toward the next disaster.

However, in post-disaster reconstruction projects 'satisfaction of disaster victims' becomes an important success criterion. This implies that a project manager should do more consultation

with the victims, in order to know what they want and contribution to the project.

The success criteria may vary depending on the stakeholders. The present research shows that respondents from contractors and consultants are more concerned with 'achieving planned quality' as the main criteria for successful projects. Meanwhile respondents from government consider 'completion of the project within the budgeted cost' as the most important criteria. On the other hand, respondents from NGO rated 'the satisfaction of disaster victims for the final product' as the most important criterion.

4. Other important issues

What factors affected knowledge management in the projects?

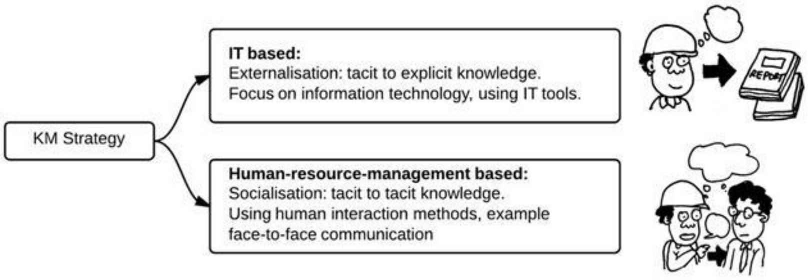
From the literature it shows that the following factors affect successful implementation of knowledge management:

- Management and leadership. Maintaining employees' morale and creating a culture that supports knowledge sharing among employees.
- Trust and relationships. High trust among employees will enhance collaboration and it allows knowledge to flow smoothly.
- Technology and information system. The purpose of information technology is to store and to distribute

knowledge and also support communication and collaboration among employees.

- Organisational structure. Fewer boundaries among divisions in organisation and ease of information flow.

What are the strategies for knowledge implementation?



In IT focus strategy, knowledge management is implemented by providing IT tools to facilitate the capture, access, and reuse of knowledge and information. In HRM strategy the focus in on how to motivate and facilitate knowledge worker to develop, enhance, and use their knowledge to achieve organisational goals.

Case example: One of project managers in the research revealed one of the best practices in his company. Every activity in the project is documented in the form of a report called 'work instructions (WI)'. So, if a project manager begins a project, he can learn various work methods from the WI reports. If he faced a new work method in the project, he will document it into the WI report and submit it to company's headquarter to distribute to other projects.

Appendix G. Questionnaire for the guidance document validation

Guidance Document Validation Feedback Form

Please email to b.hidayat@edu.salford.ac.uk

A. Background

Reconstruction projects following disasters have an important role to play in preparing (mitigation) for future disasters, but this also poses some challenges. Knowledge communication has the potential roles of supporting project management in achieving project success. This background has led to this current research.

The present PhD research proposes a model and guidelines on the role of knowledge communication in post-disaster reconstruction projects. The guidance document is provided as a single file (as attached in your email) and is provided for the project manager. This document is a validation form document, in order to finalise the guidance document.

B. Validation Questionnaire

As part of the validation process, we need your comments and suggestions on the content, structure, user-friendliness, relevance and usefulness of the guidance document. There is no right or wrong answer for the question in this survey validation, please answer based on your experience.

Please provide your views on some aspects of the guidance document. Please indicate your view by clicking the appropriate box (☐) of scale 1 to 5, where overall scale 1 means 'very poor' and 5 means 'very good'.

1. To what extent is the content of the guidance **comprehensive** (i.e. covers all the main issues in knowledge communication in post-disaster project) ?

   Not comprehensive at all → Very comprehensive

   ☐1 ☐2 ☐3 ☐4 ☐5

   Please give any comments or suggestions **on coverage** of the guidance document in the form below:

   <Add comment here>

2. To what extent is the structure of the guidance document **logical and easy to follow**?

   Not easy at all to follow → Very easy to follow

   ☐1 ☐2 ☐3 ☐4 ☐5

   Please give any comments or suggestions **on ease** of the guidance document **to follow** in the form below:

   <Add comment here>

3. To what extent is the guidance document **relevant and useful**?

   Not relevant at all → Very relevant

   ☐1 ☐2 ☐3 ☐4 ☐5

   Please give any comments or suggestions **on relevance and usefulness** of the guidance document in the form below:

   <Add comment here>

4. To what extent is the guidance **in a user-friendly format and easy to use**?

Not user-friendly → Very user friendly

☐1 ☐2 ☐3 ☐4 ☐5

Please give any comments or suggestions **on user-friendliness** of the guidance document in the form below:

<Add comment here>

5. To what extent is the guidance of **benefit to what you do**?

No benefit at all → Very high benefit

☐1 ☐2 ☐3 ☐4 ☐5

Please give any comments or suggestions **on benefits** of the guidance document in the form below:

<Add comment here>

--- THANK YOU FOR YOUR PARTICIPATION ---

Benny Hidayat
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School of the Built Environment
University of Salford
The Crescent, Salford M5 4WT
United Kingdom

Appendix H. Research timeline