Road Reconstruction in Post – Disaster Recovery; Challenges and Obstacles

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Abstract

Increasing numbers of events and victims caused by natural disaster have been unequally distributed throughout the world. Disfavour to the developing countries, evidence shows that developing countries are more vulnerable to disaster risk due to the significantly larger number of fatal injuries and higher threats to reaching development goals. In the event of natural disaster, road infrastructure appears to be one of the development sectors with the greatest losses and damages. On the one hand, even though road infrastructure plays an important role in accelerating the recovery process, post-disaster reconstruction of road infrastructure has not been adequately determined and has been frequently ignored by many aid agencies giving an extra burden to the community as it adds delays to the recovery process. On the other hand, aid agencies working on reconstruction of road infrastructure may have to face issues that are unique, in context and scale, to post-disaster project in developing countries. Accordingly, this paper tries to identify challenges and obstacles identified in the reconstruction of road infrastructure in Aceh post-tsunami recovery. Since this paper reviews the reconstruction of Aceh post-tsunami road infrastructure as a case study, limitations may then exist to large scale natural disasters in developing countries, and in particular, post-disaster of earthquake and tsunami events.

Keywords: Post-disaster reconstruction, road infrastructure, challenges, tsunami

1. Introduction

A disaster is generally defined as a serious disruption of the functioning of the society that leads to environmental and human losses on a scale that exceeds the capacity of the affected community to cope with its own resource (Vos et al., 2010, Shaluf and Ahmadun, 2006). Additionally, natural disaster is defined as disasters caused by the event of natural hazards where occurrences are out of human-control.

In the last few decades, the world has seen a significant increase of natural disasters. Not only has there been an increase in the number of events, the number of affected people as well as total losses and damages have also multiplied considerably. Between 1975 to 2009, as reported by , Centre for Research on the Epidemiology of Disasters (CRED, 2009), the trend of natural disaster events increased from less than 100 events up to almost 400 events per annum. Similarly, the trend in average economic losses and damages caused by natural disaster had also multiplied by more than nine fold, from approximately US$ 10 billion in 1975 to approximately US$ 90 billion in 2009. More detail information on the trends are presented in Figure 1

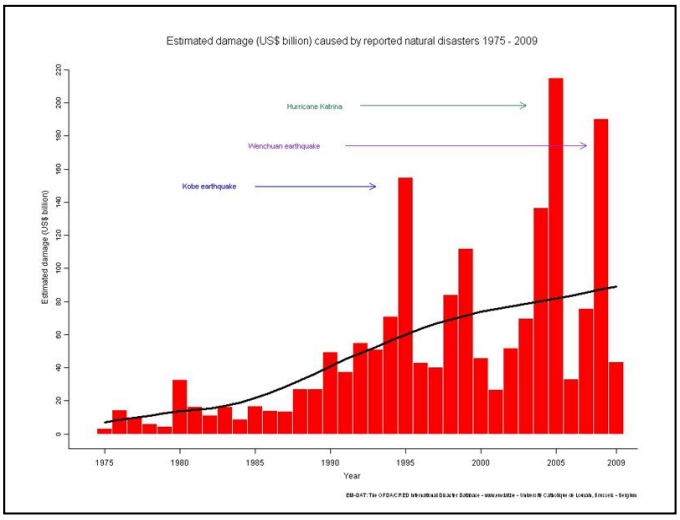

Figure 1 Natural Disaster Reported 1975 – 2009

Source: (CRED, 2009)

Adding to the increased number of natural disaster events, the geographical distribution, number of affected people and estimated total losses and damages have also been unequal, leaving some countries being even more vulnerable than the others. The following record of natural disaster events in the last three years illustrates this inequality.

Natural disaster events in the last three years, as recorded by CRED (Vos et al., 2010, Rodriguez et al., 2009, Guha-Sapir, 2011), show that cyclones, floods, earthquakes and heat waves have been the most deadly natural disasters. Cyclone Nargis and Sichuan earthquake in 2008, accounted for more than 95% of the total deaths caused by natural disasters that year. In 2009, the West Sumatra

earthquake in Indonesia caused the highest reported deaths of 1,117 (Bappenas, 2009). The trend continued in 2010 where two most deadly natural disaster, Haiti earthquake (222,570 deaths) and Russia heat wave (55,736 in deaths) accounted for 97% of the total 296,800 deaths caused by natural disaster throughout the year. In regards to economic losses, the earthquake in Chile and China in 2010 accounted for 44% of the total economic losses (US$ 30 billion and US$18 billion out of the total losses and damages of US$109 billion).

These records also show that people in developing countries are more vulnerable to natural disaster. According to UNDP, the occurrence of natural disasters events scattered around the world and strike 75% of the world area for at least once in the last three decades and even though only "11 percent of the people exposed to natural hazards live in countries classified as low human development, they account for more than 53 percent of total recorded deaths" (UNDP, 2004). Poorly planned development and poverty as well as lack of technical capabilities to mitigate disaster risk have been accused as the main origins of such vulnerability (Gauchat and Schodek, 1980, Ruddock et al., 2010, IDNDR, 1999).

The damages and losses caused by natural disaster are often overwhelming. In the case of Indian Ocean tsunami, damages and losses occur in many development sectors including social, infrastructure, production, economic and governance. Whilst on the event of natural disaster housing seems to be sector with the greatest losses and damages, transport infrastructure often appears to be one of the sectors with the greatest losses and damages. However, unlike housing, not many aid agencies allocate adequate attention and fund to the reconstruction of road infrastructure. Chang et al., (2011) study reveals that many aid agencies undermine the need to rehabilitate or reconstruct road infrastructure into their recovery plan which affect their project performance.

2. Road transport infrastructure

A significant amount of studies have been performed by researchers on the importance and challenges faced in the development of road transport infrastructure.

Perera et.al, (Perera et al., 2009) discover how road construction projects are exposed to various risks requiring better handling strategies. Anapolsky (2002) and Waters (1999) identify challenges associated with road construction projects in Montenegro and Poland, while Chang (2000) tries to evaluate losses and impact of earthquake and the recovery of port Kobe in Japan. A number of literatures also reveal that cost escalation have been a major issue in road construction project. In response, studies have been performed through analyzing bid pattern (Trefor, 2005), identification of major causes and their significance to road project delays (Kaliba et al., 2009, Odeck, 2004) and development of Neural Network based cost forecasting model (Wichan et al., 2009, Hegazy and Ayed, 1998) while Paul et al., (2009) try to eliminate delays through development of a rapid construction method decision making system in order to accelerate road construction preliminary process. Additionally, studies on the impact of road construction project to the community have also been performed towards woman trade Nigeria (Porter, 1995) and post-harvest crop losses in Malawi (Cheesman, 1993).

However, little or no literature discusses challenges or performance of road construction in post-disaster recovery context. It is therefore the intention of this paper to identify challenges faced by government and aid agencies in delivering road construction projects that is unique to post-disaster context.

Many studies have shown that improvement in road transport infrastructure may provide positive impacts to the community in various ways. Craft (2009) suggests that increased market agglomeration, productivity and labour supply resulting from reduced transport cost may create economic development opportunity for the community. Accordingly, improvement of road networks in particular may provide positive impacts to the community due to better trade, communication and economic and social growth as well as increased international competitiveness (Anapolsky, 2002). It appears that the speed, flexibility and accessibility of road transport in reaching virtually all points (Beilock et al., 2002) and in connecting other means of transport systems (Anapolsky, 2002) remain important and distinct characteristics of road networks compared with other means of transport. A study of Cheesman (1993) in Malawi points up how better accessibility and speed resulting from improved road infrastructure helped farmers moving their crops to storages efficiently reducing their post-harvest crop losses.

Moreover, the level of success of a project is often reflected from the performance of three indicators: time, cost and quality. This means that successful project is completed within the specified project period, within budget allocation and as intended quality. However, achieving all success factors in a road construction project is not a straightforward effort. Often, at least one of the factors would be compromised for achieving the other performance indicators.

in the context of time indicators, delay in road construction projects is not uncommon. A number of studies have been performed on causes and impacts of delays. Odeh and Battaineh (2002) classified factors causing delays in construction project into 8 categories namely: client related, contractor related, consultant related, material, labor and equipment, contract, contractual relationship and external factors. In accordance, a study of Kalibat et al., (2009) shows that most road construction project in Zambia experienced delays and most of the delays are actually controllable, except for external factors such as weather and inflation. As delays in construction projects may adversely affect the overall project performance due to extension of project duration and in most cases the resulting project cost escalation, understanding its causes may as well help avoid or at least minimize the impact.

Accordingly, cost escalation in road construction projects is not uncommon and in fact occurs in most road construction projects (Odeck, 2004, Kaliba et al., 2009). A number of reasons have been accused to be the main causes of cost escalation. From planning and design perspective, GAO/ RCED (1997) states that, among others, cost escalation stems from three major causes: poor preliminary estimates, modification of preliminary estimates to reflect more detailed plans and specification and changes in scope of work. In an attempt to better estimate the final construction cost, Hegazy and Ayed (1998) developed a model to estimate the road construction cost in Canada by considering project physical features including type of project, project scope, construction year, seasons, location, project duration, size, availability of water body and soil condition. In addition, variations of bid prices submitted by

contractors for a project may reflect the level of understanding, technology and methodology of bidding contractors that may affect their work performances and may accordingly affect the final project cost (Trefor, 2005). Furthermore, Kaliba et al., (2009) suggest that bad weather, scope changes, environmental protection and mitigation costs, schedule delay, strikes, technical challenges, inflation and local government pressures were the major causes of cost escalation in Zambia's road construction project. Other causes of cost escalation include reworks (Peter and Amrik, 2003) and design constructability (Trefor, 2005)

Within disaster context, road infrastructure plays an important role at all three stage of disaster cycle; pre-disaster, disaster and post-disaster. In Pre-disaster stage, which is the prevention and mitigation phase, well-planned road infrastructure may help avoid or minimize disaster impact through application of preventive and adaptive design. Construction of road infrastructure that may withstand and cope with future disaster will also help ensure development sustainability and help prevent unnecessary losses from destructed and non-functional facilities. During disaster, this will include the emergency phase and immediate duration; functioning road networks have been proven to have a major and important role. Transport disruption into and out of the affected area have been considered a vital constraint in providing efficient response in disaster and post disaster reconstruction activity (Grünewald et al., 2010). Not only does a functioning road network may save lives through enabling access for evacuations, but also help a speedy distribution of goods and helps into the affected area.. Additionally, in the longer-term post-disaster reconstruction stage, the functionality and serviceability of transport infrastructure has a great impact to the overall recovery process. Poor transport infrastructure have been among the factors that caused an increase in transportation cost and construction lead-time (Chang et al., 2011) resulting in increase of material price and construction delays.

The complexity of road construction project, however, is intensified by the chaotic environment and the level of uncertainties involved in the post disaster reconstruction context. In turn, this factor may create challenges that are unique, in context and scale, to road reconstruction post disaster .

3. Challenges in post-disaster road reconstruction

Reconstruction of road transport infrastructure in post-disaster context, however, has not been without challenges. The complex, dynamic and chaotic environment of post-disaster project compared to construction project in normal situation (Alexander, 2004) make reconstruction of road infrastructure worth further studies. Accordingly, the remainder of this paper discuss issues associated with the reconstruction of road infrastructure, taking post-tsunami project in Aceh as the focus.

In post-disaster reconstruction, transport infrastructure often appears to be one of the sectors with the greatest losses and damages thus reconstruction requires a significantly large amount of funds. In the case of earthquake and tsunami in Aceh and Nias, Bappenas (2005) reported that losses and damages in infrastructure sector accounted for 19.7% of the total estimated losses and damages caused by the disaster. In Sri Lanka, losses and damages in roads and transportation due to the tsunami accounted for 22% of the total needs. The following Table 1 and Table 2 show the detail of losses and damages of each sector for reconstruction of Asia Pacific tsunami disaster in Indonesia and Sri Lanka

Table 1 Summary Result of Evaluation of Damage and Loss Aceh and Nias Earthquake 2005 (Trillion of Rp)

Sector	Damage	Loss	Total
Social sector, including: housing, education, health, religion and culture	13,657	532	16,186
Infrastructure Sector , including: transportation, communication, energy, water and sanitation, dam	5,915	2,239	8,154
Production Sector, including: agribusiness, fishery, industry and trade	3,273	7,721	8,154
Cross-Sector, including: environment, Government Administration, banking and Finance	2,346	3,718	6,064
Total (Trillion of Rp)	27,191	14,210	41,401

Sources: (Bappenas, 2005); 1US$ ~ Rp 10,000

Table 2 Preliminary Estimates of Losses and Financing Needs For Reconstruction of Sri Lanka Tsunami Disaster (US$ Millions)

Sector	Losses	Total Needs
Housing	306-341	437-487
Roads	60	200
Water and Sanitation	42	117
Railways	15	130
Education	26	45
Health	60	84
Agriculture	3	4
Fisheries	97	118
Tourism	250	130
Power	10	67-77
Environment	10	18
Social Welfare	-	30
Other	90	150
Total ($ Millions, rounded)	970-1,000	1,500-1,600

Source: (Asian Development Bank et al., 2005)

3.1 Relatively fewer aid agencies focusing activities on road reconstruction

Many studies suggested that road infrastructures have a very important role in enabling an efficient and speedy recovery of post-disaster reconstruction. The tsunami and earthquake in Aceh and Nias resulted in 3,000km of road impassable (BRR and International Partners, 2005). As a consequence, in the post-disaster reconstruction phase, Chang et al., (2011) shows that many aid agencies in Aceh experienced a significant increase in the price of material required for reconstruction of housing sector. One of the factors that caused this increase had been the high transport cost and procurement lead time. Regardless the importance of the road infrastructure towards the overall recovery process, however, very few aid agencies provide sufficient focus and fund allocation for reconstruction of road infrastructure. Furthermore in Aceh recovery, Chang et al., (2011) reveals that many aid agencies working in the post-tsunami reconstruction undermined the need to rehabilitate road connection by not including it into their initial recovery plans. As a result, many of these aid agencies have to pay for

this negligence in forms of projects delays and increased material price which may require revision of projects scope and schedule.

In Aceh and Nias post disaster recovery, USAID and Multi Donor Fund (MDF), through its implementing partner World Bank, have been among the few aid agencies to have allocated a significant focus and fund on the reconstruction of road infrastructure. While USAID focused its project on Banda Aceh - Meulaboh access road, MDF placed emphases on infrastructure in general where reconstruction of transport infrastructure become the main parts of its IRFF project (IREP-IRFF, 2008). In relatively smaller scale, other aid agencies working on road reconstruction also include ADB and JICA.

3.2 Problems Linking With the Project Design

Considering the amount of time and resources needed, developing an ultimate plan and design prior to tender is very hard, if not impossible, in disaster environment. Therefore, the Agency for Reconstruction and Rehabilitation (BRR) adopted a design review concept, which determines only the basic concept, tender documents and estimated project value hence leaving design details to the awarded party. This was meant to accelerate most of reconstruction project and have been claimed to be an effective method (Sihombing, 2009). However, the Aceh post-tsunami road reconstruction, require different approach and obtaining "final" design is urgently required prior to land acquisition process may commence.

As a result, there have been significant delays in road reconstruction project in Aceh. Some of the main causes of the delays was that road design and implementation plan were not approved by the time it was needed. Changes in design and scope of project are not uncommon in road construction project in both developed and developing countries and it has been blamed as one of the most significant causes of project delays (Kaliba et al., 2009). In Aceh, several reasons have been referred to this issue including the frequent changes of project scope due to budget threshold and disagreement over the final road alignment (USAID, 2006).

Eventually, variations and adjustments also occurred during project implementation. However, since most road reconstruction projects are co-funded between Government of Indonesia and Donor countries or organizations, there was little flexibility to the project budget. One of the solutions to cope with the increased cost was to reduce projects' scope of work. As an example, many of the IRFF road reconstruction projects were long section of roads that were broken down into smaller packages of road segments. Some packages may also include construction of culvert or bridges. Accordingly, to maintain the targeted quality of road structure, reduction of scope of works took place in forms of reduction in road length or omission of project items. The latter include deferral of bridge construction into future projects. Consequently, many of the projects resulted in leaving some projects with "untouched" parts in the end part of the road segments while some others may have a nicely built new road with temporary wooden bridges in between.

Additionally, from socio-economic perspective, road design will also need to demonstrate its sensitivity to the indigenous society and somehow accommodate their needs into the design. Whilst

the actual and longer-term benefits to the indigenous society have yet to be assessed further, there have been concerns from the community living along the new "American- style" thoroughfare in Aceh road reconstruction project in regards to the speeding traffic and threw rocks at fast travelling cars and expressed their desire to be able to sell snacks along the road as it used to be (Perlez, 2006).

3.3 Land Acquisition issues

The reconstruction of Aceh West Coast road network consists of mainly three major tasks; construction of new road networks, rehabilitation and improvement of existing road networks and debris clearance. In some areas, many of the previous networks have been submerged by the tsunami leaving relocation of road networks as the only option to connect the existing road networks. Furthermore, as it is in other road networks in Aceh, most of the community settlements grow along the main road networks and have been developing into small coastal cities that are highly dependent to the existing road networks as the only sensible land access in and out of their cities. Many of the cities, however, have also been devastated by the tsunami and in many places left almost no survivors, which in turn lead to another undermined requirement; land acquisition

Indonesia recognizes two types of land title, land that is formally registered in National Land Agency (BPN) and land title acknowledged by the customary law (*tanah adat*). While the definition and application of this customary law varies between regions, the customary land title in Indonesia is in general land parcel which ownership is acknowledged by and attributed to a community and it is therefore for the community to decide its use, transferral of ownership and to solve the land related disputes (IDLO). Indonesian law also regulates that once customary land is registered and titled, the customary land right will then be annulled. However, the complexity and cost of land registration have been deterring customary land owners to register their land to National Land Agency (BPN) office. Additionally, as stated by Oxfam (2006) in its reports, "only around 25 % of land in the tsunami-affected areas of Aceh was statutory titled land, i.e. registered under government laws with paperwork held by landowners and in BPN offices. This means official documents did not entirely reflect the reality of land use on the ground". This has been another challenge that may be unique to Indonesia and hence the scale of difficulties resulted from such peculiarity is also unique to post disaster reconstruction.

Furthermore, land acquisition is a common constraint in road construction project. Adversely affect the construction process, acquiring land for a project may become a lengthy process, particularly when lands to be purchased are owned by private sectors. In its audit report, USAID (2007) specifically address land acquisition issue as the highest determinants to completing the reconstruction project at planned schedule and cost. Additionally, the Aceh west coast road reconstruction projects had to deal with more than three thousands parcels of lands, increasing the complex nature of land acquisition process. In post-tsunami area, in particular, not only had many of existing road networks been washed away by the tsunami and therefore require relocation but many landowners and up to 30% of government personnel as well as offices responsible for the land acquisition process had also been victims of the event (BRR and International Partners, 2005, Fitzpatrick, 2006).

Adding to the number of land parcels, disputes also occur with the community whose lands are affected by the project. Many of the tsunami survivors or relatives have moved or lived in other area and were not available on sites to discuss land acquisition issues. Eventually, land issues emerged and caused delays to land acquisition process and disputes during project implementation. There have been cases where community or individuals blocked access to construction sites claiming that their lands have not been paid or that the price negotiation has not been finalised and mutually agreed

Conversely, in Aceh post-tsunami reconstruction process, while anticipated, the significant amounts of time and other difficulties related to acquiring land had been underestimated (USAID, 2007). The low capacity and resources of the local government to manage the land acquisition process in such an immense scale did not progress as expected. The prolonging process eventually resulted in delays to the level where fund allocation for purchasing lands from the Agency for Rehabilitation and Reconstruction (BRR) was no longer usable. In turn, the district government needed to allocate fund from its own budget, a process that require parliament approval. Project wise, this also resulted in another delay.

Table 3 Damage to Property Rights and the Land Administration System

Damages	**Quantification of Damage**
Loss of BPN staff	• 40 BPN staff in Aceh Province, 30% of staff in Kota Banda Aceh.
Offices and equipment:	• 6 BPN Land Offices destroyed or severely damaged including Banda Aceh District Office completely demolished. • Destruction of office and survey equipment, including computers, to support urgent record recovery.
Damage to Government land books (the official register of land):	• 10% of land books lost. • Remaining 90% needing urgent conservation and restoration work
Destruction of official land documents	• 80% of land documents lost, including almost all cadastral maps.
Damage and disappearance of property rights evidence:	• Destruction of much of the physical evidence of property boundaries and witness evidence held in the minds of those who perished.
300,000 land parcels affected	• 170,000 urban and 130,000 rural including 549 parcels on Nias affected by the tsunami • 60,000 (40,000 urban and 20,000 rural) and 240,000 non-registered Land Parcels: • 5% of titled land parcels were mortgaged, with mortgages registered by BPN

Source: (BRR and International Partners, 2005)

Several alternatives were attempted by both government of Indonesia and USAID to speed up the land acquisition processes including establishment of "special committee" by the local government and parliament as well as requesting the governor to exercise an "eminent domain procedures" (Perlez, 2006). Nonetheless, the latter option was rejected due to additional grievance such procedures may give to the community - an option that may have been taken in normal development project.

3.4 Administrative problems

Since most of the road reconstruction project was funded or co-funded under loan or grant agreement by donor countries, combined regulation and administration between Indonesia and the government of donor countries was engaged in many part of the project. Indonesian Law (Keppres 80/2003)

stipulates that if any conflicting regulations occur between Indonesia and Donor regulation in projects that are partially or fully funded under loan or grant scheme, then Donor regulation will prevail. Accordingly, unfamiliarity with certain procedures and requirements inevitably occur. In the initial phase of the USAID project, the implementation plan proposed by the awarded Indonesia contractor, WIKA, was disapproved due to its non-compliance with the US requirement, causing delays in project commencement (USAID, 2006).

In a different perspective, Brooks et al., (2010) argue that provision of aid usually comes with certain conditions that in some case may lead to collusive agreements forcing the price level higher. This may be the case in the reconstruction road infrastructure in Aceh where most of the project are funded or co-funded with donor countries. An example of such high price level may be seen in the reconstruction of Aceh west coast. For the project, PT Wijaya Karya was awarded a $12 million contract to reconstruct an 80 km long road section which tasks included (1) design and construct 20 km of new road in four distinct segments and one bridge, (2) perform other road maintenance, repair and rehabilitation work, and (3) remove bridge debris. Additionally, Parson Global Service, a U.S. Architect-Engineer firm, was awarded a $35 million contract to perform technical design reviews of and supervise Wijaya Karya's reconstruction activities (USAID, 2006). Even though such contrast in contract value may be seen 'reasonable' from the national and international level of experience perspective, capability and necessity of awarding such contract to an international company might be questioned when the overall project performance is considerably poor.

In addition, in a construction project, delays in payment have been a major cause of project delays. On his study, Kaliba (2009) presents that payment delays as the greatest cause of road project delays in Zambia. Delays in payment to contractor may give contractors additional burden to their financial cash flow, disabling them to progress. This may also be the case in Aceh west coast road reconstruction project. In most ofthe road construction projects, contractors involved in the project were mostly local contractors or subcontractors which were also were also affected by the tsunami disaster. Additionally, prior to tsunami, the development of Aceh in broader context was not progressing well as a result of the prolonging conflict in Aceh, leaving very few contractors to have the expected qualifications. However, the involvement of local contractors was a key to achieving the reconstruction success and ensuring its sustainability. Due to the huge scale of development in the reconstruction process, as well as the scale of the project that contractors need to deliver, obtaining equipment from other companies through renting is often necessary, resulting as contractors being more dependent to project cash disbursement.

3.5 Corruption Risks

In regards to corruption in humanitarian action following a disaster, Ewins et al., (2006) identify corruption risk associated with humanitarian activities and map them according to its phase, activities and benefiting parties. The study also suggests that corruption risks in humanitarian actions are among other affected by pre-event corruption and transparency level, value of relief activities and the condition of the affected area. With a very low score of Corruption Perception Index (CPI) of 2.8 (with 10 being the less corrupt index), Transparency International (2010) ranks Indonesia at the 110th

out of 178 countries in its 2010 CPI. Consequently, being one of the most deadly natural disasters recorded in history and as a region in a prolonged conflict, Aceh tsunami recovery initiatives has a high risk of corruption. In public procurement, such corruption act may occur in form of awarding contract to best briber instead of best price-quality and resulting in higher contract value or purchase of unnecessary items (Søreide, 2005) or fraud resulting from discrepancies between amounts paid to suppliers for goods and the quantity of goods delivered (Oxfam, cited in Schultz and Søreide (2006)),

In addition, corruption practice in developing countries are often seen as common and as a fact of life that is part of the business game (Ibrahim, 1993). This may also be true in Aceh road construction project. While such corruption may be more controllable at the top level of contract (i.e main contract between general contractor or consultant and owner), it is a common practice of construction project to subcontract parts or most of the project to many subcontractors that may result in higher risk of corruption. In subcontracting process, project owners or consultant have little influence and authority as subcontractors' performance will be mainly under general contractor responsibility. However, this also means that regardless the high experience of general contractor and consultant have, project performance may be highly dependent on subcontractors' capacity which in many cases are understandably and expectedly low, creating a bottleneck effect of project performance and corruption mitigation efforts. In 2006, unfair and unreasonable subcontracting value by PT Waskita Karya, another state-owned company, to its subcontractors accused to be the main cause of project delays resulted in Turkish Red Crescent cut out 500 units of the 1050 houses initially awarded (Serambi Indonesia, 2006) and inclusion of the company to BRR's contractor black list. It was found that PT Waskita Karya subcontracted the houses construction to various subcontractors with a significant difference of unit price, Rp 82 million and Rp 68 million, resulting in subcontractor with lower unit price cease construction. While this case is in particular to housing construction project, road construction project may also be the same.

4. Conclusion

To summarize, the number of natural disaster events and losses is increasing and unequally distributed throughout the world leaving most developing countries more vulnerable to the impacts. Among other sectors, losses and damages caused by natural disaster to road infrastructure in many cases have been one the greatest. However, many aid agencies working in the reconstruction process have not allocated sufficient focus and fund for the reconstruction of road infrastructure. In turn, such negligence becomes one of the causes of increase in material price and project delays.

In addition, aid agencies working in road construction project also experienced project delays and cost overruns. While these are common in road construction project, many of the causes have been underestimated. Some identified factors include delays in approval of project design, lengthy process of land acquisition and administrative issues such as unfamiliarity to regulation and procedures resulting in payment delays as well poor contractor capacity. Corruption risks also exist in the road construction project as it is expected to occur in humanitarian activities in developing countries. While corruption and bad practices may be more controllable at the top level, project owners have lesser authority and influence to subcontracting practice, which appears to be creating a bottleneck effect of project performance and corruption mitigation effort.

Further study will be required to understand the impact of each factor to the overall road reconstruction projects and, in broader context, the overall post-disaster recovery process. However, understanding the importance and uniqueness of road reconstruction project in post-disaster context may help aid agencies identify and sufficiently anticipate these factors in the future.

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